Integrating Planning Theory with Energy Planning in Developing Rural Areas: A Critical Assessment of the Energy Intervention Programs in Rural Hainan, China

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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ABSTRACT

Energy intervention programs have gained prominence in governmental policies and development agendas as a prevailing practice of improving rural livelihoods and protecting local environment and resources in developing rural areas since early 1970s. In spite of the increasing evidences of small-scale renewable energy systems being advantageous over traditional ones towards rural sustainability, the introduction and diffusion of the new energy systems in many developing rural areas has suffered program ineffectiveness in terms of slow construction, limited utilization, and high risks of being idled or abandoned by the adopters. While there are substantial studies documenting the challenges of rural energy planning, few scholars have devoted to the processes and efficacy of the planning practice. Literature has obvious gaps between planning theory and rural energy planning practice as no prior academic efforts were uncovered to use planning theory to examine the rural energy planning practice and to provide directions to future practice. Meanwhile, literature suggests that the integration of efficacy-oriented and context-dependent principles of planning theory into the energy planning processes can contribute to the effectiveness of rural energy intervention programs. Vital to the integration is the conduct of a study that critically assesses the rural energy planning processes against the insights drawn from planning theory and then provides policy implications for bridging the gaps between theory and practice.

A review of literature on energy, planning, and community development in relation to sustainability led to an evaluative framework containing 24 criteria which were aggregated into six groups of principles, i.e., equity, flexibility, efficiency, participation, continuity and reflectivity. The principles were coupled respectively focusing on the operationalization, implementation, and monitoring processes of rural energy planning. Employing a primary case study design, the researcher conducted the field study in southern China’s Hainan province to examine whether the aggregated criteria were upheld and performed in local practices. In the field research, the author collected relative information and data through interviews, surveys, secondary sources, and direct observation. The data were analyzed in a mix of inter-related qualitative and quantitative methods. Where possible, the author used triangulation to limit individual and methodological biases.

Hainan's rural energy intervention programs of introducing and diffusion renewable energy systems such as anaerobic digesters and solar heaters in developing rural areas were significant contents of the provincial eco-village program and eco-province strategy. Although the energy programs had satisfactory effectiveness sporadically in a few villages, the majority of the programs suffered from problems like slow construction, limited utilization, and high risks of being idled or abandoned by the adopters. A number of challenges were recognized and mentioned by the administrative interviewees, including financial, technical, social, cultural, institutional and other constraints that support and conform to the discussions in literature. The study advances the understandings by identifying the gaps between planning theory and local rural energy planning practice in Hainan. Specifically, the equity principle was recognized but not totally fulfilled; the flexibility principle remained contentious and singularly executed; the efficiency principle was accepted but performed without enough scrutiny; the participation principle was emphasized but challenging; the continuity principle was aware of but not compulsorily executed; and the reflectivity principle was vague and overlooked. The author further analyzes that there will be barriers at the *micro*, *meso*, and *macro* levels to impede the integration of planning theory into rural energy planning practice. Extending the findings to a broader discussion on planning for development projects in developing rural areas, the author highlights a number of external and internal problems that harm the program effectiveness and calls for immediate and meaningful attention to ensuring program effectiveness. Several suggestions are provided for policy reconsideration and reorientation.

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ACRONYMS

ADB	:	*Asian Development Bank*
CAG	:	*China's Agenda 21 Group*
CAUPD	:	*China Academy of Urban Planning and Design*
CCC	:	*Chinese Communist Congress*
CEO	:	*Civilization-Ecological Office*
CEV	:	*Civilized and Ecological Village*
CIDA	:	*The Canadian International Development Agency*
CMA	:	*China's Ministry of Agriculture*
CMEP	:	*Chinese Ministry of Environmental Protection*
CMST	:	*Chinese Ministry of Science and Technology*
CNDRC	:	*Chinese National Development and Reform Commission*
CO_2	:	*Carbon Dioxide*
COD	:	*Chemical Oxygen Demand*
DRAs		*Developing Rural Areas*
EIA	:	*Environmental Impact Assessment*
EPS	:	*Eco-province Strategy*
FAO	:	*Food and Agricultural Organization*
GC	:	*Government of Canada*
GHG	:	*Green House Gas*
HDRC	:	*Hainan Development and Reform Commission*
HLER	:	*Hainan Department of Land, Environment and Resources*
HPBS	:	*Hainan Provincial Bureau of Statistics*
HPPD	:	*Hainan Provincial Publicizing Department*
HPTB	:	*Hainan Provincial Tourism Bureau*
IEA	:	*International Energy Agency*
IUCN	:	*International Union for the Conservation of Nature and Natural Resources*
LDCs	:	*Less-developed countries*
MNES	:	*Ministry of Non-conventional Energy Sources*

NBS	:	*National Bureau of Statistics*
NCAER	:	*National Council of Applied Economic Research*
NGO	:	*Non-governmental Organization*
NPIC	:	*National Program on Improved Chulhas*
ODPM	:	*Office of the Deputy Prime Minister*
OWE	:	*Oxford World Encyclopaedia*
PCH		*The People's Congress of Hainan*
RCP	:	*Rational Comprehensive Planning*
RETs	:	*Renewable Energy Technologies*
SDPC	:	*State Development Planning Commission*
SETC	:	*State Economic and Trade Commission*
SEZ	:	*Special Economic Zone*
SWOT	:	*Strength, Weakness, Opportunity and Threats*
TCE	:	*Tons of Coal Equivalent*
UNCED	:	*United Nations Conference on Environment and Development*
UNDP	:	*United Nations Development Program*
UNEP	:	*United Nations Environment Program*
UNFCCC	:	*United Nations Framework Convention on Climate Change*
UNGA	:	*United Nations General Assembly*
USEIA	:	*US Energy Information Administration*
USNRC	:	*The U.S. National Research Council*
WB	:	*World Bank*
WCED	:	*World Commission on Environment and Development*
WCS	:	*World Conservation Strategy*
WEC	:	*World Energy Council*
WRI	:	*World Resources Institute*
WWF	:	*World Wildlife Fund*

CHAPTER ONE: INTRODUCTION

1.1 Foreword

Energy occupies a vital position in our society because it is essential to economic and social development as well as improved quality of life in the world (Dincer, 2000; Fanchi, 2005). The continuous growth of global energy consumption has created tremendous international concerns about the relationship between energy and sustainability. Today, scarcely a day passes without energy being raised as an issue in the media or in the policy debates. Specifically, soaring and volatile oil prices[1], impact of energy on economic growth, environmental implications from the increasing fossil fuel consumption, and innovations of cleaner energy are all prominent in our daily news (Mulugetta, Doig, Dunnett, Jackson, Khennas, & Rai, 2005). Driven by the awareness of the availability of energy in a long term, many scholars have focused on assessing historical patterns and generating plausible estimates of alternative energy futures (Clark, 1990; Liu, 2005). While conservative projections to the middle of the 21st century suggest that developed countries will be using about one-half of the energy in the world, the world overall energy consumption is likely to increase because of rapid population growth and economic advancement in less-developed countries [LDCs] (Fanchi, 2005). Inevitably, these concerns will lead to more questions about the social, economic and environmental implications of energy use and planning issues in LDCs[2].

Although there is substantial literature that documents the connection between energy and sustainability, the significance of energy planning in developing rural areas [DRAs][3] is often overlooked. Particularly, little research has addressed the efficacy or effectiveness of energy planning in DRAs. In many of these areas, a forefront of energy planning is to formulate and implement policies on reducing deforestation by promoting more efficient uses of firewood as well as adopting alternative sources of energy especially renewable energy[4] technologies [RET] (Fanchi, 2005). However, these efforts are not as effective as people expect. The problems of fuel shortage, over exploitation of biomass resources, and poor reliability and quality of energy services to the rural

[1] The price of crude oil was 9.16 USD per barrel in December 1998 and it rocketed to around 140 USD per barrel in June 2008 (US Energy Information Administration [USEIA], 2008). Although it dropped in late 2008, it has remained quite volatile.
[2] Developing countries have the same meaning as less-developed countries in this thesis.
[3] Refer to Appendix A.3 for detailed description of developing rural areas.
[4] Renewable energy is defined as energy from the continuous or repetitive currents of energy occurring in the natural environment (Twidell & Weir, 1986).

masses still widely exist in these areas (Neudoerffer, Malhotra, & Ramana, 2001). By criticizing the limitations of mathematical modeling approaches to energy planning, Munasinghe and Meier (1993) identify that the ineffectiveness of energy planning in DRAs is mainly attributed to energy planners' insufficient attention to the human and social factors that determine the viability of energy intervention programs. In order to increase the effectiveness of energy planning in DRAs, issues, including how to enhance the introduction and diffusion of RETs, and how to ensure the utilization of the new energy systems, need to be explored and discussed in local practices. Efforts are needed to address the issues through an in-depth exploration of literature and an empirical study. This chapter first introduces the study scope with a statement of the existing problems in relation to energy use and planning in LDCs. The rationale and significance of the research focus, research goal, objectives, questions and thesis structure are provided in sequence.

1.2 Study Scope and Justification

Energy use is central to climate change[5], but also to sustainability in general (Schrattenholzer, 2004). Addressing energy with sustainability leads to the necessity of critical analysis on the effectiveness of energy policies and planning practice, which is the main theme of the thesis. This study seeks to explore the gaps between planning theory and local energy planning practice to analyze the opportunities and conditions of theory pertinent to strengthening the effectiveness of energy planning in DRAs. Based on a broad literature review, the study intends to establish a set of aggregate criteria, against which the process of energy planning in DRAs can be assessed through a case study of rural Hainan in China to provide suggestions on more effective rural energy planning practice. Effective in this study is defined as *being widely accepted and continuously viable, and having the desired effects that lead to positive changes in rural people's energy use*.

The study scope is determined based on four main factors, including the importance of energy to society, the author's previous research, and problems of energy use and planning in DRAs. Energy is as essential as water and food for the survival and well-being of humankind[6] (Dearden & Mitchell, 1998). Energy resources are regarded as the bricks for building human civilization (Marchetti, 1979). With rapid development of science and technology, energy is now a necessary factor in virtually all

[5] Primary energy consumption of fossil fuels leads to carbon dioxide [CO_2] emissions, which are often referred to as carbon or greenhouse gases [GHGs]. GHGs contribute to the warming of the earth and the higher surface temperatures impact climate. Climate changes have huge social, economic and environmental impacts, both locally and globally (Gonick, 2007).
[6] The history of life on the Earth is based on the history of photosynthesis and energy availability (Marchetti, 1979).

economic activities in the world (Dincer, 2000). To some extent, energy is considered as not only a prime agent in the generation of wealth, but also an important indicator of the level of economic activities (Islam, 1995; Kaygusuz, 2002). It was not until the 'energy crisis' in the 1970s when the awareness of energy security was increased did energy planning become significant in governmental agendas around the world (Sankar, 1984). Ever since, the worries about energy security and energy-related environmental problems have been discussed increasingly (Fisker, 2005; Goldblatt, 2005).

Energy shortage and environmental degradation have been persistent problems in DRAs. Whilst energy shortage problems persist in the Third World, the energy demand of the poor keeps increasing (Vedavalli, 2007). The International Energy Agency [IEA] estimates that two-thirds of the increase in the world's primary energy demand between 2002 and 2030 will come from the developing world[7], especially countries in Asia (IEA, 2004). Nowadays, poverty alleviation and improved well-being are two common and overarching development goals in most DRAs (Posa, Diesmos, Sodhi, & Brooks, 2008). However, rural poverty has resulted in poor rural households' dominant reliance on firewood, charcoal, kerosene and dung cakes as their main sources of energy, which has led to environmental damages and resource degradation (Kebede & Dube, 2004). For example, in Southeast Asia, the large, impoverished and rapidly increasing populations have caused widespread deforestation and environmental destruction for their energy needs, and the environmental degradation has made the rich biodiversity one of the most endangered in the world (Posa, et al., 2008). Ironically, the vicious circle of energy consumption for livelihoods and environmental degradation is often mentioned in the "sustainable development" discourse in the Third World where population increase and poverty push people to over-exploit and degrade local biomass resources to meet their energy needs and thus further impoverish themselves (Pearce & Warford, 1993). The vicious circle of poverty and environmental/resource degradation in DRAs indicates that poverty alleviation and environmental/resource conservation are interdependently connected. It also prioritizes the necessity of strengthening the effectiveness of energy intervention programs in DRAs.

Given the problems of energy use in developing countries, there is a growing call for sustainability intervention within poor communities. Prior to this study, the author had examined the positive impacts of RETs on rural communities in Hainan (Bi & Haight, 2007). Although RETs are found to

[7] The main factors contributing to the strong increase in energy demand in the developing world include the rural poor's need of economic growth, industrial expansion, population increase, urbanization, increasing use of fuel in the transport sector and substitution of commercial fuels for non-commercial fuels (IEA, 2004; Vedavalli, 2007).

fit into the rural livelihood system of rural communities, the previous study was insufficient to examine the stakeholders and their roles in rural energy planning, and what can be done to promote the diffusion and utilization of RETs in DRAs. As David Suzuki[8] identifies that,

> "*Where there is a conflict between an available clean technology and an entrenched dirty one, the challenge is politics and the need for legislative action, not technology*" (as cited in Mallon, 2006, p. 1).

With the limitations, the previous study has left room for further exploration on governmental energy policies, efficacy of energy intervention programs on community capacity building, and stakeholder interactions in community development projects.

1.3 Statement of Problem

Energy planning started in developing countries with a goal of balancing energy demand and supply after the first oil price shock in 1973 (Munasinghe & Meier, 1993). In many DRAs, energy planning not only concentrates on meeting energy demands but also serves as a policy priority to alleviate energy-related negative environmental impacts (Dincer & Rosen, 2005). A typical energy planning program is to promote more efficient use of firewood and the adoption of RETs on a household basis (Fanchi, 2005). However, most of these attempts so far have either failed or only met with moderate success (Maya, Mhlanga, Nziramasanga, & Mutyasira, 2002; Hudnut, Bauer, & Lorenz, 2006; Mabuza, Brent, & Mapako, 2007; Vedavalli, 2007). For example, India's *National Program on Improved Chulhas 1983* [NPIC] aimed at helping rural people use firewood more efficiently by improve their cook stoves (Neudoerffer, et al., 2001). A report of the Indian *National Council of Applied Economic Research* [NCAER] shows not only the scale of operation and the diffusion rate were low, but only 55.6 percent of these improved cook stoves were in use (NCAER, 1993). Similarly, from the early 1980s to the mid-1990s about 14,000 units of firewood stoves were installed in the poor families in rural Zimbabwe and 95 percent of them had been abandoned by 1997 (Mapako, 2004). India's biogas movement started in early 1980s and 2.8 million household biogas digesters had been installed by the end of March 1999, only representing 24 percent of the national potential (Neudoerffer, et al., 2001). Although there are no overall data showing the resent overall usage rate, India's *Ministry of Non-conventional Energy Sources* [MNES] (1999) estimated that the

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[8] David Suzuki is a Canadian science broadcaster and environmental activist. He has been known for his TV/radio series and books about nature and the environment and for criticizing governments for their lack of action to protect the environment.

digesters placed the functional rate at around 50 percent. A Philippine government program for biogas-powered water pumping in the 1980s saw only 1 percent of the gasifiers in use after some years, while 16 percent went unused and 80 percent needed repair (Bernardo & Kilayko, 1990). In 1998, the government of South Africa spent 2.5 million South Africa Rand [9] and installed photovoltaic units for 582 rural households in Folovhodwe, South Africa (Bikam & Mulaudzi, 2006). However, by mid-2004, only 13 of the 582 photovoltaic units were operational[10] (Bikam & Mulaudzi, 2006). The abandonment or limited success of the energy intervention programs has left room for decision-makers and researchers to reconsider the effectiveness of energy planning activities, as the problems of fuel insufficiency, over exploitation of biomass resources, and poor reliability and quality of energy services to the rural masses still exist in DRAs (Neudoerffer, et al., 2001).

Given the ineffective energy planning experiences in DRAs, extensive research has devoted to identifying the challenges and barriers of energy planning (e.g. Dracker & De Laquil, 1996; Reddy & Shrestra, 1998; Painuly, 2001; Li & Hu, 2003; Weisser, 2004; Limmeechokchai & Chawana, 2007). Undeniably, energy planning in DRAs is confronted with challenges and barriers[11] from social, economic, financial, institutional and environmental dimensions (Mabuza, et al., 2007). However, the ineffectiveness of energy planning, particularly the energy intervention programs, originates from the insufficient attention to the human and social factors and relationships within the planning process. Hudnut, et al. (2006) recognize that many well designed technologies do not become broadly adopted in DRAs, not because of flaws in the technology, but because there is not an effective process of distributing, servicing, and improving the technology. In addition to Munasinghe and Meier's (1993) criticism on the dominant mathematical modelling approaches to energy planning which rely on many unrealistic assumptions and scenarios in academia, Miller and Garnsey (2000) highlight that literature on technology diffusion has failed to integrate the wide range of human and social factors in the planning process that can affect a technology's progress. Mabuza, et al. (2007) see that energy planning, particularly technology diffusion in DRAs, is not mere delivery of high tech equipment from developed to developing world or within the developing world from R&D institutions to society—rather, it entails much more, including, but not limited to "*entire systems and their component parts, know-how, goods and services, equipment, and organisational and managerial procedures*" (p.237). Consequently, researchers and practitioners must examine the planning process

[9] 1 South Africa Rand is equivalent to about 0.11 USD.
[10] About 20 were stolen and 549 were no longer operational (Bikam & Mulaudzi, 2006).
[11] Challenges and barriers of energy planning will be summarized in Chapter 2.

to identify why energy planning could not have been more effective. Measures to facilitate energy planning practice, including sharing lessons are important for DRAs where energy consumption increases are inevitable due to the pursuit of economic development (Mabuza, et al., 2007). Accordingly, it is imperative to explore opportunities and conditions from planning theory to provide insights required to strengthen the effectiveness of energy planning in DRAs. Policy implications towards more effective energy planning also need to reflect on the planning problems of other rural development projects.

1.4 Research Goal, Objectives and Questions

The central purpose of the study is to explore and analyze the gaps between planning and energy planning practice and to provide strategies for more effective energy planning in DRAs through a case study that critically evaluates the local attitudes and actions against theoretical insights. In order to fulfill the general purpose, the following objectives are established:

1. To provide a synthesis of understanding concerning energy, planning and community development in relation to sustainability as well as challenges of energy planning in DRAs;
2. To explore planning theories and approaches that can be of use in developing an evaluative framework to examine energy planning practice in DRAs;
3. To critically assess the process of energy planning in DRAs against each criterion, using a case study of rural Hainan, China; and
4. To prepare suggestions on how to enhance the effectiveness of rural energy planning or other development planning practice in rural Hainan and similar development contexts.

In order to achieve the objectives, specific questions underlying each objective are developed:

1) How the ethos of sustainable development has influenced energy planning as a community development initiative in DRAs? What are the factors that confront rural energy sustainability? What principles of energy planning should be addressed towards energy sustainability? What are the challenges and barriers that impede energy planning in DRAs?
2) What are the major current approaches to planning? What major perspectives can be synthesized to generate insights for more effective rural energy planning? What major steps must be included in rural energy planning practice? What aggregated criteria from planning theory can be developed to examine local attitudes and practices?

3) Who are the stakeholders and what are their roles, involvement, and perceptions with regard to energy planning in rural Hainan? What are the gaps between theoretical insights and local stakeholders' perceptions and actions? What lessons arising from the gaps in rural Hainan may reflect on the applicability of the theoretical insights of planning theory?
4) Based on the answers to the above questions, what social issues of energy planning need to be addressed by planning? What strategies need to be developed to deal with these issues? What recommendations can be developed to facilitate energy planning and community development projects in rural Hainan and other similar DRAs?

Hainan was selected as the study site for two main reasons:

1) Despite its unprecedented growth rate after being established as a special economic zone of China, Hainan is still dominantly rural and the conventional energy use in its rural areas are identified as devastating to local resources and environment; and
2) In 2001, the Hainan government established a *Civilized and Ecological Village* program with promoting renewable energy as one of the main targets to strengthen rural community development. Its energy planning practice and efficacy of energy intervention program have established the ground to explore and test the utility of theoretical insights from planning theory.

The case study of energy planning in rural Hainan is achieved through a field study during which the following tasks are accomplished:

1) To examine energy policies, plans and planning process in rural Hainan;
2) To examine the roles, participation and perceptions of the main stakeholders (governments, technical experts, community cadres and residents) with regards to energy planning in rural Hainan;
3) To identify key social issues on energy consumption that need to be addressed through planning in rural Hainan; and
4) To explore implication of the research findings for planning of prospective energy planning practice elsewhere in China.

1.5 Significance

This study has both theoretical and practical implications. Theoretically, the study is contextualized as an inter-disciplinary study of planning in relation to energy policies and community development strategies in DRAs. This research is established upon the identification of the literature gap between planning theory and energy policies in relation to community development, specifically planning approaches, policy implementation, stakeholder interactions, and efficacy of energy planning in DRAs. Findings from the study will add perspectives to existing discussions in the literature. Results from this study also cast light on energy planning practice as a process through understanding the roles and actions of its stakeholders. Although the research design is a case study of rural Hainan, there are potentials for the research design and results to be generalized to the development of other DRAs. Hence, the study contributes to the state-of-the-art discussions on planning theory and energy planning practice, and to the studies of applied research on community development in DRAs in general. Practically, the research results in policy recommendations for improvement of energy planning and community development in rural Hainan. Specifically, in relation to the villages of Hainan involved in the study, some of these results are useful for a better understanding of challenges and opportunities for sustainable rural development and a reconsideration of how development strategies can be better implemented in rural Hainan.

1.6 Structure of the Thesis

This thesis comprises six chapters (Figure 1.1). Chapter one presents a brief introduction to the research topic and its justification. Several important concepts, research purpose, objectives and questions are presented. Chapter two provides a critical synthesis of existing literature that informs this research. This includes energy planning, planning approaches, and community development in relation to sustainability, as well as perspectives on public participation, social learning and stakeholders. Chapter three covers the research methods that were employed in the field research, data collection and analysis. Case study as a comprehensive research strategy is discussed. Its applications in social research are reviewed from a state-of-the-art analysis. Research design and implementation such as sequence of data collection and techniques used for data analysis are also included in this chapter. Research challenges and limitations are also discussed. Chapter four presents research findings from interviews, survey, document analysis and on-site observations. Chapter five discusses research findings in relation to existing literature. Chapter six reiterates major research findings relevant to the research objectives and questions, provides implications and recommendations for energy planning in DRAs. The contributions and limitations of the research are discussed and future research directions are also suggested. Finally, more specific theoretical background and contextual information of the study location are appended with key participant recruitment documents and survey instruments.

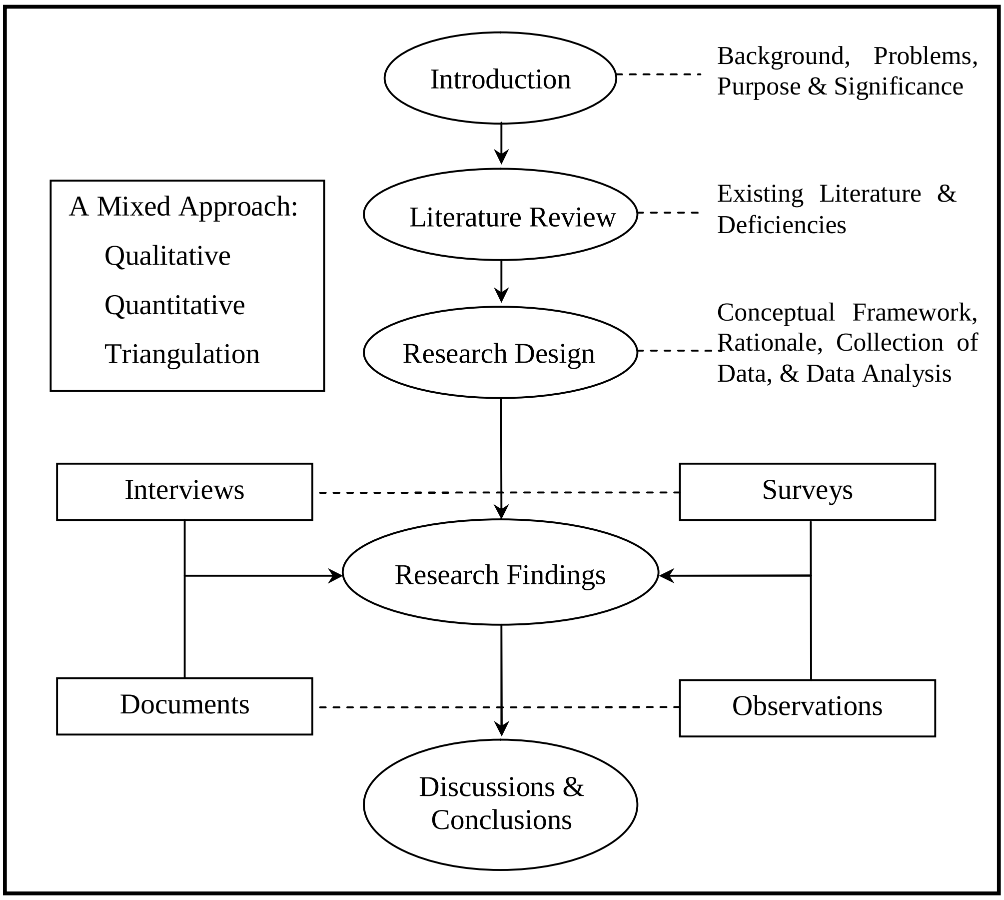

Figure 1.1: Structure of the Thesis

Source: Created by the author

CHAPTER TWO: LITERATURE REVIEW

This chapter presents the review of relative literature. In relation to sustainable development, major perspectives on energy planning, planning theory and community development are examined (Figure 2.1). The chapter begins with an introduction of sustainable rural development and its significance (Section 2.1). Major concerns, goals, strategies and principles of sustainable development are briefly presented. The broad direction was delimited to energy planning in DRAs. The relationship between energy and sustainability is highlighted (Section 2.2). The operational definition, principles and practice of energy planning are presented with a summary of the existing barriers of energy planners (Section 2.3). Next, the chapter introduces the connection between planning and sustainability (Section 2.4). The evolution of planning theory, major planning approaches, and the impacts of planning theory on energy planning are covered. This chapter also examines the relationship between community development and sustainability (Section 2.5). Several important components are presented, including community capacity building, public participation, stakeholder theory, and social learning theory. Finally, the chapter summarizes literature with an emphasis on the deficiencies of the literature and the evaluative framework (Section 2.6).

2.1 Sustainable Development

The discourse of *sustainable development* began in the 1960s when people realized the increasing conflicts among the scarcity of natural resources, growing population, and pollution on communities (Beratan, Kabala, Loveless, Martin, & Spyke, 2004). The term was first codified in the World Conservation Strategy[12] [WCS], a document prepared over a period of several years in the later 1970s by the International Union for the Conservation of Nature and Natural Resources [IUCN] with finance provided by the United Nations Environment Program [UNEP] and the World Wildlife Fund [WWF] (IUCN, UNEP, & WWF, 1980). It was then further developed through the report of the World Commission on Environment and Development [WCED], *Our Common Future* (WCED, 1987), and the follow-up to the WCS, *Caring for the Earth* (IUCN, 1991), before its appearance in *Agenda 21* at the Rio Conference (United Nations Conference on Environment and Development [UNCED]) in 1992. Ever since its appearance, sustainable development has received increasing

[12] Before the mainstream, the United Nations Conference on the Human Environment held in Stockholm in 1972 had already identified the development problems in the Third World, as motivated by the classic concerns of First World environmentalism, particularly pollution associated with industrialization (McCormick, 1992).

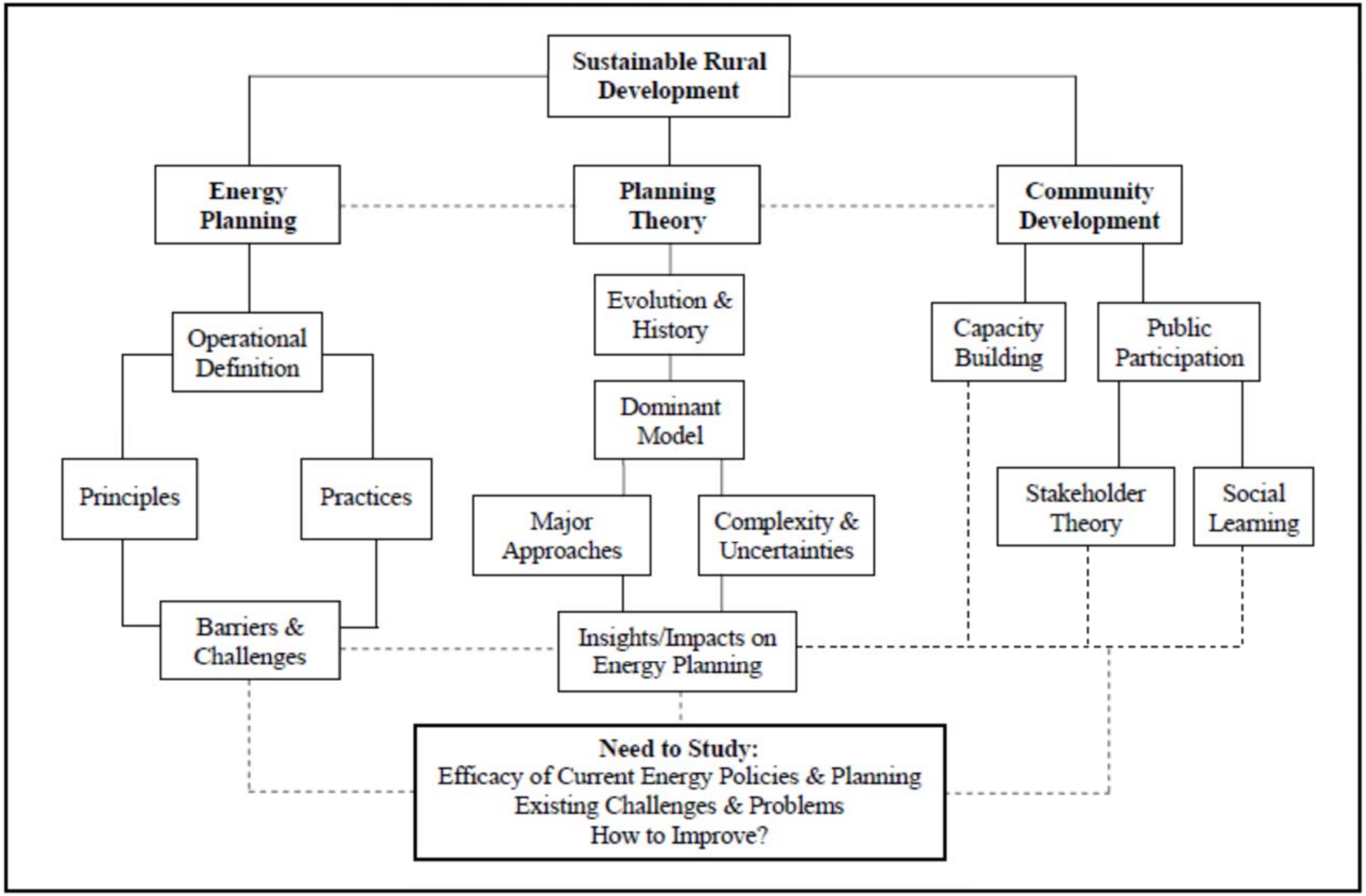

Figure 2.1: Literature Map of the Thesis

Source: Created by the author

attention from policy-makers and researchers (Schrattenholzer, 2004). The most popular definition is from the World Commission on Environment and Development (WCED, 1987, p.43) that, "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". More than four decades' discussion has led to various definitions of the term. These definitions differ, but have a consistent core of ideas, a vision of sustainable development strongly influenced by science, by ideas about wildlife conservation, by concerns about multilateral global economic relations, and by an emphasis on the rational management of resources to maximize human welfare. Today, the term is a keystone of government policies and serves as an overall guiding principle that drives research activities on environmental/resource management and development (Mendoza & Prabhu, 2003).

Sustainable development is obviously a worthy goal, but it is perpetually challenging to provide details for ways to achieve the goal. At its basics, it has three dimensions: economic, environmental, and social, which are frequently referred to as the triple bottom line, and are used to gauge the success of a particular development program or project (Rogers, Jalal, & Boyd, 2008). Despite the elusive nature, *sustainable development* and *sustainability* contain the themes of long-term maintenance of the stock of biological resources and productivity of agricultural systems, stable human populations, growing economies, and continued support and quality of human life on Earth (Brown, Hanson, Liverman, & Merideth, 1987). Lele (1991) suggests that 'sustainability' has three connotations: literal, ecological and social meanings. Lele (1991) also emphasizes that discussion about sustainability should be based on what is to be sustained, for whom, and how to achieve? Depending on the definition, sustainable development may be seen as developing less sustainably or more sustainably rather than sustainably or not (Peacock, 2008).

2.1.1 Sustainable Rural Development

Influenced by the broad theme of sustainable development, *sustainable rural development* in the 1980s emerged as a dominant goal (also a greatest challenge) of DRAs through helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of rural development (Chambers, 1983; Pugliese, 2001). It relates to the basic geographical unit *village*[13] and is concerned with the total social-economic-environmental development as a whole strategy to enable a specific group of rural poor people to gain for themselves and their children more

[13] The view is consistent with Dyck's (1998) recognition that efforts to promote sustainable development in DRAs have often embraced the community or village level as a proper scale for the implementation of sustainable development policies.

of what they want and need (Chambers, 1983; Day, 1998; Carvalho, Kronemberger, Oliveira, & Souza, 2001; Momen & Hossain, 2005). Day (1998) suggests that these features should be induced according to a bottom-up approach, through sustainable use of local endogenous resources, including environment, labour force, knowledge, patterns of production, consumption, and communication. The Food and Agricultural Organization [FAO] defines *sustainable rural development* as,

> "*The management and conservation of natural resources base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development in the agriculture, forestry and fisheries sectors conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable*" (Anon, 1989, p. 1).

The definition extends the WCED's definition of sustainable development and emphasizes the importance of local natural resources and the roles of technological changes in the process of development in DRAs.

2.1.2 Major Concerns and Goals

Despite recent high rates of urbanization, the majority of the population in developing countries lives in rural areas (Kebede & Dube, 2004). DRAs also harbour a majority part of hunger and poverty in the world (Morse, Islam, & Soesastro, 1984). While people in DRAs are struggling with many development problems, at least five basic problems are related with environment and poverty (Rogers, et al., 2008, p.51-52):

- Most environmental degradation is caused by the poor.
- Poverty reduction necessarily leads to environmental degradation.
- Population growth necessarily leads to environmental degradation.
- The poor are too poor to invest in the environment.
- Poor people lack the technical knowledge for resource management.

Although the five basic problems do not address energy explicitly, energy use in DRAs is closely associated with the poverty and environmental problems. Population growth and energy needs for fulfilling economic development objectives in developing countries are pushing people to increase energy input. How can the increasing energy demand of DRAs best be met? Will rural areas, like the urban ones, become increasingly dependent upon fossil fuels, which must be exhaustible? Or is sufficient energy available through the intelligent planning and development of indigenous energy sources to fill the gap? It is an important policy challenge to ensure energy security in DRAs, especially with the focus on poverty alleviation and environmental/resource protection (Liu, 2005). From these facts and concerns, there emerges a new set of priorities for energy and rural development research and an integrated set of methods of encouraging rural people's participation in energy aid program and other community development projects.

Rogers, et al. (2008) summarize Smith and Jalal's work (2000) and present the two major vicious circles in DRAs (Figure 2.2). As shown in the figure, the left circle illustrates how poverty causes resource depletion and degradation in perpetuity. By the sheer necessity of survival, the poor pollute the environment and erode the land, both of which, in turn further entrench poverty. Former Prime Minister of India, Indira Gandhi, once called this vicious loop the "pollution of poverty". The right vicious cycle demonstrates how development leads to resource depletion, degradation, and climate

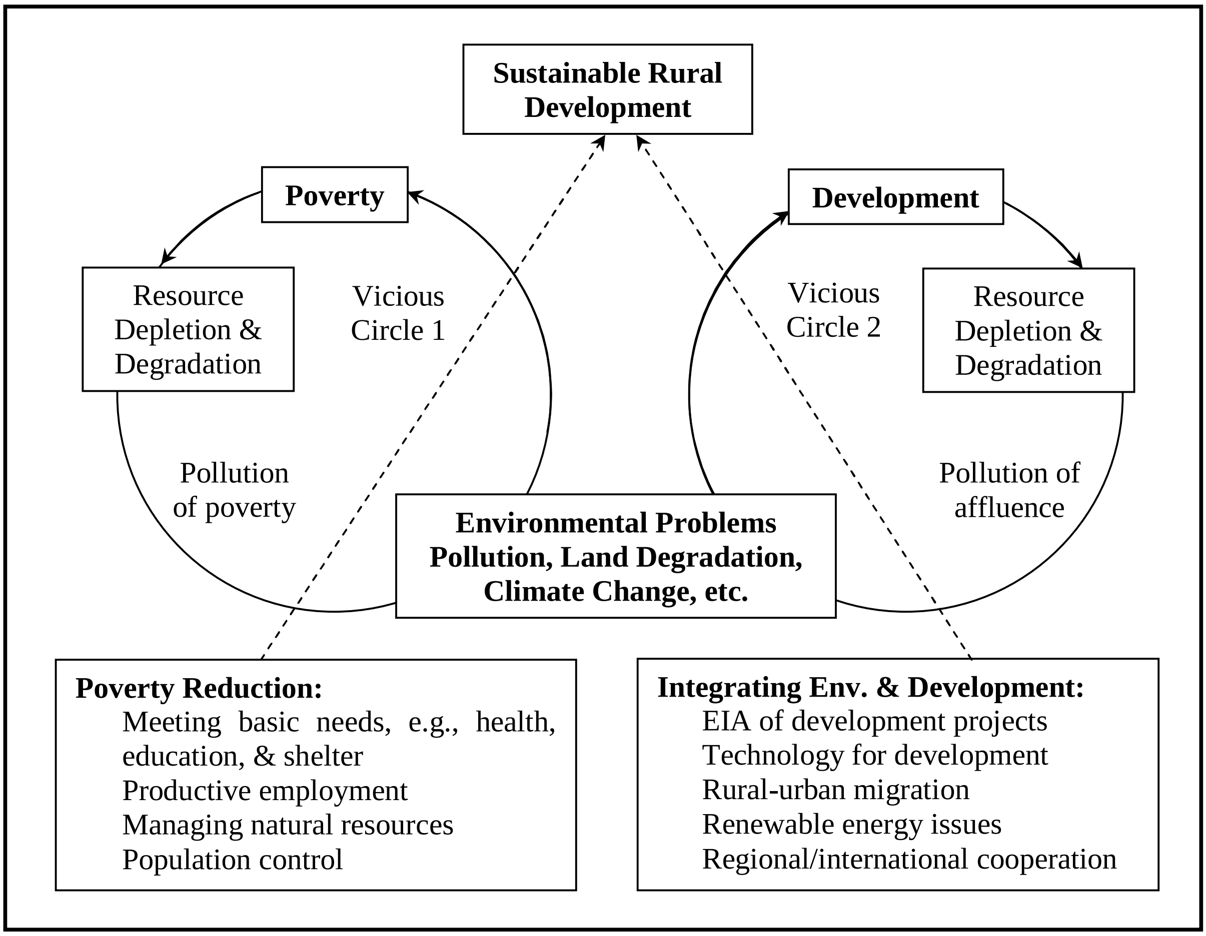

Figure 2.2: Linkages between Sustainable Development, Environment, & Poverty

Source: Adapted based on Smith & Jalal, 2000 changes. These environmental problems then retard, if not stop, the development process, because the resources of the environment are also important for development. Rogers, et al. (2008) point out that these two circles have to be broken if rural development is to be sustainable. Based on figure 2.2, major goals of sustainable development in DRAs include: poverty must be reduced by meeting basic needs: health, education, shelter, productive employment, control over common property, and population management; minimize the environmental and social consequences of development; a strategic assessment of policies and plans must be undertaken and projects must be assessed for their impacts upon the environment and society. To successfully achieve sustainable development, the community of nations must also stop the unfavourable impacts of rural-to-urban migration in developing countries, consider renewable energy issues, and promote regional and international cooperation (Rogers, et al., 2008). With the goals of sustainable rural development discussed, initiatives and programs that help poverty reduction and environmental/resource protection should be given priority in DRAs. The effectiveness of these programs deserves more attention.

2.1.3 Strategies & Principles

Given the uncertainty of development and the complexity of the developing problems in DRAs, it is challenging to specify strategies and principles that are guaranteed procedurally feasible and objective-attainable. As Ewel (1999) identifies, different rural areas in different countries have their own characteristics and an international standard often fails to act as a worldwide benchmark of rural sustainability. He further suggests different environments require different solutions in the quest for systems of land use that are ecologically, socially, economically, and politically sustainable (Ewel, 1999). Following its definition of sustainable development, WCED suggested seven areas should be addressed, including reviving growth; changing the quality of growth; meeting essential needs for jobs, food, energy, water and sanitation; ensuring a sustainable level of population; conserving and enhancing the resource base; reorienting technology and managing risk; and merging environment and economics in decision-making (Mitchell, 1997). The suggestions are extended by many scholars and organizations, including but not limited to, Raeburn (1984), Blaikie & Brookfield (1987), MacNeil (1989), Lele (1991), Shiva (1992), Asaduzzaman & Westergaard (1993), Barrow (1995), Rocheleau, 1995, Peet & Watts (1996), Carvalho, et al. (2001), the World Resources Institute [WRI] (Willers, 2002), and World Bank[14] [WB] (2006). Despite the diverse inputs, these discussions are still not specific to solve problems that confront sustainability in DRAs. For after all, whether

[14] Its mission is to provide financial and technical assistance to developing countries for development programs (e.g., bridges, roads, schools, etc.) with the stated goal of reducing poverty.

sustainable rural development can be achieved depends on creative and innovative conservation and production practices that provide famers with economically viable alternatives or options in their livelihoods (Virmani, Katyal, Eswaran, & Abrol, 1994).

Additionally, scholars and organizations also pay more attention to the human/social values and planning/management approaches that are needed to strengthen sustainability in developing rural areas. Although not specifying on energy planning, these rural-sustainability-oriented discussions offer insights to address how to improve the effectiveness of the practice in DRAs. Pearce (1988) focuses on the factor of resources and provides two basic strategies for sustainable rural development. He states that sustainable development argues for: (1) development subject to a set of constraints which set resource harvest rates at levels not higher than managed natural regeneration rate[15], and (2) use of environment as a 'waste sink' on the basis that waste disposal rates should not exceed rates of managed or natural assimilative capacity of the ecosystem (Pearce, 1988). The U.S. National Research Council [USNRC] regards it a major objective of sustainable rural development to strengthen or revitalize local culture and communities of the rural areas, guided by the values of stewardship and self-reliance and an integrated or holistic approach to the physical and cultural dimensions of production and consumption (USNRC, 1989). Among the principles in the Rio Declaration are human-oriented, equity, integrated development, cooperation, capacity building, participation, enactment of effective environmental, legislation, precautionary, internalization of environmental costs, environmental impact assessment, women's vital role, recognizing the potential of youth, recognizing the vital role of indigenous knowledge and traditional practices, and global partnerships (UNCED, 1992). Barrow (1995) summarizes directions for implementation strategies for sustainable development. Among those suggestions include the need for corrective treatment of root causes of non-sustainability, a move away from consumerism, the adoption of a much longer planning horizon by politicians and planners, a reduction of pollution and waste, a social transition toward a more equitable sharing of resources, the use of adaptive strategies to deal with the unforeseen, coordination of various approaches, and the adoption of multi-disciplinary study, planning and administration, and a proactive approach. Davidson (1996) suggests a few requirements for sustainable development: participative planning mechanisms, strategic decision-making for the

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[15] If: X_1 = m^3 biomass removed/unit time
X_2 = m^3 biomass regenerated naturally and/or reforested/unit time
Then: X_1 should be less than X_2 for sustainable resource utilization.

common good of a future generation, an integrated approach for an efficient use of scarce resources, legal backing and institutional basis for enforcement, and a long-term examination of the impacts of action. Drakakis-Smith (1996) considers it important to address rural issues, including quality of life, social justice, human rights, social and ethnic self-determination, democracy, empowerment and participation, people-focused approaches, integrated and comprehensive approaches, and bottom-up initiatives. As mentioned by Fricker (1998), three main principles guide sustainable development: the humility principle (recognizing the limitations of human knowledge), the precautionary principle (advocating caution when in doubt), and the reversibility principle (requiring us not to make any irreversible changes).

2.2 Energy and Sustainability

Energy is closely related to sustainability as human activities and most social development issues are intimately linked to the production and use of energy (Asif & Muneer, 2007; Kemmler & Spreng, 2007). Energy sources not only heat and power human development, but also put the quality and long-term viability of the biosphere at risk as a result of 'unwanted' adverse effects[16] of energy production and consumption (Hammond, 2004a). With continuously agitated concerns of the high oil prices, energy security and environmental risks, discussions on sustainability necessarily call for a vision that recognizes the multi-dimensional nature of sustainability. The need to balance the social, economic and environmental aspects of sustainability is manifested in the World Energy Council [WEC] goals of energy accessibility, availability and acceptability (WEC, 2005). The linkage between energy and sustainability originates from two major viewpoints, energy security and environmental impacts of energy production and consumption.

2.2.1 Energy Security

The process of human development is narrowly related with the evolution of the exploration and use of the energy sources in nature and the structuring of complex energy systems (Da Paz, Da Silva, & Dias, 2007). Civilization's advances during the 20th century have been closely associated with an unprecedented rise of energy consumption (Smil, 2000). The driving forces behind the increasing need for energy supply are a growing population[17] and the rising living standard of individuals

[16] For example, the deforestation in the Third World, the depletion of North Sea oil and natural gas resources, the generation of smog from urban road transport, the formation of acid rain via pollutant emissions from (primarily) fossil fuel power stations, and the possibility of global warming due to an enhanced greenhouse effect induced by combustion-generated pollutants.

[17] While economic growth continues, it is expected that world population will be in excess of 12 billion in 2060 (Sayigh, 1999).

(Voorspools, 2004). While the human needs are limitless, the natural resources, primary source of supply of those needs, are limited. The dynamics of the economic activities including satisfying human needs discretion when facing the natural obstacles (Da Paz, et al., 2007).

Today, the world heavily relies on fossil fuels[18] to meet its energy needs—fossil fuels such as oil, gas and coal are providing almost 80 percent of the global energy demands while renewable energy and nuclear power only contribute 13.5 percent and 6.5 percent respectively (Asif & Muneer, 2007). The global energy demand is expected to increase by as much as an order of magnitude by 2060, while primary energy demands are expected to increase by 1.5 to 3 times (Dincer & Rosen, 1999). Heavy reliance on non-renewable resources presents a threat to sustainability because their uses reduce the amount of energy resources available to people in the future. Although fossil fuels are still being created today by underground heat and pressure, they are consumed much more rapidly than they are created (Hammond, 2004a). Hence, the production and consumption of fossil fuels worldwide will have to face and struggle with the problems of peak points. For example, the rate of global oil production will enter terminal decline after the 'peak oil' – the point in time when the maximum rate of global petroleum extraction is reached (Bardi, 2009). Although people have recognized the prospective depletion of fossil fuels, people are still facing the energy security-related problems and challenges mainly stemming from a growing energy demand as well as excessive dominant use and dependence on fossil fuels (Gupta, 2003).

In DRAs, the main threats to the environment come not from too much economic growth but too little and the resulting poverty drives people to exploit their environment and resources (mainly biomass) in a non-sustainable fashion (Dearden & Mitchell, 1998). Today, a great part of the world population in DRAs rely on less-efficient fuels (i.e. firewood, agricultural residues, animal and human traction) because they do not have financial resources to guarantee the purchase of commercial fuels (Da Paz, et al., 2007). Of the world's 6 billion people, an estimated 1.6 billion still have no access to electricity and 2.4 billion still depend on biomass energy (mostly wood, dung and charcoal) for cooking and heating[19] (IEA, 2002). People in DRAs spend long and arduous hours every day in collecting firewood and carrying water to meet their daily needs (United Nations

[18] Fossil fuels (e.g., coal, oil, and gas) were formed millions to hundreds of millions of years ago from decaying prehistoric plants and animals (Hammond, 2004a).

[19] Biomass provides about fourteen percent of the world energy or about 14 million barrels of oil equivalent per day and is the most important source of energy in developing countries, especially in the rural areas (Afgan, et al., 1998).

Development Program [UNDP], 1999). Biomass energy[20] is potentially a type of renewable energy. However, the primary problem of using biomass energy in developing countries lies in the fact that the demands of biomass energy are often greater than the regenerative capacity of the traditional energy resources, which makes biomass non-renewable in these areas (Dearden & Mitchell, 1998). There are multiple factors that lead to the increasing demands of energy resources in DRAs, including population increase, urbanization, industrial development, needs of a better quality of life, and the 'non-commercial' nature of biomass resources (Asif & Muneer, 2007). Over-reliance on biomass energy leads to low energy efficiency[21] as there are limits to the amount of energy that can be transformed by people in DRAs. From a 'sustainability' perspective, relying on biomass energy can lead to deforestation and finally depletion of the natural regenerative capacity of biomass resources in DRAs if demands are greater than resource regeneration (Dearden & Mitchell, 1998). Sustainable rural development requires that energy or resource consumption does not deplete the ecosystem's capacity to reproduce over the long term. Over-reliance on biomass is not sustainable.

2.2.2 Energy-related Environmental Problems

Over-reliance on fossil fuels or biomass resources also results in damage to the environment that will have cumulative negative effects on the food, water, and land people require to live (Hammond, 2004a). As a major source of emission, primary energy use of fossil fuels has resulted in tremendous exhausted gases which have led to serious damage to the global environment (Dincer & Rosen, 2005). The main environmental problems caused by energy production or consumption include acid precipitation, stratospheric ozone depletion and global climate change (Dincer & Rosen, 1999). For instance, the growing reliance of China on fossil fuels to meet its energy needs has contributed to environmental degradation. Specifically, the coal-dominated energy utilization has made the country the world's leading emitter of sulphur oxides, which have been dispersed so widely that complaints of acid rain from Chinese sulphur emissions have arisen in Indochina, Japan, and Korea (Buran, Butler, Currano, Smith, Tung, Cleveland, Buxton, Lam, Obler, Rais-Bahrami, Stryker, & Herold, 2003). Continuation of the use of fossil fuels is set to face multiple challenges: depletion of fossil fuel reserves, global warming and other environmental concerns, geopolitical and military conflicts

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[20] Biomass energy refers to biomass that can be directly or indirectly used as fuel. Biomass energy, in the context of renewable energy, is defined in the Encyclopaedia of China (Agricultural Volume) (p. 1021) as "*energy generated from firewood, straw, carbohydrate-bearing crops, oil crops, hydrophytes, farming wastes, and animal excrement formed through direct burning, or after being processed into gaseous, liquid, or solid fuel*" (GEBEC, 1994b).

[21] According to the second law of thermodynamics, when energy is transformed from one form into another there is always a decrease in the quality of usable energy (Liu, 2005).

and of late, continued and significant fuel price rise (Asif & Muneer, 2007). Consequently, reconciling the conflicts between environmental pollution and primary energy production and consumption is a key challenge in terms of securing long-term sustainability (Buran, et al., 2003; Hammond, 2004a & 2004b; Dincer & Rosen, 2005; Asif & Muneer, 2007).

Use of traditional energy sources by the rural poor, such as firewood, contributes to deforestation and results in health-damaging indoor pollution (WEC, 2005). Between the late 1960s and the late 1990s, the forest coverage of Asia's developing countries reduced from 66 percent to 49 percent of the region's total land area (De Koninck, 1999). Based on the deforestation figures from United Nations, it can be estimated that by 2010, the forest's overall extent will have dropped well below 40 percent perhaps below 30 percent (Butler, 2005). In practically every developing country of the region, in coastal and lowland areas as well as in the highlands, forests continue to lose ground[22] at such a pace that the overall environmental equilibrium is threatened. Exploitation of the forest beyond its sustainable capacity has several implications. Forest and firewood resources are under severe pressure of depletion. Declining soil fertility, reducing crop yields and environmental problems are other results (Zhang & Wen, 2008). Traditional cooking style (by real fire) is still dominantly adopted in DRAs and kitchens are often filled with smoke when cooking. More than two billion people, almost all living in DRAs, are exposed daily to high levels of smog due to biomass combustion (WRI, UNEP, UNDP, & WB, 1996). Long-time exposure to health-damaging pollutants in smoke from traditional solid fuel stoves can lead to severe illness, including pneumonia, cancer, as well as lung and heart diseases (Smith, 1993). While smoking is the primary risk factor of lung cancer[23], domestic firewood combustion for cooking and heating purposes is also associated with the disease (Straif, et al., 2006). The overall challenge of energy use in DRAs is, therefore, to deliver sufficient energy for equitable and secure social and economic development while avoiding environmental impacts which would compromise the health condition of the current generation as well as the capacity of future generations to enjoy the fruits of that development.

2.2.3 Energy Sustainability

Given the two key concerns of energy in relation to sustainability, it is necessary to address the two aspects in defining energy sustainability. Voorspools (2004) suggests that there are two long-term

[22] Although all forest types are submitted to the onslaught, two are being taken to task with particular intensity: the mountain rain forests, which are the richest in terms of biomass and biodiversity; and the mangrove forest, which are narrow coastal amphibious formations, already very limited in extent and one of the most vulnerable types of rain forests.
[23] Global lung cancer totals 1.4 million cases & 1.2 million cancer deaths yearly (Parkin, Bray, Ferlay, & Pisani, 2005).

solutions to energy-related problems. The first is the discovery of a sustainable energy source with an unlimited potential that can cater to an exponentially growing demand. The second is to limit economic growth, which will also stop the corresponding demand for energy services. In this case, sustainable energy sources with limited potential or resources can provide sufficient energy supply. Mulugetta (2008) suggests that the core of sustainable energy strategy lies in the vision of providing all citizens with sufficient quantity of modern energy services—first, the provision of adequate energy services must go beyond the 'achievement' of economic growth and incorporate the satisfaction of basic human needs and improve social welfare; and second, the production and consumption of energy should not endanger the quality of life of current and future generations and should not exceed the carrying capacity of ecosystems[24].

Lovins (1979) suggests that a different 'world view' will have to become dominant if sustainable development is to be achieved. He illustrates and compares the two world views by drawing a parallel between '*hard*' and '*soft*' energy paths (Table 2.1). A '*hard*' energy path, reflecting the dominant social world view, focuses upon increasing supplies of non-renewable energy sources to meet growing demand (Lovins, 1979). A '*soft*' energy path, reflecting the new environmental world views, attempts to reduce the demand for or use of energy by focusing upon use of renewable sources of energy supply, reducing demand or use, and achieving more efficiency in patterns of use in combination with decentralizing energy generation and control (Lovins, 1979). With the identified energy problems, the 'soft' path is needed to reduce resource consumption, to recognize limits to the biosphere, and to become less complacent about accepting technological answers to issues that are basically social in origin and character (Dearden & Mitchell, 1998). Solutions to energy problems thus should not be confined to searching for new energy sources. Rather, equal or greater attention would be directed to increasing the efficiency of, or achieving an absolute reduction, in energy consumption. Hence, minimization of negative effects is not enough; it is needed to encourage positive steps towards greater community and ecological sustainability through energy projects (Gibson, 2006a). The focus is not only on avoidance or mitigation of significant negative environmental effects, but also those negative impacts on the human aspects and biophysical

[24] The carrying capacity concept has a long and lingering history in application to natural resource management and has been embraced as a tool for application in the protection of natural environments and protected areas (Budd, 1992). The underlying principle of there being 'limits to growth' in terms of the resource base limits growth and productive capacity is often expressed as a threshold by the term 'carrying capacity' (Meadows, Meadows, & Randers, 1992).

environment (Gibson, 2006a; 2006b). Adoption of the 'soft' energy path needs people to accept the basic values of the new environmental world view.

Table 2.1: Major Characteristics of Competing World Views

	Dominant Social World View	**New Environmental World View**
Humankind & nature	Domination of nature Natural environment valued as a resource	Harmony with nature Natural environment intrinsically valued
Growth & technology	Continual economic growth Supply orientation Confidence in science and technology	Sustainable development Public interest Demand orientation Limits to science
Quality of life	Centralized Large scale Authoritative (experts influential) Increased material consumption	Decentralized Small scale Participative (citizen involvement) Decreased material consumption
Limits to biosphere	Unlimited resources Non-renewable resources No limits to growth	Limits to resource extraction Renewable resources Limits to growth

Source: Adapted based on Lovins, 1979; Kuhn, 1992

WCED also tries to define energy sustainability and indicates four key elements of energy sustainability, including energy sufficiency, energy efficiency, public safety and health, and environmental protection (as cited in Jefferson, 2006, p. 573): sufficient growth of energy supplies to meet human needs (accommodating relatively rapid growth in developing countries); energy efficiency and conservation measures, in order to minimize waste of primary resources; addressing public health and safety issues where they arise in the use of energy resources; and protection of the biosphere and prevention of more localized forms of pollution or environmental degradation. Similarly, Lund (2006) proposes that sustainable energy systems typically involve the use of renewable energy resources, improvement of energy efficiency, and enhanced energy security. Wang and Feng (2002) identify the importance of ensuring energy security and environmental protection, and define sustainable development of energy is a process,

> "*to satisfy the energy demand for the social and economic development, establish an efficient and economical energy demand and supply system and give priority to regenerate energy and maintain the improvement of environment*" (p. 402).

Harmaajarvi (2000) describes an ecologically sustainable area as,

> "*an area that requires the supply of as little energy and raw materials as possible (especially non-renewable materials), and that produces the minimum of harmful emission and wastes from all the building and operating processes on a lifecycle basis*" (p. 373).

These statements imply that sustainable development within a society requires a supply of energy resources that, in the long term, is readily available at reasonable cost and can be utilized for required tasks with minimum negative societal and environmental impacts.

WEC (2005) suggests it is necessary to define energy sustainability in DRAs by addressing the accessibility, availability and acceptability. WEC (2005) points out the fact that some 1.6 billion people are still entirely dependent on highly inefficient traditional forms of energy and an energy consumption pattern embodying such inequities is not sustainable or acceptable[25]. For energy availability, WEC (2005) addresses the evidence that there are millions of people whose access to energy is insufficient or highly unreliable, and the frequent supply interruptions[26] they suffer add a significant cost burden and severely hamper economic development. For energy acceptability, WEC (2005) highlights the environmental problem caused by the over-reliance on fossil fuels in developed areas and biomass in DRAs and declares that a sustainable global energy system must optimize efficiency and limit emissions. Schweizer-Ries (2008) suggests that energy sustainability means to be consistent, efficient and sufficient. Consistency is the change from traditional energy supply towards renewable energy resources like wind, water, biogas and solar energy; efficiency means the reduction of energy consumption without a foregoing reduction of energy supply; and sufficiency deals with saving energy input as well, but in another way that produces new living styles and energy consumption culture (Schweizer-Ries, 2008).

2.3 Energy Planning

Although energy planning is important to all countries in the world, no definition of energy planning can satisfy all energy researchers. Because of different patterns of energy demand, consumption and resource availability, the definition of energy planning and its perception differ from developing countries to developed ones and from oil importing countries to oil producing ones (Elnasr, 2004).

[25] Without access to affordable modern energy services, the United Nations' Millennium Development Goals cannot be achieved, as clearly recognised at the 2002 World Summit on Sustainable Development in Johannesburg.
[26] For example, the blackouts in North America and Europe in 2003.

Nowadays, energy planning has been performed at different levels. It addresses designing energy supply and utilization in new buildings, municipal planning of district utility supply and the structure of heating systems (Malkina-Pykh & Pykh, 2002). Energy planning at the national and regional level is acknowledged to be an important task for securing a technically safe, economically efficient and environmentally friendly energy supply system (Mavrotas, Demertzis, Meintani, & Diakoulaki, 2003). At regional and national levels, energy planning has been linked with political targets like diversification of energy sources or environmental targets like reducing acidification of soil and lakes (Malkina-Pykh & Pykh, 2002). In DRAs, energy planning has become a main initiative for poverty reduction (Kadian & Kaushik, 2003).

2.3.1 Operational Definition of Energy Planning

Del Valle (1984) defines energy planning as "*a process of providing rational and systematic guidance to energy development*" (p. 84). Kleinpeter (1995) states that energy planning is based on the challenges of energy supply and demand and states energy technologies of the future will influence energy planning over the long-term. Energy planning processes usually include a study of sectorial demand and supply, forecasts of the trends of input–output items, based on economics and technological models, and a list of actions, collecting several measures voted to fulfil the main objectives of the energy plan (Beccali, Cellura, & Mistretta, 2003). Hollwey (1996) suggests that energy planners should avoid instant reaction to the pressure of immediate energy events and suggests proper energy planning means standing back, assembling, costing and analysing all the diverse energy alternatives before selecting the best option. Since the availability and cost of energy are major factors in consumption and investment decisions, the main objective of energy planning is to ensure the availability of energy and determine the least cost energy policy path for a community with the least environmental damage (Byer, 1984; Khella, 1997). Awerbuch (2006) criticizes energy planning as an investment-decision problem and emphasizes that energy planning needs to abandon the preoccupation with finding "low-cost" alternatives and focus instead on developing efficient (optimal) generating portfolios. Cormio, Dicorato, Minoia, and Trovato (2003) emphasize that energy planning discipline must consider political aspects, social and environmental considerations, and is carried out taking into account the historical data collected in the previous energy plans of the region under examination. Nijkamp and Volwahsen (1990) suggest that energy planners should investigate detailed triangular relationships and synergisms among energy systems, regional development and environmental management from a planning viewpoint.

An operational definition of energy planning is generalized in light of the above interpretations, critiques and suggestions. Energy planning is *a process of formulating, implementing, monitoring and adjusting energy plans and policies based on a combined assessment of current energy consumption pattern and existing energy plans and policies to enhance energy sustainability in a given area*. The aim of the process is to develop and promote a cost-effective and environment-friendly portfolio of energy production and consumption to satisfy the energy demand for the social and economic development for the area. Baum (1984) suggests that energy plans should establish energy production and consumption objectives for the medium and long term; define the strategies to be followed and the resources to be committed; and propose the necessary legislative and administrative action for monitoring implementation. He also points out that the planning system and related institutions should stimulate broad and effective participation in policy formulation and implementation (Baum, 1984).

2.3.2 Principles of Energy Planning

Within energy sustainability discourse, four sustainability-driven principles of energy planning can be generalized, including rational energy use, alternative sources, mitigation of environmental impacts and integrated energy planning (Based on Kleinpeter, 1995; Afgan, Carvalho, & Hovanov, 1999; Afgan, Gobaisi, Carvalho, & Cumo, 1998; El Bassam, 2004). These four principles range from energy conservation to energy efficiency improvement to alternative energy sources with a focus on renewable resources. From different perspectives, these four approaches are in compliance with the deep ecology of environmental and resource protection and management.

(a) Rational Energy Use

The rational energy use principle[27] considers how energy is utilized (Kleinpeter, 1995). The principle aims at maximizing the benefits from utilizing energy resources (Kleinpeter, 1995). The principle acknowledges that all energy resources are to some degree finite, so that less energy input[28] or greater efficiency in utilization allows such resources to contribute to development for a longer period of time (Dincer & Rosen, 1999). Even for energy sources that may eventually become

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[27] The principle is based on the First Law of Thermodynamics, i.e. on the conservation of energy and the Second Law, i.e. the minimum theoretical energy necessary for obtaining a product (Fisker, 2005).

[28] Streimikiene, Ciegis, and Grundey (2008) assert that energy saving or increase of energy use and supply efficiency is the most effective measure to implement all other priorities of the sustainable energy policy in the European Union: increase security of energy supply, reduce pollution and environmental energy impact, reduce vulnerability of low-income population in energy affordability and ensure competitiveness and growth of economy and employment.

inexpensive and widely available, increases in energy efficiency will remain sought after to reduce the resource requirements to create and maintain systems and devices to harvest the energy (Fisker, 2005). Energy conservation incorporates the concepts and the actions applied to the research of sustainable balance between nature and the energy availability (Dias, Mattos, & Balestieri, 2004). Expedient activation of savings potentials brings economic benefits and reduction of energy consumption and pollution (Al-Mansour, Merse, & Tomsic, 2003). Simultaneously, increasing energy efficiency is an important means of realizing the triad of established objectives of energy policy: security of supply, competitiveness (achieved by producing and using energy in the most cost-effective way possible) and environmental sustainability (Al-Mansour, et al., 2003; Ramachandra & Subramanian, 1997). Hasatani (1997) identifies that the energy flow consists of three basic steps, including primary energy conversion, energy transportation and energy utilization including storage and recovery. To increase energy efficiency means to save energy in the three steps. Afgan, et al. (1999) view that possible efficiency increases can be achieved through the change in the efficiency of primary energy source conversion and the change in the efficiency of the final energy use. Thus, society can maximize the benefits it derives from energy use, and reduce related negative environmental impacts (Dincer & Rosen, 1999).

(b) Alternative Sources

The principle of alternative sources focuses on different sources, sectors and uses of energy to meet the demand of energy (Kleinpeter, 1995). The principle addresses two questions. First, how will different forms of energy be allocated to the users and provide optimum use for the regional economy given the structure of the energy supply? Second, if the energy demand is known for a given period of time, what should the optimal distribution of the energy supply be (Kleinpeter, 1995)? Consequently, the concern for renewal of natural resources has become a major issue in this principle (Islam, 1995). Voorspools (2004) suggests that an effective long-term solution to current energy-related problems would be the discovery of renewable energy[29] sources with unlimited potential that can cater for an exponentially growing demand. Sayigh (1999) emphasizes renewable energy is an abundant, well established technology and the main ingredient is free. Lovins (1976, 1979) designs a "*soft path*" and argues that a low-energy future for the United Sates is feasible. His goal was to make the case that technical advances would allow the nation to shift away from historic trends of an ever

[29] Renewable energy is often cross listed with clean energy or green energy. While the definition of renewable energy focuses more on the availability and continuity of energy sources, clean/green energy focuses more on the environmental impacts of energy. In other words, energy which is continuous or repetitive may have huge environmental impacts, e. g. hydropower (Truffer, Bratrich, Markard, Peter, Wiiest, & Wehrli, 2003) and wind energy (Arfi, Guiral, & Bouvy, 1993).

more fossil- and nuclear-based energy supply and toward renewable sources. Dincer and Rosen (2005) suggest renewable energy resources will provide an effective sustainable solution, and can contribute over a long term to achieving sustainable solutions to today’s energy problems. Presently, renewable energy represents 5 percent of all prime energy use, but by the year 2060, it is predicted that it will reach 70 percent (Sayigh, 1999).

(c) Mitigation of Environmental Impacts Principle

Since primary energy resources use of fossil fuels is a major source of emissions, the production and consumption of energy from fossil fuels are the main causes for the pollution of air, soil and water (Koroneos, Michailidis, & Moussiopoulos, 2004). Typical pollutants include carbon monoxide, sulphur dioxide, nitrogen dioxide, particles, and lead. These pollutants are closely related with global environmental problems of climate change, acid precipitation, stratospheric ozone depletion, emissions of a wide range of a wide range of pollutants including radioactive and toxic substances, and loss of forests and arable land (Dincer & Rosen, 2005). These environmental problems give rise to resource devastation and potential environmental hazards on a local, regional and global scale (Hammond, 2004b). The mitigation of environmental impacts principle aims at the reduction of pollutants and subsequent environmental problems during energy production and consumption (Kleinpeter, 1995). The main assumption of this principle is to protect the environment and public health in the process of meeting energy requirements (Hepbasli & Canakci, 2003). Dias, et al. (2004) believe energy use should consist of a set of actions that represents search for a conscious balance between the availability/consumption of energy relation and the environmental status. This principle is similar with the resource and environmental management paradigm of environmental protection. The principle can be achieved from the processes of energy production and consumption with the use of sources of clean energy and minimizing the embodied energy in materials and products by way of reuse and recycling (Hammond, 2004b). Effective management of available resources of energy and minimization of environmental impacts are crucial for energy planning in DRAs (Goralczyk, 2003).

(d) Integrated Energy Planning Principle

The rational energy use, alternative sources and mitigation of environmental impacts principles each make a valuable contribution to energy planning for more sustainable energy use (Kleinpeter, 1995). However, danger arises when energy policies are formulated based exclusively on one principle and prevent the consideration of a wider range of options. Ramachandra and Subramanian (1997) believe that the complex conflict between energy demand and environmental quality goals can be solved by an integrated approach to the problem of energy planning with emphasis on minimizing the consumption of non-renewable sources of energy, such as coal, oil, etc., to maximize the efficiency of end use devices in all sectors, and to organize a better approach to the use of renewable sources. The Integrated Energy Planning principle is being used by many countries all over the world, especially in developing countries. Buran, et al. (2003) state an integrated energy planning approach of adopting renewable energy sources and advanced technology, improving energy efficiency as well as reducing air pollution and greenhouse gas emissions are in the best interest of developing nations. Ramachandra and Subramanian (1997) suggest an integrated energy plan should include strategies to: (1) improve the efficiencies of end use devices and/or conversion equipment in all sectors; (2) optimize energy sources (end use matching); (3) maximize the use of renewable resources; (4) balance the exploitation of biomass energy resources; and (4) discourage the use of depletable resources. They complement the integrated energy planning approach will certainly help in boosting economic growth of a region, and equally important, it promotes structural changes which are conductive to overall development (Ramachandra & Subramanian, 1997).

2.3.3 Examples of Energy Planning and Usage Practice

The four principles of energy planning are commonly adopted in practice and many uses have been published. These examples range from corporate to the national level, reflecting one or several energy planning principles of increasing energy efficiency, energy conservation, utilization of technologies of renewable energy, making use of waste and integrated energy planning (Table 2.2).

Table 2.2: Examples of Energy Planning and Usage

	Corporate Level	**Local Level**	**Town Level**	**City Level**	**National Level**
Rational Energy Use	…	…	…	…	Japanese “Smart Life” (Mizuta, 2003)
Alternative Sources	Indian “Solar Roof” (Palaniappan & Subramanian, 1998)	Greece “RETs” (Koroneos, et al., 2004)	…	…	…
Mitigation of Environmental Impacts	…	…	Italian “Waste to Energy” (Maria & Fantozzi, 2004)	Turkey “Geothermal” (Hepbasli & Canakci, 2003)	…
Integrated Energy Planning	…	Chinese “Biogas” (Wang & Li, 2005)	…	…	…

By installing the "solar roof", some tea factories in South India reduced the energy consumption by 25 percent (Palaniappan & Subramanian, 1998). On the island of Lesvos in Greece, RETs are used to satisfy part[30] of the energy needs. In combination with the low-cost maintenance, RETs are found more attractive to use than traditional sources (Koroneos, et al., 2004). Household biogas digester is a good example of applying the integrated energy planning principle at the local level—while making use of wastes the application is generating considerable environmental and economic benefits (Wang & Li, 2005; Bi & Haight, 2007). At a larger level, micro-pyrolysis waste-to-energy plants in Italy's Umbria town not only reduce urban wastes between 30 to 50 percent but also contribute to electricity generation (Maria & Fantozzi, 2004). Turkey's Izmir-Balcova has extensive uses of geothermal energy, including space heating and domestic hot water supply, greenhouse heating, swimming and balneology, industrial processes, heat pumps and electricity generation (Hepbasli & Canakci, 2003). The geothermal applications in the city provide considerable energy supply and significantly reduce the consumption of fossil fuels and thereby atmospheric pollutants (Hepbasli & Canakci, 2003). At the national level, Japan is a good example of calling for and implementing the principle of rational energy use. The "Smart Life" policy aims at less energy consuming and a simple daily life with concrete targets[31]. With the uses of RETs, these efforts contribute to the energy-efficiency image of Japan (Mizuta, 2003).

Practices of energy planning principles are often facilitated and strengthened with the application of various policy instruments (Wiser, 2000). Established with concentration on certain energy problems or areas needing improvement, energy policies and their instruments are best embodiments of energy planning principles (Dias, et al., 2004). The literature has provided various energy policy instruments, most of which are widely used in developed countries. Typical energy policy instruments range from subsidy to pricing, from management/regulation to voluntary programs, and from education to cooperation, with increased capabilities in terms of increasing energy and environmental awareness, energy technology innovation and diffusion, and partnership and cooperation (Table 2.3). These improvements finally reflect the effectiveness and impacts of one or several fundamental principles of energy planning. Although these policy instruments may be difficult to apply in a context of a developing rural area, they can be used as good references for energy planners in practice.

[30] Koroneos, et al. (2004) acknowledge that it is impossible to replace the conventional energy systems completely by RETs, but the existing conventional energy systems can be replaced partially by RETs and RETs can be used to cover the needs for electricity and for hot water, while they can be used in combination with the existing systems for space heating.

[31] Such as mild setting of air-conditioning temperature, turning-off unnecessary light, television or other appliances, recycling of waste, more public transportation use than private car, etc. (Mizuta, 2003).

Table 2.3: The Portfolio of Energy Policy Instruments

Instrument	Methods and Incentives	Increased capability	Examples
Regulation standards	Control the set of technology choices; Induces high costs for using outdated systems	Increases energy and environmental awareness	Motor efficiency standards in the US (Akbaba, 1999) and European Union (Knight & McClay, 2000)
Subsidies, R&D support	Subsidy increases the economic attractiveness of options; R&D support enhances technical progress & innovation	Contributes to the adoption of renewable energy technologies	Civilized and Eco-villages in Hainan, China (Bi & Haight, 2007)
Pricing	Affects preference of energy-efficient measures	Contributes to higher awareness; Increase energy efficiency	Carbon taxes, fuel (excise) taxes, technology adoption tax credits, depletion allowances (Clarke, 1982; Pacudan, 1998; Serra, 1997)
Emission trading	Creates a price and market for energy/emission reduction	Increases energy awareness, communication and dissemination; Reduces environmental pollution	Dutch Long-term Agreement (Minnesma, 2003), EU greenhouse gas trade (Markussen & Svendsen, 2005), German Voluntary Agreement scheme (Kristof & Ramesohl, 1999)
Public voluntary programs	Provides know-how, and management support	Stimulates spontaneous R&D	US Green lights and Energy Star ®, Industries of the Future (Wiser, 2000); Canadian Voluntary Challenge and Registry (Takahashi, Masao, Kooten, & Vertinsky, 2001)
Management tools	Lowers transaction costs for efficient actions	Increased information; Strengthened staff capacities; Induced learning effects	UK Eco-Management and Audit Scheme (Strachan, Haque, McCulloch, & Moxen, 1997), ISO 14001 (Raines, 2002)
Labeling	Better communication of cost parameters	Increases information, Higher market transparency	E.U. labels, U.S. Energy Star® labels(Wiel & McMahon, 2003)
Technology procurement/ education	Provision and dissemination of information, know-how; Qualification and training	Stimulates R&D and innovation	E.U. energy+, Austrian Ecoprofit, U.S. Industrial Assessment Centre Program (Dias, et al., 2004)
Agency networks	Partnerships	Networking of actors	Allied Partners, Energy Star ® (Brown, Webber, & Koomey, 2002)

Sound uses and practices of energy planning lead to inspiring results and impacts. However, energy planners also need to consider, estimate and avoid the potential of failure in energy planning practice. Ramachandra and Subramanian (1997) argue that the failure of past energy planning is due to the primary goal of energy supply expansions based on the assumption of linkage between energy consumption and the economic growth of a region, with which energy becomes an end in itself, and the focus shifts on meeting increased energy consumption through energy supply expansion alone. Dincer and Rosen (1999) identify that the supply and demand based planning for each individual energy form has resulted in problems like inefficiency, losses, more conversions and other environmental problems. Kleinpeter (1995) emphasizes that energy planning must take into account all the political aspects including economic, social and environmental considerations depending on available energy resources and their acceptance by society.

2.3.4 Challenges and Barriers

Energy planning provides an excellent example of some of the challenges and barriers to be encountered in dealing with complexity and uncertainty (Dearden & Mitchell, 1998). The discussion on estimating future conditions and energy needs highlights the importance of different world views in influencing our judgements as to what is the most appropriate course of action. On one hand, it is a challenge to forecast energy supply and demand, as assumptions must be made about population growth, the nature of the economy, technology, relative prices, changing values, national security, environmental assessments, and access to offshore supplies. On the other hand, energy-related environmental impacts need to be considered and addressed in practice. Even when decision-makers have strategies to balance energy supply and demand in an environmentally sensitive way, further complicating this matter is the fact that there are too many constraints to restrict the implementation of energy policies and plans. The literature has sufficient discussions regarding the common challenges and barriers of energy planning in DRAs. These include cost-effectiveness, technical barriers, and market barriers such as inconsistent pricing structures, institutional, political and regulatory barriers and social and environmental barriers (Table 2.4).

2.4 Planning and Sustainability

Planning is a process of intervention with an intention to alter the existing course of events and the justification for planning is often comprehensiveness (Campbell & Fainstein, 1996b). It refers to a wide range of systematic activities designed to ensure that desired goals[32] are achieved in the future (Wheeler, 2004). Seeking to bring about a society that will not only exist but thrive far into the future, planning is closely related with sustainability (Wheeler, 2004). As an influential document on sustainable development, Agenda 21 states that authorities construct, operate, and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and sub-national environmental

[32] Such as environmental protection, urban development, particular forms of economic activity, social justice, and other ideals.

Table 2.4: Barriers of Energy Planning in DRAs

Barriers of Energy Planning	References
Financial • Economically not viable, e.g. high cost of capital, fees & long payback period; • Financing problems, e.g. lack of access to capital or credit to consumers; • Market problems, e.g. market size small & high capital costs for investors; • Lack of financial institutions & financial instruments to support.	(Dracker & De Laquil, 1996; Lookman & Rubin, 1998; Painuly, 2001; Weisser, 2004; Wyman, 1999)
Market • Favour to conventional energy sources or highly controlled energy sector; • High costs on energy technologies & equipment and other trade barriers; • Immaturity of energy market, e.g. lack of market competition & infrastructure; • Lack of information & awareness on energy system upgrading.	(Glicksman, Norford, & Greden, 2001; Muntasser, Bara, Quadri, El-Tarabelsi, & La-azebi, 2000)
Technical • Lack of skilled personnel/training facilities; • Lack of institutions, operation and management facilities & entrepreneurs; • Lack of technical assistance, testing & certification of energy systems.	(Gallaghe, Holdren, & Sagar, 2006; Li & Hu, 2003; Martinot, Sinton, & Haddad, 1997)
Institutional • Lack of mechanisms or legal/regulatory framework to disseminate info.; • Lack of involvement of stakeholders in decision-making; • Lack of professional institution & private sector participation; • Clash of institutional interests.	(Limmeechokchai & Chawana, 2007; Reddy & Shrestra, 1998; Roos, Graham, Hektor, & Rakos, 1999)
Social, Cultural & Behavioural • Unstable macro-economic environment; • Lack of research & development (R&D) culture; • Lack of public education on energy systems; • Lack of public acceptance of energy products & technologies.	(Kulczycka & Lipinska, 2003; Lutzenhiser, 1993; Rosch & Kaltschmitt, 1999)
Other Barriers • Uncertain governmental plans and policies on energy; • Environmental and resource constraints; • High risk perception for energy technologies.	(Leiserowitz, Kates, & Parris, 2006; Sathaye & Ravindranath, 1998)

policies[33] (UNCED, 1992). Contemporary to the UNCED's recognition of the key role of planning in relation to sustainable development, more than 60 developing and transitional countries have been recasting the original WCED's definition of sustainable development to highlight the local planning and management implications by developing the "Local Agenda 21" (WB, 1993). Rees (1988) suggests sustainable development needs effective planning and in return efficacious planning contributes to sustainable development. Given the prominence of planning in sustainable development programs, it is inevitable that sustainable development becomes a new focus for

[33] This broad statement emphasizes the importance of implementing policy at the local level and supports local levels of government to implement global environmental mandates.

planning, warmly embraced by planners (Healy & Shaw, 1994; Selman, 1995). Brugmann (1996) suggests planners simultaneously address social, economic and environmental issues and link local actions with global outcomes, which are in compliance with the needs of sustainable development. Sustainable development is viewed as a framework for long-term plans, integrating new tools (e.g., economic instruments & environmental thresholds), raising new issues and affecting underlying attitudes (Voogd, 1994; Selman, 1995). Despite the increasing attention given to planning as part of sustainable initiatives and discourse regarding sustainability, the role that planning practitioners actually play in the adoption and implementation of new environmental programs and plans has received only scant attention (Feitelson, 1998).

2.4.1 Evolution of Planning

Modern planning originated in the late 19th century when rapid growth of cities following the industrial revolution led to a vast of urban problems[34], such as inadequate sanitation, water supply, transportation, and housing (Campbell & Fainstein, 1996b). Many professionals responded to the urban crises of this period, applying planning in various fields (Figure 2.3). In the meantime, there emerged a number of early planning visionaries such as Ebenezer Howard, Patrick Geddes, and Ildefons Cerda who applied broad and holistic styles of thought to urban problems, leading to concepts such as Howard’s “garden city” (Wheeler, 2004). After the emergence of zoning in German cities in the 1890s, planning began to be established as a profession in Britain and North America during the 1910s and 1920s when municipalities started creating planning commissions, planning staffs, and zoning laws (Klosterman, 1996). During the evolution of planning, two major changes took place (Taylor, 1998b). The first occurred in the 1960s with the shift from the “Blue Print” Planning or traditional urban design to systematic and rational planning to cope with urban sprawl, increasing population densities, reduction of open space, inadequate housing, water shortage, sewage contamination and spreading diseases. The second change happened in the 1970s and 1980s and shifted the role of planners as a technical expert to a facilitator, i.e. drawing more on other people’s views to the making of planning judgments in attempt to narrow the gap between planning theory and practice (Brooks, 2002). Despite of the evolution, few researchers or planners focused on the effectiveness of energy planning. So far in the literature, there is no well-established framework available for examining the process of energy planning in DRAs.

[34] At that time, millions of industrial workers and their families flooded in poor urban residence without adequate light, water, or sewer facilities in Europe and North America. A city of this period was described as “a city of dreadful night” (Hall, 1996).

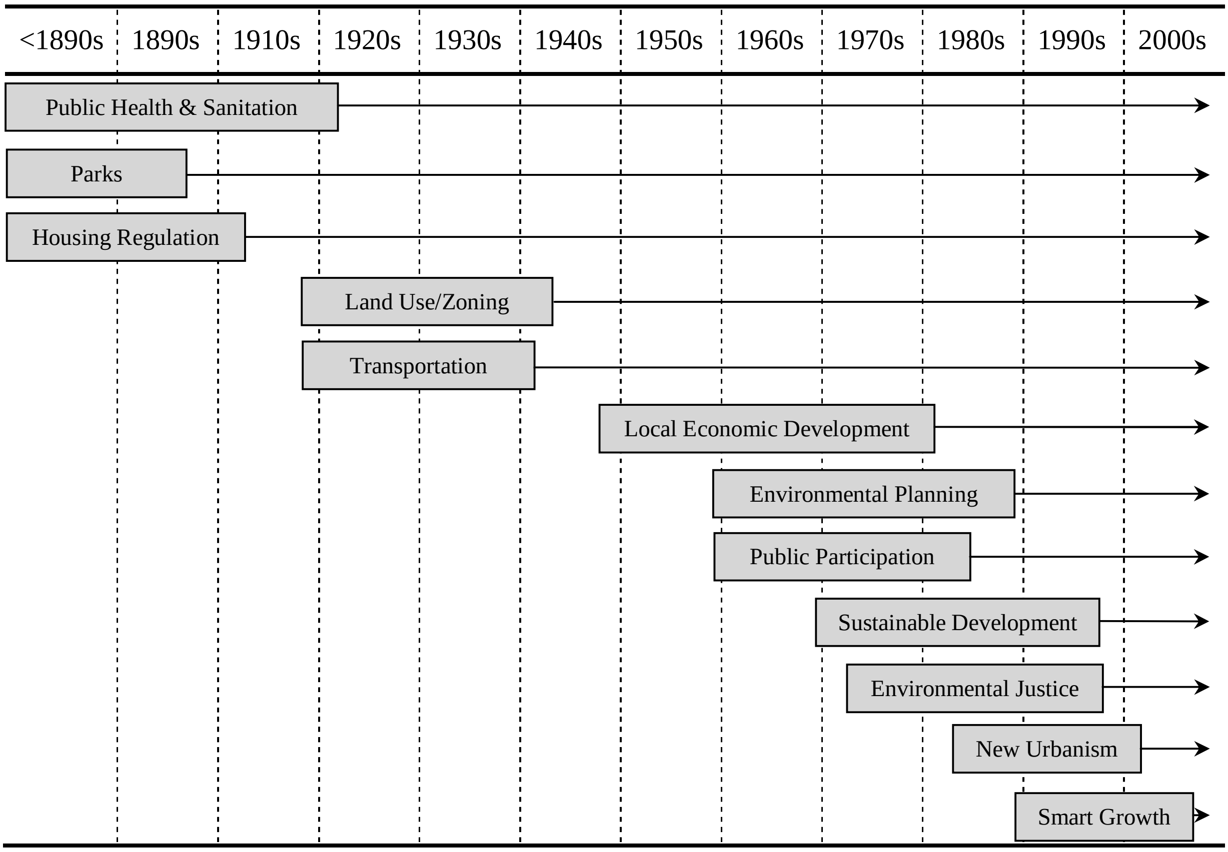

Figure 2.3: The Evolution of Planning

Source: Adapted based on (Wheeler, 2004)

2.4.2 Fundamental Model: Rational Comprehensive Planning

In World War II, the Rational Comprehensive Planning [RCP] model became the theoretical foundation of planning (Klosterman, 1996). Under the model, planners analyze situations, define goals, identify obstacles that prevent these from being accomplished, develop alternative solutions, compare these, decide on a preferred solution, implement this, and then evaluate its success (Hock, 2000). Since planners are often uncertain about the efficiency, effectiveness, or impacts of their interventions (Seasons, 2003), a holistic, scientific or rational approach makes them more confident (Hodge, 1998; Baum, 2001; Wheeler, 2004). According to Mitchell (1997, p. 84-85),

> "*The approach has some well-established steps or phases, including (1) defining the problem, (2) establishing goals and objectives, (3) identifying alternative means of achieving the goals and objectives, (4) assessing the options against some explicit criteria, (5) choosing a preferred solution and implementing it, and (6) monitoring and evaluation.*"

The RCP approach has many strengths—it provides a clear, straight-forward method of formulating policy and programs, and is useful at many different levels of planning; it also meshes well with the use of indicators to measure sustainability problems and the effectiveness of policies; it appears logical to many members of the public, tends to be respected by local political leaders, and can be designed to offer opportunities for public involvement (Wheeler, 2004). Hostovsky (2006) identifies the objectivity represents the greatest strength of the comprehensive approach which results in a more convincing solution because of the consideration of the widest variety of variables.

However, this model has been criticized on a number of grounds. The approach is often seen as overly expert-driven, based on a mind-set in which detached, 'objective' planning analysts determine policy rather than letting public concerns drive the planning process (O'Sullivan, 1981). In practice, it has also been criticized for relying on quantitative analysis of data rather than taking into account less tangible qualitative elements of social, human and environmental factors (Wheeler, 2004). Hence, the approach is likely to fail in developing the public and political buy-in necessary for policies to work (Wheeler, 2004). Also, planners may become seduced by the expert or facilitative roles required in the RCP model, and may simply focus on fulfilling these responsibilities and allowing the model to work rather than taking on more active entrepreneurial or advocacy roles to ensure that plans are implemented, goals are met, and underrepresented interests are considered in the process (Wheeler, 2004). Hostovsky (2006) criticizes the complexity of the rational comprehensive approach as the greatest weakness since the approach leads to overly complex, redundant, time-consuming, and expensive. The complexity often leads to accumulation of outdated or impossible general goals and volumes of data but with very little coordination or understanding (Swanstrom, 1987; Noble, 2000). Also, public inputs, which determine the success of the plans, may be ignored by the comprehensive approach because of its great reliance on quantification technology (O'Sullivan, 1981).

2.4.3 Other Major Planning Approaches

Modern planning has evolved with public participation in a number of planning projects of local economic development and environmental planning in the 1960s – 90s, including slum clearance, urban sprawl and inadequate housing (Grant, 1989; Hall, 1980; Taylor, 1998a). With increasing critiques were made on the shortcomings of the RCP model, more and more scholars came up with new ideas for more effective planning. In the period, various planning ideas and approaches emerged, including integrated planning (Conyers & Hills, 1986), strategic planning (Kaufman & Jacobs, 1987), incremental planning (Lindblom, 1959), adaptive planning (Holling, 1978), advocacy planning (Davidoff, 1965), transactive planning (Friedmann, 1973), and collaborative/communicative planning (Healey, 1992). Each of these classic planning approaches contraposes the shortcomings of RCP and reinforces the approach in different aspects. Along with RCP, the discussions and arguments on the new approaches also provide insights on more effective energy planning in DRAs. Of course, RCP and other approaches to planning have own strengths and weaknesses, which are summarized in Table 2.5[35]. The critical review of the strengths and weaknesses is a key and fundamental step of identifying the impacts of planning approaches on energy planning and developing the evaluative framework.

Table 2.5: Summary of Planning Approaches

Approach	**Strengths/Pros**	**Weaknesses/Cons**
RCP	• Emphasizes the integrity of planning • Well-established steps of planning • Relies on holistic and scientific approaches • Conducts comprehensive studies & comparisons • Decisions made upon the best solution among a few alternatives • Clear and straight-forward for planning • Emphasizes monitoring, evaluation, and reflection	• Overly expert-driven • Overly relies on quantitative data and approaches • Ignores public concerns and inputs in planning • Overly complex, redundant, time-consuming, and expensive • Lacks of flexibility and may not fit the changing settings
Integrated	• A holistic approach on specific problems • Respects carrying capacity of eco-system • Values stakeholders' inputs & participation • Addresses a constructive process • Aims at all of its component parts working together harmoniously • Respects culture and attitudes • Highlights legitimation applications • Emphasizes the integrity of planning, management and control	• Over-estimates planners' ability • Not enough respect to uncertainty and complexity • Does not work well with situations of contradictions, uncertainty, and complexity • May cause frustration among planners • Compromises may be needed
Strategic	• Decision-making based on comprehensive analyses • SWOT analysis • Advocates competition and emphasizes competitive advantages • Action-oriented and focuses on strategic issues and opportunities • Emphasizes the present & future contexts	• Being amorphous • May fail due to confrontations • Not much attention to implementation • Constraints of legislation limit the flexibility • Problematic within non-profit organizations

35 Detailed description and critique of the approaches can be referenced in Appendix B.

Table 2.5. Continued.

Incremental	• Acknowledges complexity and uncertainty • Relies on successive limited comparison • Establishes attainable and generally satisfactory goals • Not all alternatives need to be identified • Achieves realistic, short-term goals • A precautionary principle	• Too timid or conservative • Too ideal to be practical • May reinforce inertia and anti-innovation • Doubts on small progresses leading to revolution • May be sub-optimal & inefficient
Adaptive	• Learning by doing, and trial-and-error • Acknowledges and respects uncertainty & complexity • Establishes & implements plans based on local conditions • Flexible and resilient • Continuous monitoring, assessing & policy adjustments	• May be passive • Unclear cause-and-effect relationships between intervention activities and changes in ecosystem conditions • May be hard to be adopted in practice
Advocacy Transactive Collaborative	• Equity, Participation & Reflection: • Involves citizens & civic leaders in decision-making • Advocates interests of the public especially the disadvantaged groups • Face-to-face dialogues (interactions) & learning • Planners should represent groups being affected • Planners should connect government & the public • Communication & interactions among institutions	• May be subject to political and legal constraints • May be ineffective in building support for constructive alternatives • Not enough respect to scientific approaches • Time and budget constraints to public participation • Conflicts and unwarranted public trust • Doubts on the effectiveness of communication

2.4.4 Complexity & Uncertainty

Planning, taken as a social science, is deeply associated with ecology and is subject to our knowledge of nature (Vasishth, 2008). Complexity and uncertainty commonly exist in nature as well as the planning process (Dearden & Mitchell, 1998). Definitions of complexity and uncertainty vary with the change of subject and context. Complexity tends to be used to characterize something with many parts in intricate arrangement (Lloyd, 2006). Materialism and dialecticism affirm that nature is our first and best operational example of complex system, which is evolving and constantly changing (Vasishth, 2008). Likewise, there is no unique definition to the term 'uncertainty', which has different meanings according to various authors. According to Hrudey (1996), uncertainty comprises true uncertainty, which is theoretically (although often not practically) reducible, and variability or indeterminacy, which is inherent in natural systems and cannot be reduced. Stirling (2001) describes that "*uncertainty applies to a condition under which there is confidence in the completeness of the* *defined set of outcomes, but where there is acknowledged to exist no uniquely valid theoretical or empirical basis for the assigning of probabilities of these outcomes*" (p. 78).

As our knowledge and understanding of environmental issues have evolved, we have come to realize that environmental decision-making has to address complexity and uncertainty of both ecological systems and independent human organizational and institutional systems (Berkes & Folke, 1998; Gunderson & Holling, 2002; Holling, 2001; Kay, et al., 1999; Mitchell, 2002). The acknowledgement of complexity and uncertainty in nature and planning indicates that planners should take planning in a way that respect complexity and uncertainty in some sophisticated cognitive way, rather than seeking to reduce them to a form more manageable by planners' innately limited perceptual abilities (Slocombe, 2004; Vasishth, 2008). Consequently, the effectiveness of planning interventions under complexity and uncertainty is contingent upon the telling of context and consequence, and on the pragmatic construction of strategically information-rich descriptions (Vasishth, 2008).

2.4.5 Impacts of Planning Theory on Energy Planning

Energy planning represents a typical example of some of the challenges to be encountered in dealing with complexity and uncertainty. As summarized in previous sections, energy planning is confronted with two main challenges, energy security and environmental impacts of energy production and consumption if energy sustainability is to be achieved. Forecasting energy supply and demand is a challenge, as many assumptions must be made about population growth, the nature of the economy, technology, relative prices, changing values, national security, environmental assessments, access to offshore supplies and so on (Dearden & Mitchell, 1998). Further complicating this matter is the necessary attempt of minimizing environmental problems caused by energy production and consumption, during which human and social conflicts may exist and confront the practice of energy planning, especially in DRAs (Mitchell, 2002).

Despite the diversity of approaches to planning, it is unlikely to identify a 'one size fit all' planning approach for a specific planning practice. Each planning approach has merits and weaknesses, and no single planning model or approach can prevail without inputs from the others (Hudson, 1979; Barrett & Grizzle, 1999). A planning model for energy planning process takes its theoretical guidance from planning theory, thereby demonstrating greater promise for promoting effectiveness. Planning theory suggests that we should proceed with ecological intervention if we are reasonably sure that current activities will cause a significant long-term loss of productivity or significant long-term impacts on the environment (Parma & NCEAS, 1998). Given the necessity of improving the current energy consumption pattern in DRAs, appropriate energy intervention programs are imperative. With the high degree of uncertainty and complexity in the energy environment, energy planning tasks become more and more difficult and complicated (Edelman, 2000). On the other hand, energy plans should establish energy production and utilization objectives for the medium and long term; define the strategies to be followed and the resources to be committed; and propose the necessary legislative and administrative action for monitoring implementation (Baum, 1984). Addressing the problems of energy use and energy planning in DRAs, it is crucial that the energy intervention programs are widely accepted and continuously viable, and have the desired effects that lead to positive changes in rural people's energy use. A mixed scanning[36] of major planning approaches leads to a series of key considerations for energy intervention programs in DRAs (Table 2.6). RCP provides a rationale that energy planning should follow a few necessary planning steps of operationalization, implementation and monitoring. Integrated planning emphasizes the necessity of considering and integrating a holistic and operational scope that is directed to focus on key variables identified relevant to the system in question. Strategic planning expands the analytical angle by stressing the SWOT [strengths, weaknesses, opportunities, and threats] analysis of both internal and external factors. Incremental planning and adaptive planning acknowledge and respect complexity and uncertainty, and prioritize principles of limited variables, successive processing, and continuous learning. Advocacy planning, transactive planning and collaborative planning emphasize the importance of communication and interaction among different stakeholders, which indicate that energy planning in DRAs should be equitable, participative, and reflective.

2.5 Community Development and Sustainability

As an idiom of intervention, community development originates within politico-administrative transformations of the nation-state, and in competing Western reformist and socialist intellectual traditions (Campfens, 1997). Community development has connected and flourished with planning after the World War II (Arce, 2003). There are many definitions of community development from

[36] Etzioni (1967) suggests that a broad scanning of the problem is complimented with a detailed examination of aspects that arise from the larger scan. He terms this approach as 'mixed scanning' and highlights that we do not approach an issue or problems without a picture of what to expect or how to frame it. Thus, mixed scanning is a compromise approach to the choosing of a combination that combines the merits of different approaches and views, and is likely to fit in with problems.

Table 2.6: Impacts of Planning Theory on Energy Planning

Approach	Key Elements & Insights for Energy Planning	References
RCP	Well established steps or phases for planning: • Defines the problem • Establishes goals & objectives • Identifies alternative means of achieving the goals • Assesses options against some explicit criteria • Chooses a preferred solution & implement it • Monitoring and evaluation	Campbell & Fainstein, 1996a; Mitchell , 1997; Hock, 2000; Noble, 2000; Baum, 2001; Wheeler, 2004; Hostovsky, 2006;
Integrated	A holistic approach: • Stresses an operational scope • Focuses on key variables • Integrates perspectives of the peer communities • Involves public participants • Generates solutions built on consensus	Conyers & Hills, 1986; Briassoulis, 1989; Mitchell, 1997, 1999; Kay, et al., 1999; Tarsitano, 2006
Strategic	Comprehensiveness & Competitiveness: • A continual & iterative process • Stimulates competition • Considers both external & internal factors • SWOT analysis	Denhardt, 1986; Bryson & Roering, 1988; Bryson, 1995; Stead & Stead, 2004
Incremental	Incrementalism: • Relies on successive limited comparison • Establishes attainable & generally satisfactory goals • Acknowledges complexity and uncertainty • Not all alternatives need to be identified • Achieves realistic, short-term goals • A precautionary principle	Lindblom, 1959, 1974; Altshuler, 1965; Durand, et al., 1982; Campbell & Fainstein, 1996b; Mitchell, 1997
Adaptive	Adaption & Flexibility: • Learning by doing, and trial-and-error • Acknowledges and respects uncertainty & complexity • Establishes/implements plans based on local conditions • Continuous monitoring, assessing & policy adjustment	Holling, 1978, 1986; Haney & Power, 1996; Walters & Holling, 1990; Thom, 2000; Parma, et al., 1998
Advocacy Transactive Collaborative	Equity, Participation & Reflection: • Involves citizens & civic leaders in decision-making • Advocates interests of the public especially the disadvantaged groups • Face-to-face dialogues (interactions) & learning • Planners should represent groups being affected • Planners should connect government & the public • Communication & interactions among institutions	Davidoff, 1965; Hudson, 1979; Friedmann, 1987, 1996; Healey, 1992, 2003; Khakee, 1998; Booher & Innes, 2002; Wheeler, 2004; etc.

different angles. Day (1998) sees that community development is about bringing the social relationships of community into alignment with the pursuit of locally preferred economic and political ends, while making the economics of the locality an integral part of the whole social system. Craig (1998) defines community development as,

> "*A method of working with people…a way of working which essentially starts with the needs and aspirations of groups of disadvantaged people in poor localities and which struggles, first of all, to articulate and organize politically around those needs and aspirations, placing them at the front rather than the end of political debate …*" (p. 15).

He states that what community development strives for is to give ordinary people a voice for expressing and acting on their extraordinary needs and desires in opposition to the vested interests of global economic and political power, to counter the increasing commodification of human welfare and human beings themselves (Craig, 1998). The Office of the Deputy Prime Minister [ODPM] (2003) of England specifies the key requirements of a sustainable community (Table 2.7). Community development supports the normative notions of sustainable development, advocating equity, empowerment, and environmentally sensitive economic development (Raco, 2005).

Table 2.7: Key Requirements of a Sustainable Community

- A flourishing local economy to provide jobs and wealth
- Strong leaderships to respond positively to change
- Effective engagement and participation by local people, groups and businesses in the planning, design and long-term stewardship of their community
- An active voluntary and community sector
- A safe and healthy local environment with well-designed public and green space
- Sufficient size, scale and density and the right layout to support basic amenities in the neighbourhood and minimize use of resources
- Good public transport and other transport infrastructure both within the community and linking it to urban, rural and regional centres
- Buildings—both individually and collectively—that meet different needs over time and minimize the use of resources
- A well-integrated mix of decent homes of different types and tenures to support a range of household sizes, ages and incomes
- Good quality local public services, including education and training opportunities, health care and community facilities, especially for leisure
- A diverse, vibrant and creative local culture, encouraging pride in the community and cohesion within it
- A sense of "place"
- The right links with the wider regional, national and international community

Source: Adapted based on (ODPM, 2003)

Rather than as a method to which community members must adhere, community planning and community development should start from "*where the people are*" (Minkler & Wallerstein, 1997, p.

242). Forms of conservation, production and development practice should be more endogenous or integrated in their orientation than those which have prevailed in the past (Day, 1998; Keane, 1990). Lindsey, Stajduhar, and McGuinness (2001) argue that if community members are given the opportunity to work out their own problems, they will find solutions that have a more lasting effect than when they are not involved in such problem solving processes. Sustainable rural communities should be able to recognize and internalize exogenous opportunities of growth, i.e. markets, policies, and technology opportunities, properly integrating and balancing them with the need to preserve and enhance rural specificities and diversity (Van der Ploeg & Long, 1994). At the local level, rural populations are key actors in natural resource governance and their everyday actions are influencing the effectiveness and long-term sustainability of the rural areas (Constantin, 1999). Consisting of resources and capacities, the sustenance of rural activities could make a significant contribution in alleviating or eradicating poverty whilst protecting environmental resources (Dovie, 2003). Farmers and rural people thus assigned an active role and identified as primary economic and social actors in the determination of their development options, in the control over the development process and in the retention of the benefits. Day (1998) sees that it may take a long time and considerable efforts to find ways of working which are in harmony with what is already there but in the end the process may produce benefits which are strong and lasting.

2.5.1 Community Capacity Building

Although sustainability has generated a variety of interpretations and definitions, there is an intimate connection between community sustainability and community capacity (Roseland, 2000). Community capacity is defined as the community's ability to identify, enhance and mobilize its human potential, economic opportunities, social relationships and ecological resources for the purpose of improved community stability (Laverack, 2005; Roseland, 2000). Paralleled to the process of community development, community capacity building is a process of voluntary cooperation and self-help or mutual aid among community members for the purpose of achieving effective community based action and change (Chavis & Florin, 1990; Pierce & Roseland, 2000). At its most basics, community development is about the enhancement of the capacity of local populations to respond collectively to events and issues that affect them (Gilchrist, 2003). As Maser (1996) identifies that "*development as process means building capacity, and sustainable community development means building the capacity of people to work collectively in addressing their common interests in the local society within the context of sustainability*" (p. 174). Such definition evinces the need to serve the vulnerable and marginalized, to create political and social spaces and to counteract the objectification of ordinary people. It is about restoring the human face that is often left out of economic development measurements based predominantly on growth. Developing local capacities, and finding ways of working which are in harmony with what is already there, rather than simply imposing standard models from outside, demands patience and a considerable investment of effort; but in the end it may produce benefits which are lasting, and which do less damage to a rural social fabric that has been constructed over a very long period of time (Day, 1998). To enhance community capacity, local populations prioritize or focus on areas experiencing multiple disadvantages or where there is a perceived need for local infrastructure and capabilities to be improved (Gilchrist, 2003). Roseland (2000) emphasizes that the process of community development often contains citizen action, voluntary participation, cooperation, and collaborative problem solving, empowerment and a focus on holistic, community-wide outcomes. Often, the outcome of such process is a healthier and more reasonable community condition in terms of human, social, economic and ecological capacities as shown in Table 2.8 (McCall, 2003).

Table 2.8: Indicators of Community Capacity: Areas and Factors

Human Capacity	**Social Capacity**	**Economic Capacity**	**Ecological Capacity**
Skills and Education	Sense of Community	Economic Health	Ecosystem Health
Leadership	Community-based Organizations	Diversity	Natural Resources
Civic Engagement[i]	Community Participation	Adaptability	Commercial[ii]
Entrepreneurial Spirit	Community Planning	Health of Local Businesses	Harvesting
Labour Force	Community Cooperation	Sustainability	Ecological amenities[iii]
		Informal Economic Activity	Stewardship[iv]
		Local Control	
		Access to Capital	
		Local Infrastructure	
		Amenities[v]	

i. Individual and collective actions designed to identify and address issues of public concern
ii. Community and environmental image and reputation that lead to further investments
iii. Ecological factors that increases attractiveness of people or tourists
iv. The responsibility for environmental quality shared by community members whose actions affect the environment
v. Economic features and conditions that increase attractiveness of investments or value

Source: (McCall, 2003)

2.5.2 Public Participation

Originally conceived as a mechanism for obtaining local views on complex issues, public participation provides a safeguard against ill-informed decisions, educates the public and decision-makers alike of each other's concerns, builds public confidence and understanding, and provides new and valuable information to planners and policy makers (Pollard & McKechnie, 1986). Today, public participation has been recognized by decision-makers as an indispensible element in resource planning and management (Dearden & Mitchell, 1998). As stated in the Canadian federal government's Green Plan that, "*also needed is effective public participation*" and "*decision-makers recognize that we can no longer rely solely on experts for the solutions to environmental problems. Instead, we need input from a wider cross-section of the population*" (Government of Canada [GC], 1990, p. 18). Typical participation mechanisms include public hearings, citizen forums, community or neighbourhood meetings, community outreaches, and focus groups, the Internet, and e-mail are also used (Wang, 2001). Public participation leads to satisfying the needs of the public; it helps build consensus on organizational goals, service priorities, good performance, and fiscal commitment; and it improves public trust of governmental decisions (Wang, 2001).

The literature on public participation and participatory processes stems from two major branches: political sciences with discussions around democracy and citizenship especially within the context of regional and local planning (Davis, 1996; Munro-Clark, 1990), and development theory especially within the context of sustainable land use (Chambers, 1997; Nelson & Wright, 1995). Based on the two branches, theoretical perspectives and practice of public participation have flourished. Firstly, public participation is identified as an ideology or a specific ethos for community development (Walters, Aydelotte, & Miller, 2000). Occurring in policy-making or decision-making, public participation requires the public to involve in goal setting, strategy, policy, capacity determination, and implementation evaluation (Waters, et al., 2000). Western scholars, such as Lando (1999) and Yankelovich (1991), regard public participation in decision-making as evidence of 'genuine' or 'meaningful' participation as it is how 'public beliefs and values' can be integrated and realized. Across a range of policy areas, public participation and community involvement in decision-making is seen as a way of building accountability and legitimacy, empowering people and communities, and ensuring that public policies better reflect the needs of people (Gustafsson & Driver, 2005). Secondly, public participation is identified as "*a means to an end*", which include a set of guidelines and practices of involving communities or the general public in specific planning activities (Hoverman & Buchy, 2000, p. 16). In this regard, public participation appears in various public service functions as economic development, environmental protection, education, public health, and public safety (Aryani, Garrett, & Alsabrook, 2000; Foley, 1998; Iglitzin, 1995; Kovalick & Kelly, 1998; Morgan, 1987; Sanoff, 2000), as well as in management functions such as budgeting (O'Toole & Marshall, 1988; Simonsen & Robbins, 2000).

Public participation may vary among different domains, and the level of influence and power transferred to citizens involved in public participation processes may differ significant, depending on whether information transfer, consultation, or consensus building is the goal of the process (Arnstein, 1969). Arnstein (1969) conceptualizes a ladder of participation (Table 2.9). Her contention indicates that there are alternative ways of defining the power relationship between government and the public, and that the only real participation is one where there is at least full partnership or, potentially, full control by the participants involved. Otherwise, she argues that participation can be simple manipulation, tokenism or the like. For example, we can distinguish between modes of 'consultation', where local authorities receive suggestions and criticisms but can simply reject the ones they think are inappropriate or irrelevant, and 'participation' where there is a certain degree of redistribution of power (Bickerstaff, Tolley, & Walker, 2002). The literature also points out that enthusiasm for participation often disregards the unrealistic demands it makes on people, with more pressing demands on their time and in their lives (Golooba-Mutebi, 2004). As Schmitter (1995) realizes that,

"*individuals have preferences and are aware of the need for collective action to defend*

Table 2.9: A Ladder of Public Participation

Mode of participation	**Involvement of local people**	**Relationship of research & action to local people**
Co-option	Token; representatives are chosen, but no real input or power	On
Compliance	Tasks are assigned, with incentives; outsiders decide agenda and direct the process	For
Consultation	Local opinions asked; outsiders analyze and decide on a course of action	For/With
Cooperation	Local people work together with outsiders to determine priorities, responsibility remains with outsiders for directing the process	With
Co-learning	Local people and outsiders share their knowledge, to create new understanding and work together to form action plans, with outsider facilitation	With/By
Collective action	Local people set their own agenda and mobilize to carry it out, in the absence of outside initiators and facilitators	By

Source: Adapted from (Arnstein, 1969)

them, they also have a restricted capacity to explore their interest situation and a strong temptation to free-ride on the action of others" (p. 20).

Consequently, participation requires people to give their time and resources, which may be problematic and hard to sustain (Golooba-Mutebi, 2004).

2.5.3 Stakeholder Theory

Stakeholder theory developed from political science and business management research (Brugha & Varvasovszky, 2000). In the early 1930s, the General Electric Company identified four major interest groups as the company's primary stakeholders, including customers, employees, the general public and shareholders, giving rise to the stakeholder theory (Preston, 1990). With Freeman's pioneer work "*Strategic Management: A Stakeholder Approach*" stakeholder theory has been advanced rapidly in both the literature and practice of management, planning and public administration (Bryson, 2004; Burby, 2003; Freeman, 1984; Friend & Hickling, 2004). Today, there is an extensive literature on stakeholders and how they influence policy, organizations, decision-making, and development projects (Brugha & Varvasovszky, 2000). The modern conception of a stakeholder is established based on Freeman's (1984) definition of a stakeholder, "*any group or individual who can affect or is affected by the achievement of an organization's objectives*" (p. 46). Similarly, Donaldson and Preston (1995) define a stakeholder as a group or individual who has a legitimate interest in an organization's activities; Carroll (1996) defines a stakeholder as an individual or group who can affect or is affected by the actions, decisions, policies, or goals of an organization. Although stakeholder theory originates from corporate management, it has been extended beyond a narrow business focus to other areas, such as policy and planning (Burby, 2003; Friend & Hickling, 2004).

Brugha and Varvasovszky (2000) suggest that planners should employ stakeholder theory to assist policy analysis and formulation, to conduct strategic planning and evaluate threats and opportunities for change, to facilitate consensus building, public participation and stakeholder collaboration in a planning process, or to facilitate efficiency, effectiveness and equity in planning and decision-making. It is commonly accepted that analysis of stakeholders' perspectives is useful in generating knowledge about relevant individuals and groups, both within and outside of a specific domain, so as to understand their interests, interrelations and behaviours; to assess the their impacts on decision-making or implementation processes, to manage stakeholders and identify opportunities to mobilize their support for achieving specific objectives, to understand the policy context and assess the feasibility of future policy directions, and to facilitate the implementation of projects, specific decisions or objectives (Burby, 2003). Modern stakeholder theory has three directions, including descriptive/empirical, normative, and instrumental rationales (Donaldson & Preston, 1995). Descriptive studies document how organizations manage or interact with stakeholders; normative stakeholder theory prescribes how organizations ought to treat their stakeholders; and instrumental stakeholder theory focuses on how organizations pursue their interests through managing relationships with stakeholders (Butterfield, Reed, & Lemak, 2004; Freeman, 1999). These three approaches are not totally distinct, but overlapping and mutually supportive (Jones & Wicks, 1999). Descriptive papers have first tried to identify and classify the main stakeholders and, subsequently, normative and instrumental articles have attempted to provide guidance and directions for the actions of organizations in order to meet the particular requirements of specific stakeholders (Antonacopoulou & Meric, 2005).

2.5.4 Social Learning

Since the pioneering theoretical combination of psychoanalysis and behaviourism (Rutter, 1954), there has been a growing body of evidence and discussion linking social learning with improved mental and physical health, and other general well-being outcomes of community members (Berkes & Folke, 1998). As a tradition in planning[37], social learning theory acknowledges ‘learning by doing’ in community development projects (Friedmann, 1987). Social learning depicts a process in which individuals learn from their community neighbours’ previous experiences of adopting new technologies and the subsequent outcomes (Munshi, 2004). Focusing on the learning that occurs within a social context, social learning theory considers that people learn from one another, through such processes as observational learning, imitation, and modeling (Bandura, 1988). Webler, Kastenholz, and Renn (1995) address that social learning means more than merely individuals learning in a social situation. Rather, social learning envisions a community of people with diverse personal interests, but also common interests, who must come together to reach agreement on collective action to solve a mutual problem (Webler, et al., 1995). Social learning usually consists of two general components, cognitive enhancement and moral development (Webler, et al., 1995). Cognitive enhancement is the acquisition of knowledge while moral development refers to how individuals come to make decisions about what is right and wrong (Webler, et al., 1995).

[37] Other traditions in planning include policy analysis, social reform and social mobilization (Friedmann, 1987).

Social learning theory suggests that results of people's behaviour have an impact on the motivation of their community members to engage in that behaviour (Rutter, 1954). Desiring positive results or effects, people will more likely to engage in a behaviour from which they expect a high probability of a positive outcome. Then, the behaviour is reinforced with positive outcomes and will lead other people to repeat the behaviour (Bandura, 1988). This perspective is in consistent with Quirke's (1997) communication theory. Quirke (1997) believes that communication or learning is a continuous and dynamic process. He further proposes 'a communication escalator' demonstrating the five main stages of involvement in collective decisions on community development projects, including creating and increasing awareness, building understanding, gaining support, involving stakeholders, and gaining commitment (Figure 2.4).

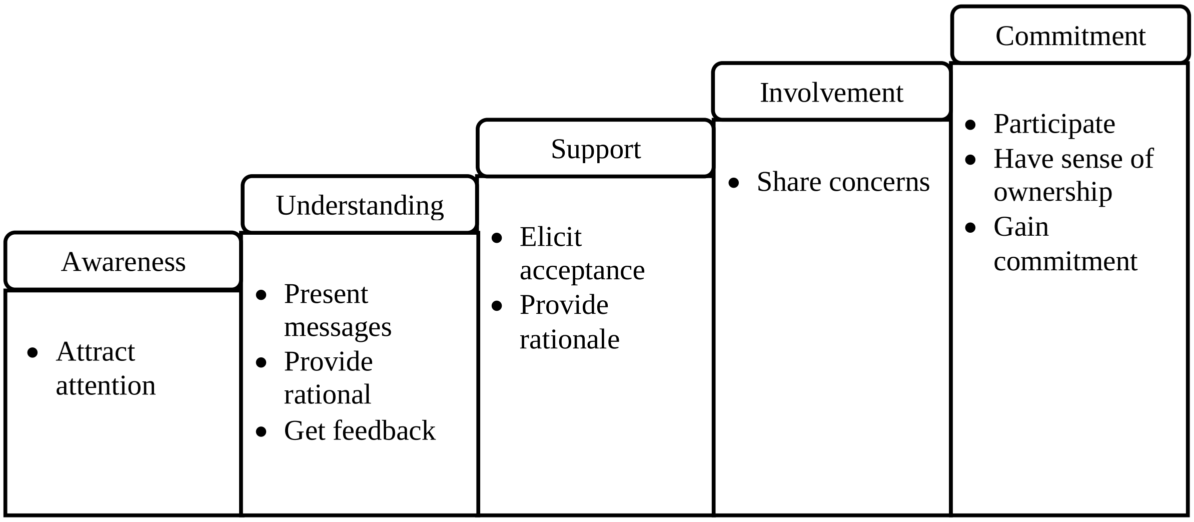

Figure 2.4: The Communication Escalator

Source: Quirke, 1997

On the other hand, social learning, as a specific and collective form of studying, has special significance in planning and policy fields. Although individuals and communities may have diverse, partial, and sometimes irreconcilable perspectives on public problems and solutions, learning together where these partial views intersect, diverge, and may reach compromise may be the only democratically legitimate means of devising socially reliable solutions to many contemporary planning and policy dilemmas (Holden, 2008). As Dryzek (1990) identifies that, "*without understanding and indeed promoting social learning, there is little hope of reasoned resolution of the clash of inevitably partial ideologies or rationalities*" (p. 122). In recent development practice, policy analysis, and management studies, scholars have proliferated the concept of social learning to comprise a collection of phenomena of learning by individuals through observation or interaction with their social context, learning by social aggregates, learning pertaining to social issues; and learning that results in recognizable social entities such as collective decision-making procedures, culture, etc. (Maarleveld & Dangbegnon, 1999).

In terms of a normative framework for resource management, a social learning perspective aims to convey the manner in which people learn and need to learn how to gain insight into, predict, and control the way their actions affect the natural and human domains to ensure a sustainable future (Maarleveld & Dangbegnon, 1999). There is a growing call for research into social learning process as part of the research agenda for more sustainable livelihoods (Ekins, 2004). Darby (2006) states that social learning is a prerequisite for sustainable energy use and energy sustainability can only be understood through a continuous learning process that occurs when a given domain acquires the necessary knowledge to reduce its energy consumption or increase its energy efficiency without diminishing its quality of life or creating new social inequalities. The premise of social learning for the author is the procedure of obtaining, interpreting, and acting upon information in energy planning for regional development which is much less like a computer algorithm, rather an embedded collective reasoning and learning process towards public ends – and planners and policy researchers have a lot to learn about such learning process. As part of a learning process, decisions and policy implications certainly depend on good information, but they also depend on contingencies in information transfer among stakeholders of policies and decisions.

2.6 Concluding Remarks

This chapter covers the theoretical context of the study through a detailed review of literature. The chapter begins with the theme of sustainable development with a focus on DRAs. Addressing the vicious circles that many DRAs are struggling with, it highlights the concerns, objectives, strategies, and principles of promoting sustainable rural development. Then, it focuses on energy in relation to sustainability. Energy sustainability is closely associated with two major branches of facts and concerns – energy security and energy-related environmental problems. In order to promote energy sustainability in DRAs, an operational definition of energy planning is developed together with a synthesis of the principles and examples of energy planning as well as a summary of challenges and barriers of energy planning in DRAs. In order to improve the energy planning practice, planning theory is reviewed, including the evolution, major approaches, and the impacts on energy planning.

Important concerns relevant to rural sustainability, including community capacity building, public participation, stakeholder, and social learning, are presented.

2.6.1 Summary of Literature

The broad overview of the literature indicates that the vicious circles that impede the development of many rural areas in the developing world are identified and commonly recognized. In this context, sustainable rural development has been promoted as a long-term goal by decision-makers around world to overcome the problems. However, what precisely is meant by sustainable rural development or rural sustainability is still under extensive debates. The literature has provided sufficient discussions on factors that need to be sustained in DRAs. If energy sustainability is to be achieved, energy supply should meet the demand of the rural people while avoiding resource over-exploitation and minimizing negative environmental impacts. Effective energy planning is strategic to energy sustainability. Major principles of energy planning include rational energy use with a focus on energy efficiency, alternative sources with a focus on renewable energy, mitigation of negative environmental impacts and an integration of the three principles. In order to strengthen the effectiveness of energy planning or energy intervention programs in DRAs, a mixed scanning of major planning approaches were conducted. It is clear that no sole model or approach to planning can prevail without inputs from the others. The scanning highlights each approach's strengths which provide theoretical guidance to the energy planning process. Effective energy planning, which may lead to community capacity building in a long-run, requires the public not only to involve in the decision-making process and mutually commit to the collective decisions on community development. In order to meet the standard, continuous social learning is needed.

2.6.2 Gaps Identified

A literature review reveals that energy, planning, and community development are closely associated with sustainability in general, but how to improve energy planning practice in DRAs is overlooked. Meanwhile, such object-oriented understanding is precisely what is needed by theorists, practitioners, decision-makers, and international-aid organizations alike in order to stimulate the diffusion of RETs, to bolster public support and engagement in community development projects, and to improve energy production and consumption practice by adjusting energy plans and policies. Specifically, three main deficiencies are identified as follows.

Although there is substantial literature that documents the connection between energy and sustainability, little research has been devoted specifically upon the efficacy of energy planning. Literature has abundant energy policy studies with a focus on mathematical simulation, modelling and scenario analysis approaches (e.g., Spinney & Watkins, 1996; Li, 2003; Ford, 2005; Rozakis & Sourie, 2005; Stadler, Kranzl, Huber, Haas, & Tsioliaridou, 2007, etc.). These studies can be referenced when making energy policies and plans as they discover patterns of events that reveal the presence of underlying structures, conceptualize and explore the behaviour of possible generative mechanisms, and conduct analysis to test out possible explanations. However, quantitative methods have weaknesses in terms of neglecting causation, reducing the real to empirical data, its atheoretical and *ad hoc* nature[38], and the limitations of the significance testing procedure (Mingers, 2006). At the same time, the external factors relating to the context of energy policy such as the changing and open nature of the social world are unlikely to be quantified and measured. Consequently, a softer approach is called for in exploring energy planning issues. However, few efforts to date have combined energy planning with planning theories to explore policy options and strategies to enhance the effectiveness of energy planning in DRAs[39].

Based on a systematic thinking[40] (Skyttner, 2001), it is evident that most energy intervention programs with policies and outcomes have a common shortcoming that we only have limited knowledge about the internal processes of energy planning. The processes of energy planning, including operationalization, implementation and monitoring, have become "grey boxes"[41] in our common understanding towards energy planning (Figure 2.5). Being explorative in nature, this study assumes that the contents of energy plans/policies affect local energy systems and the processes of energy planning determine the effectiveness of the energy plans/policies. According to anti-RCP planners[42], however, it is of course not possible or mandatory to gain total command of the information inside all "grey boxes". Rather, the illumination of the gaps here is to gather relative empirical materials and data that are sufficient to be assessed against theoretical insights drawn from

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[38] Scholars criticize that many quantitative methods have been atheoretical in developing empirical models independently of theory and using *ad hoc* criteria to choose among the many competing models (Fildes, 1985; Hendry, Leamer, & Poirier, 1990).
[39] Even in some more recent studies, such as Rad (2008), Blanco, et al. (2009), and Ivner, et al. (2010), the authors still remains largely conceptual without much exploration on the planning procedures, not to mention the gaps between theory and practice.
[40] The simplest form of this approach means an open loop system with an inflow, a process of change and an outflow. Inflow could be political decisions, reforms or programs. The process of change is the implementation within authority administration. Finally, outflow is what comes out from the authority or an action plan. This approach is heuristic, explorative, and can be used for investigating processes (Skyttner, 2001).
[41] If a grey box is made transparent with good knowledge of the contents, it can be called a "white box" (Skyttner, 2001).
[42] E.g. incremental planners, adaptive planners and integrated planners

planning theory. Experiences and lessons from an empirical study on energy planning with a focus on the processes of operationalization, implementation, and monitoring will allow us to explore opportunities and conditions from planning theory to provide theoretical insights required to strengthen the effectiveness of energy planning in DRAs.

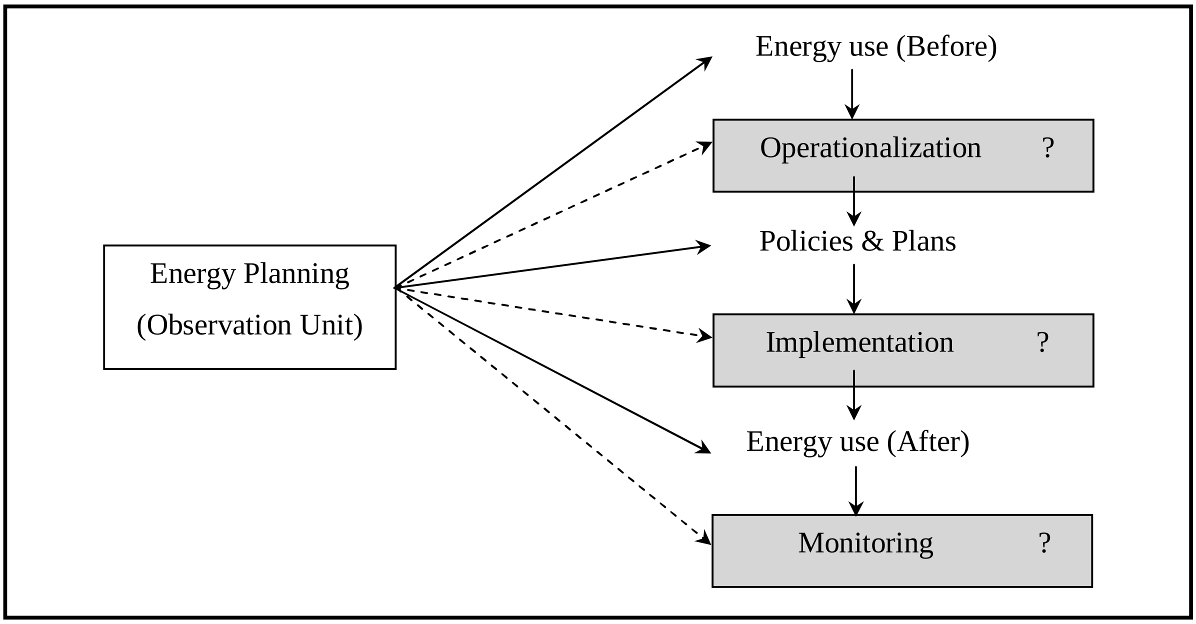

Figure 2.5: Grey Boxes of Energy Planning

Source: Created by the author

Modern planning originated in the late nineteenth century when urban problems exploded as a result of industrial revolution (Campbell & Fainstein, 1996b). Seeking to bring about a society that will not only exist but thrive far into the future, planning is closely related with sustainability (Wheeler, 2004). Planning theory and practice have broadened enormously since the origins with applications in not only land use and management issues of urban and regional areas (Wheeler, 2004). What is progressive is the attempt of planning theorists to focus on the shortcomings of RCP and probe into different approaches to be able to plan, implement and evaluate in a program context. However, the discussion is generally theoretical and often stops at the evaluation stage of the program cycle. To date, planning literature is limited in terms of both theoretical exploration and empirical studies with respect to the energy intervention programs in DRAs. Despite the recent advances in knowledge noted above, and considering the important role that insights from planning theory could play in increasing the effectiveness of energy planning practice, planning theory remains unfamiliar in DRAs like rural China. In conceptualizing the integration of planning theory into energy planning process, it is clear that insights from planning theory have the potential to increase the effectiveness of energy planning in DRAs. However, there has been little empirical study to test these insights or prove them workable in the circumstances of DRAs.

Furthermore, although literature indicates that the delivery of sustainability-oriented community development projects requires various actors' active participation and coordination. Recent studies (e.g., Brett, 2003, Chaskin, 2005, Xu & Chow, 2006, etc.) indicate that the implementation of revitalizing poor communities through participatory and collaborative efforts, although theoretically recognized, is largely inadequate or problematic in practice. This happens in part because the organization of these efforts embodies an inherent tension between an ideology of associational action and local democracy and an adherence to essentially rational-bureaucratic approaches to planning and implementation[43] (Kubisch, Brown, Chaskin, Hirota, Joseph, Richman, & Roberts, 1997; Chaskin, 2005; Luo & Shen, 2008). Meanwhile, a degree of resistance to participation in decision-making exists in DRAs (Ohemeng, 2009). In particular, some planners identify that most rural people in DRAs lack of political will due to poor educational levels and empowering the grassroots in decision-making process may bring only marginal advantages (Rist, Chidambaranathan, Escobar, Wiesmann, & Zimmermann, 2007). Hence, a critical aspect of participation in community development projects (e.g. energy intervention programs) remains to be demonstrated through research – in what way are community development projects in DRAs involved with various stakeholders and carrying out the insights of planning theory?

2.6.3 Evaluative Framework

Based on literature review, a set of evaluation criteria is developed to test and explore the utility and potential of insights from planning theory to increase the effectiveness of energy planning in DRAs. The criteria are consolidated through defining the key considerations and elements which are involved in each criterion. The criteria for assessment of energy planning efforts and process towards energy sustainability are illustrated in Table 2.10. A critical evaluation of the existing energy planning in DRAs under a top-down planning system is to be conducted. The next chapter will introduce the research methodology and the study site.

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[43] System rational-bureaucratic approaches to planning are dominant in a top-down political system (Luo & Shen, 2008).

Table 2.10: Evaluative Framework for Energy Planning in DRAs[44]

Operationalization

Equitable:

- Aims at positively improving the welfare of all people, especially the poor and disadvantaged;
- Addresses sufficiency and opportunities of current generation in ways that do not compromise future generations' opportunities;
- Identifies energy problems and objectives of energy intervention programs, which are fully informed among all stakeholders, particularly local people to be intervened;
- Makes pertinent data & information accessible to all and communicate relevant information to stakeholders;

Flexible:

- Concentrates on a limited number of key factors leading to the identified energy problems and provides reliable information for decision-making;
- Considers factors of energy sustainability, including accessibility, efficiency and acceptability against local geographical and economic conditions as well as barriers of proposed energy intervention programs;
- Considers various opinions by involving interested and affected public, professional, social groups and government bodies throughout the decision-making process;
- Prepares alternative options for the proposed energy intervention programs upon the identified problems;

Implementation

Efficient:

- Acknowledges 'trial and error' – testing the effectiveness of experimental projects in limited destinations before wide implementation and promotion;
- Implements energy intervention programs based on local conditions & seeks for time/cost effectiveness;
- Emphasizes 'learning by doing' – acquiring insights from both successful and unsuccessful experiences;
- Prepares initial incentives to responding and affected people for participating in the programs;

Participative:

- Defines the duties and responsibilities of leading and participating organizations and ensures exchange of information and collaboration among agencies;
- Requires all stakeholders to exert their functions in energy intervention programs collaboratively;
- Provides technical support to the local people – fully explains existing problems of energy use with a focus on the rationale and potential impacts of energy intervention programs;
- Facilitates social learning among all stakeholders on the energy issues in question to mediate potential conflicts which may discontinue the energy intervention programs;

Monitoring

Continuous:

- Conducts regular assessment of the energy program to influence the decision-making & planning process;
- Updates and makes relative data and information accessible to all, and communicates with stakeholders;
- Encourages local people to keep learning the technologies/devices from their colleagues & other sources;
- Provides incentives to local people for continuous using new technologies or devices;

Reflective:

- Considers development options and alternative proposals;
- Has adaptive capacity to learn from and adjust policies and plans based on results from project assessment;
- Seeks legislative opportunities to regulate environment & resource devastating activities;
- Prepares strategies to keep the use of new energy technologies/devices active & widen their applications at a broader scale.

[44] References for each criterion are provided in Table 2.11.

Table 2.11: References of the Evaluative Framework

Stage	Criterion	References
	Equitable 1	Simon, 1993; Day, 1998; Adams, 2001; WB, 2006; Peacock, 2008
	Equitable 2	Chambers, 1983; WCED, 1987; Anon, 1989; Carvalho, et al., 2001
	Equitable 3	Booher & Innes, 1999, 2002; Healey, 2003; WEC, 2005; Mulugetta, 2008
Operationalization	Equitable 4	Friedmann, 1987; Parma, et al., 1998; Thom, 2000; Gibson, 2006a, 2006b
	Flexible 1	Lindblom, 1959, 1974; Holling, 1978; Mitchell, 1997; Parma, et al., 1998
	Flexible 2	WEC, 2005; Mulugetta, 2008; Walters & Holling, 1990; Thom, 2000
	Flexible 3	Davidoff, 1965; Etzioni, 1967; Friedmann, 1987, 1996; Craig, 1998
	Flexible 4	Campbell & Fainstein, 1996a;Noble, 2000; Baum, 2001; Hostovsky, 2006
	Efficient 1	Lindblom, 1959, 1974; Holling, 1978, 1986; Mitchell, 1997; Thom, 2000
	Efficient 2	Holling, 1978; Walters & Holling, 1990; Parma, et al., 1998; Thom, 2000
	Efficient 3	Lindblom, 1959, 1974; Altshuler, 1965; Holling, 1978; Mitchell, 1997
Implementation	Efficient 4	Arnstein, 1969; Schmitter, 1995; Golooba-Mutebi, 2004
	Participative 1	Campbell & Fainstein, 1996a; Hock, 2000; Noble, 2000; Baum, 2001
	Participative 2	Healey, 1992, 2003;Khakee, 1998; Booher & Innes, 2002; Wheeler, 2004
	Participative 3	Davidoff, 1965; Hudson, 1979; Friedmann, 1987, 1996; Wheeler, 2004
	Participative 4	Bandura, 1988; Webler, et al., 1995; Quirke, 1997; Berkes & Folke, 1998
	Continuous 1	Campbell & Fainstein, 1996a, 1996b; Hock, 2000; Hostovsky, 2006
	Continuous 2	Friedmann, 1987; Parma, et al., 1998; Thom, 2000; Gibson, 2006a, 2006b
	Continuous 3	Dryzek, 1990;Maarleveld&Dangbegnon,1999;Darby, 2006; Holden, 2008
Monitoring	Continuous 4	Arnstein, 1969; Schmitter, 1995; Golooba-Mutebi, 2004
	Reflective 1	Campbell & Fainstein, 1996a; Noble, 2000; Baum, 2001;Hostovsky, 2006
	Reflective 2	Walters & Holling, 1990; Parma, et al., 1998; Gibson, 2006a, 2006b
	Reflective 3	Baum, 1984; Campbell & Fainstein, 1996a,1996b;Friedmann, 1987, 1996
	Reflective 4	Campbell & Fainstein,1996a,1996b;Friedmann,1987,1996,Wheeler, 2004

CHAPTER THREE: RESEARCH METHODOLOGY

This chapter presents the research methodology. Section 3.1 introduces the research paradigm and the conceptual framework of the field study. Section 3.2 covers the research methods, including the geographic context of the study location, the preparation of the field study, identification of stakeholders, design and pre-testing of the interview guides and questionnaires, data collection, and data analysis. Section 3.3 discusses the quality of the data, i.e. validity and reliability, with a description of the problems encountered in the field research and perceived limitations of the information and data. The chapter concludes with a discussion of the methodological strengths and weaknesses of the field study in section 3.4.

3.1 Research Paradigm

Social research is concerned with exploring and understanding social phenomena which are educational in nature, mainly leading to formalized and/or spontaneously occurring social, cultural, and psychological processes (Holliday, 2002; Creswell, 2003). Often, social research seeks to understand the complexity of interrelationships and perceptions within a setting by examining an array of variables (Holliday, 2002). In doing so, social research deals with research questions that can be investigated in a satisfactory manner, and the methods which enable such investigation and the utility of results stemming from such investigation (Dash, 1993). Given the gaps identified from the exploration of literature, a mix of inter-related qualitative and quantitative methods was needed to explore the answers the research questions. The research paradigm of the field study was established based on the understanding of two basic philosophical terms, anti-positivism[45] and positivism, two main paradigms in the verification of theoretical propositions.

3.1.1 Philosophical Understanding as a Construct

Anti-positivism and positivism are two important concepts of social reality (Figure 3.1). Anti-positivism emphasizes understanding and interpretations of phenomena and making meaning out of the inquiry process. Positivism holds objectivity, measurability, predictability, controllability and constructs laws and rules of human behaviours (Cohen, Manion, & Morrison, 2000).

[45] Also known as naturalistic inquiry (Creswell, 2003).

Anti-positivists believe that reality is often multi-layered and complex and that a single phenomenon has different interpretations based on the ideological positions that different researchers possess (Creswell, 2003; Flowerdew & Martin, 2005). They also believe that there are many epistemologies possible in research process (Dowling, 2005). Consequently, anti-positivism emphasizes that the verification of a phenomenon is adopted when the level of understanding of a phenomenon is such that the concern is to probe into the various unexplored dimensions of a phenomenon rather than establishing specific relationships among the components (Creswell, 2003). Anti-positivists emphasize human interaction with phenomena in the daily life, and suggest qualitative rather than quantitative approach to social inquiry and studies (Cohen, et al., 2000).

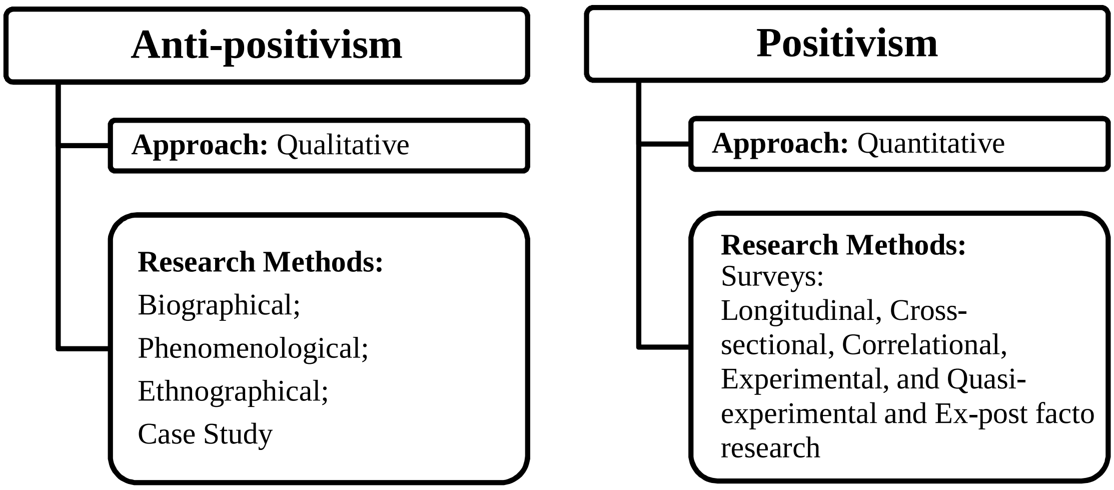

Figure 3.1: Comparison of Major Research Paradigms

Source: Adapted based on Cohen, et al., 2002

The positivism paradigm is developed based upon the philosophical ideas of August Comte, who regards observation and reason as means of understanding human behaviours (Cohen, et al., 2000). Positivists believe that true knowledge is based on experience of sense and can be obtained by observation and experiment (Cohen, et al., 2000). This belief is manifested by the faith in realism that there is one single ‘truth’ out there, independent from our existence and awaiting discovery (Patton, 2002). Accordingly, positivists favour quantitative approaches in inquiries. Although positivism has significant influence on social research, the paradigm is criticized by anti-positivists for the lack of regard for the subjective states of inquirers (Cohen, et al., 2002). Anti-positivists argue a reliance on quantitative methods in a paradigm of positivism as inappropriate as the ideology regards human behaviours as passive, controlled and determined by external environment and human beings are thus dehumanized without their intention, individualism and freedom taken into account in viewing and interpreting social reality (Cohen, et al., 2002).

The research paradigm of the thesis was established based on the author's research philosophy on the strengths by combining anti-positivism and positivism. The two philosophical paradigms, although seemingly and literally contradictory, do not essentially contradict each other in social science and research. Rather, the two basic philosophical paradigms focus on different perspectives. Given the purpose of the field research to examine and explore the utility and potential of insights from planning theory to increase the effectiveness of energy planning in DRAs, a qualitative approach would be dominant in the inquiry process of the field study and would be supported by some quantitative methods. A combination of qualitative and quantitative approaches would strengthen a sociological research by explaining research findings from different angles. The mixed approach will be elaborated in a later section of the chapter.

3.1.2 Conceptualization & Research Framework

Guided by the sustainable development theme, the field research was to be conducted under the broad framework of interactive relationships among energy, planning, and program effectiveness in DRAs. Under the broad term of 'rural sustainability', the study focused on 'energy sustainability' which was also the ultimate goal of rural energy planning. The study's central purpose of investigating and analyzing the effectiveness of energy planning and policies in DRAs was consistent with the theoretical tenets of planning literature that strive for more effective planning practice. Exploring the perceptions on and the conduct of the planning theoretical insights in rural energy planning practice would reveal the gaps between theory and practice. To bridge the gaps, suggestions and strategies could be developed to strengthen the current energy planning practice through more theoretically sensitive and enlightened planning for prospective rural energy intervention programs at the study destination and areas with similar contexts. By working on a specific case of energy planning in rural Hainan, this study should be able to develop strategies for improving the current local energy planning practice, and possibly lead to policy recommendations for rural energy planning and community development planning in DRAs, like rural China.

A case study is a multi-perspectival analysis, which requires the researcher to consider not just the voice and perspective of the actors, but also of the relevant groups of actors and the interaction between them (Feagin, Orum, & Sjoberg, 1991). In an exploration of the process of existing rural energy planning practice, it was important to discover the perspectives of the provincial government officials of Hainan as well as the concerns of stakeholders at the local level. In the literature, there is an explicit recognition that village leadership and collective organization play important roles in motivating community residents to participate rural community development projects. Although the top-down political system permeates most Chinese rural development initiatives, studies of community development indicate that some level of local organizing, cooperation, and dialogue exist among community residents, village leaders, government authorities and academic researchers (Plummer & Taylor, 2004; Sanders, 2000). Examining perspectives from stakeholders at various levels would also lead to valuable lessons and insights.

A research framework was developed to guide the field research as well as to get coherent understanding of the process of rural energy planning in Hainan (Figure 3.2). Aiming at fulfilling research objectives three and four as outlined in Chapter one, the framework depicts the steps to collect and analyze data. The framework focused on the key steps of assessing the process of rural energy planning in the context of pursuing sustainable rural development; tried to demonstrate the strategies of discovering the theory-practice gap of rural energy planning; and emphasized preparing policy recommendations for more informed and effective rural energy planning practice. The conceptual framework not only outlined the key steps of the field research but also provided the structure of how the research findings were to be presented in the following chapters.

Prior to the field research, it had been important to ascertain the policy context in the province. As Stake (1995) recommends for an exploratory research[46] that, a pilot study of the policy context offers the opportunity to maximize what can be learned, knowing that time is limited. Yin (1994) also suggests that an overview of the existing project objectives and relative case study issues will strengthen the use of case-study protocol. This stage involved the exploration of existing policies and plans as well as stakeholders' perspectives on the current policies and projects. Identifying government's expectations of the rural energy programs and the challenges in energy planning practice would enhance the understanding towards the accomplishments and failures in local practice and would facilitate the assessment of the energy planning processes.

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[46] Other types of major social research include explanatory and descriptive.

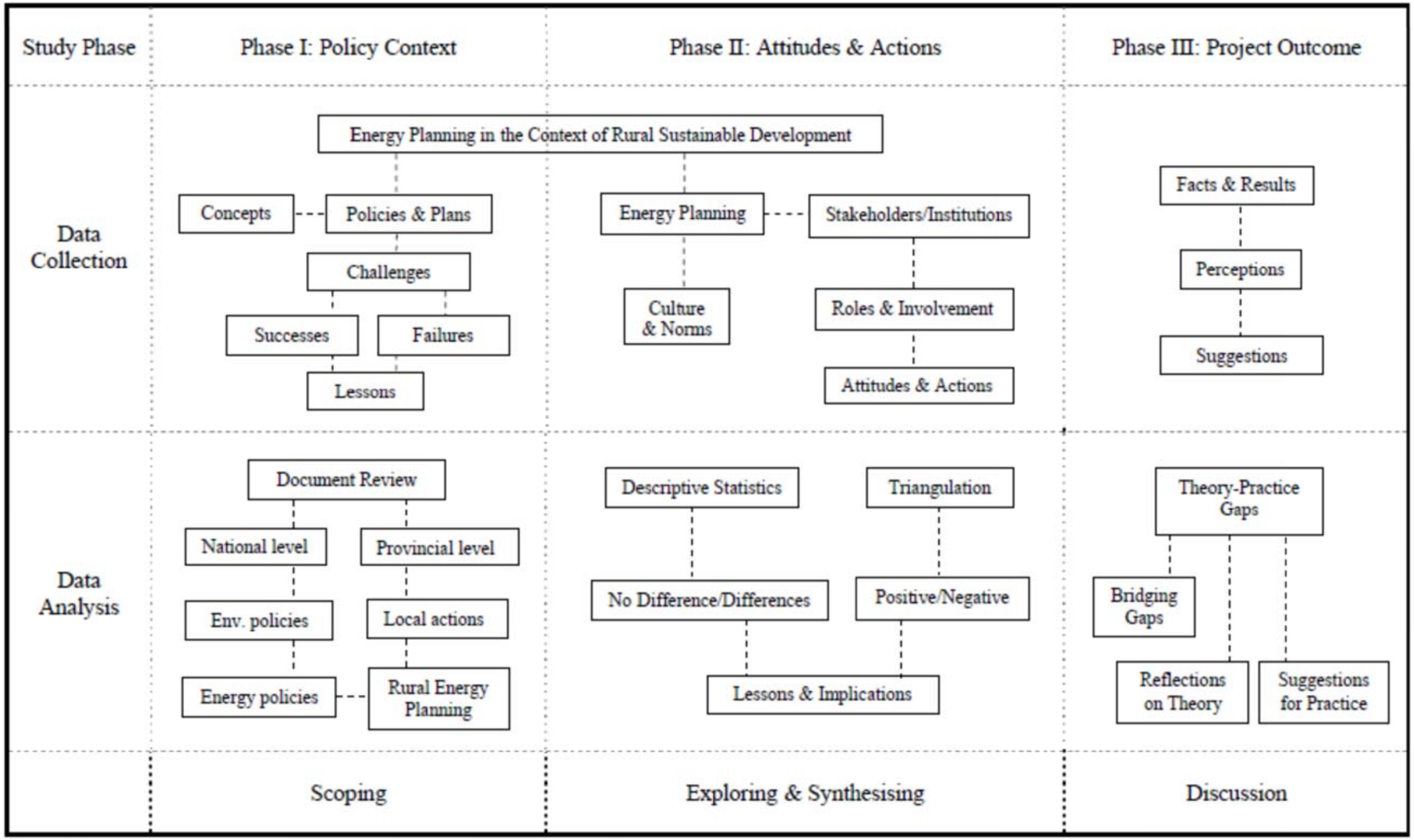

Figure 3.2: Conceptual Framework of the Field Research

Source: Created by the author

As noted in Chapter two, an evaluative framework was developed as the yardstick to test and explore the utility and potential of insights from planning theory to increase the effectiveness of energy planning in DRAs. The criteria were consolidated into six principles by addressing the key considerations for three major processes of planning, including operationalization, implementation, and monitoring. Against the yardstick, the field study should identify the gaps between theory and practice as well as the factors that lead to successes and failures of the energy intervention programs in rural Hainan. The assessment of the rural energy planning processes was achievable by exploring the attitudes of the stakeholders towards the evaluative criteria and the conduct (or not) of the criteria in practice.

With the policy context and the gaps between theory and rural energy planning practice, the next step in the conceptual framework was to analyze the causality of the gaps. To integrate planning theory with rural energy planning practice, suggestions and strategies would be provided to address the gaps identified in the study location. In discussing the applicability of the evaluative framework, rural energy planning in DRAs should be insightful in addressing the problems of community development planning in general. Being reflective, the discussion of the study should also reflect the shortcomings of literature—not only should the discussion address the perspectives that would be reinforced or weakened by the study, but also the discussion section should come up with the empirical generalizations that would stem from the study.

3.1.3 A Case Study Method

A case study method was employed to examine the issues associated with energy planning in rural Hainan. Yin (2003) defines a case study as "*a research strategy, an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident*" (p. 17). Rather than a mere data collection tactic or an analytical method, a case study method is a comprehensive research strategy or framework of design (Dufour & Fortin, 1992). A case study is done mainly in a way that incorporates the views of the "actors" with special attention to completeness in observation, reconstruction, and analysis of the case under study[47] (Zonabend, 1992). A case study allows for procedural, contextual and generally longitudinal analysis of the various actions and meanings which take place and which are constructed within specific social or organization contexts (Hartley, 1994). Yin (2003)

[47] A case study should not be confused with qualitative research and the case study protocol can be based on any mix of quantitative and qualitative evidence (Yin, 2003).

recommends a case study method in an inquiry situation of asking how or why questions about a contemporary set of events, over which the investigator has little or no control. Unsurprisingly, the use of a case study approach has been high and increasing over the years in social sciences research (Yin, 2003).

A mix of qualitative and quantitative approaches was adopted in the case study. More specifically, interviews were dominant in the inquiry process of the field study and were affiliated by quantitative approaches. The selection of the case study method was determined by the purpose of the field study. Mainly through interviews, the researcher aimed at exploring the related policies, principles and perspectives of various stakeholders in rural Hainan. At the same time, descriptive statistics were used to clarify the presentation of the findings. As Yin (2003) notes the case study approach has three distinctive characteristics. First, it is able to cope with a particular situation where many variables of interests are involved. Second, the case study method can make use of multiple sources of evidence through a mix of methods of data collection. Last, a case study can benefit from the prior development of theoretical propositions. In short, the case study approach represents a holistic method which covers the logic of design, data collection techniques, and approaches to data analysis. Accordingly, a case study of mixed approaches has proven to be advantageous to fulfill the research purpose.

Central to the case study methodology, validity[48] and reliability[49] are crucial in designing and conducting the field research (Yin, 2003). Yin (2003) analyzes and provides suggestions to ensure the validity and reliability of a case study (Table 3.1). The case study protocol can be a study that involves a single case or multiple cases. A multiple-case study follows the logic of replication to gain more general research results. A single-case study can be useful in testing a theory that has specified propositions, or examining extreme, unique, representative cases (Yin, 2003). Yin (1994) emphasizes that generalization of results from a case study, from either single or multiple cases, is made to theory and not to populations. A study of multiple cases can enhance the results by replicating pattern-matching, thus increasing confidence in the robustness of the study and the theory. However, Yin (1994) also mentions that with constraints like availability, time and budget, researcher can limit to a single-case study and a good instrumental case does not have to defend its typicality. Yin (2003)

[48] Validity is the strength of our conclusions, inferences or propositions.
[49] Reliability is the consistency of measurement, or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. In short, it is the repeatability of measurement.

proposes the use of critical, extreme/unique, representative/typical, revelatory, and/or longitudinal cases in such case study designs. The rationale of a single-case study of rural Hainan was that Hainan's rural energy planning experience represented common attributes of China's rural development and planning reality. Hainan's experience of rural energy planning involved not only typical representative activities of rural energy planning, but also some applicable community development projects which rested firmly within the top-down Chinese planning system. To the extent possible, it was more reasonable and reliable for the researcher to visit some villages, to observe the projects, and to have discussions with local residents.

Table 3.1: Tactics for Ensuring Validity & Reliability of a Case Study

	Case study tactic	**Phase of research in which tactic occurs**
Construct validity[i]	• Use multiple sources of evidence	• Data collection
	• Establish chain of evidence	• Data collection
	• Have key informants review draft case study report	• Composition
Internal validity[ii]	• Do pattern-matching	• Data analysis
	• Do explanation-building	• Data analysis
	• Address rival explanations	• Data analysis
	• Use logic models	• Data analysis
External validity[iii]	• Use theory in single-case studies	• Research design
	• Use replication logic in multiple-case studies	• Research design
Reliability	• Use case study protocol	• Data collection
	• Develop case study database	• Data collection

i. Refers to the extent to which the variables accurately reflect or measure the behaviour of interest.
ii. Refers to whether cause-effect relationships between variables can be inferred from the observations.
iii. Refers to the extent to which the observations can be generalized to other settings and populations.

Source: Yin, 2003, p. 34

A case study can be holistic or embedded and the latter relates to multiple units of analysis. The unit of analysis refers to a system of action that is selective and fundamental to the development of case under investigation (Yin, 2003). As an embedded case study, the research had two units of analysis – the theory-practice gap of rural energy planning as well as the integration of insights from planning theory into energy planning in rural Hainan. With the theoretical insights on research methodology, the design and conduct of the field research involved the consideration and efforts in increasing the validity and reliability. A number of data-collecting vehicles were used in the case study, including key informant interviews, on-site observations, workshops, surveys and secondary data. Personal and methodological biases were limited and triangulation[50] of a phenomena or research questions from multiple perspectives and sources of data were used whenever possible. With various data sources and methods, the study was strengthened in terms of the increased credibility, dependability and objectivity of the research data and findings.

3.2 Field Research

Field research was developed originally from anthropology and is often referred to as participant research or as ethnography in anthropology (Silverman, 1985). According to Babbie (1989), "*field research is a social research method that involves the direct observation of social phenomena in their natural settings*" (p. 288). Field research is conducted for the purpose of collecting primary data mainly through interviews and surveys that are designed specifically for particular research questions. Being closer to the up-to-date social settings under study, researchers can design the research in the best way to discover the particular information required in terms of freshness, depth and comprehensiveness (Babbie, 1989). Schatzman and Strauss (1973) describe that, "*field method is more like an umbrella of activity beneath which any technique may be used for gaining the desired knowledge, and for processes of thinking about this information*" (p. 14). Through field research, researchers can recognize nuances of attitudes and behaviours that may bypass researchers using other methods without the field study (Babbie, 1989). The field research of the study was undertaken in Hainan between July 2007 and April 2008. A wide variety of data collection methods were employed during the field work. The following sections details the processes of the field research, including preparation, data collection, and data analysis.

3.2.1 Geographic Context of Hainan

Separated from the Mainland China by the 24-kilometre wide Qiongzhou Strait, Hainan province is located in the southernmost part of China and occupies a total land area of 34 thousand square kilometres (Figure 3.3) (Hainan Provincial Tourism Bureau [HPTB], 2002). The province faces Vietnam across the North Bay to the west, and Malaysia and Indonesia across the South China Sea to the south. It covers about two million square kilometres of sea area and has a coastline of 1,584.8

[50] In order to avoid biases, the approach requires measures to be interrelated besides the premise that each measure is right. Methodological triangulation refers to using more than one research method to examine a same question. Data triangulation means to use same approach for different sets of data in order to verify or falsify trends generalized in one data set. Investigator triangulation refers to making use of different investigators with different background. Multiple triangulation combines at least two of the other triangulation methods in combination (Oppermann, 2000).

kilometres (HPTB, 2002). It is noted that the physical size of Hainan Province covers not only the Hainan Island but also the Xisha islands, the Nansha islands, the Zhongsha islands and more than 2 million square kilometres of sea area (HPTB, 2002). These specks of islands, many of which are reefs and shoals, are also called the Spratly Islands and they have been controversially claimed by different Southeast Asian countries (HPTB, 2002). Located between 18°10 –20°10 North Latitude and 108°37 – 111°05 East Longitude, Hainan has the largest tropical area in China (HPTB, 2002). Hainan is in the central part of the Pacific Economic Circle and at the same latitude as Hawaii. Hong Kong, Taiwan, Vietnam, and the Philippines are located (HPTB, 2002). Hainan has a marine tropical monsoon climate with an annual average temperature ranging from 22.4°C –25.5°C and yearly average precipitation of 1,500 – 2,000 millimetres (HPTB, 2002). The unique oceanic climate and the island characteristics of Hainan have endowed the province with broad resources of tropical and seasonal rainforest as well as plentiful biodiversity. It has a large stretch of tropical forests, mountain ranges and rivers where over 560 species of animals and 4,200 types of plants live and multiply

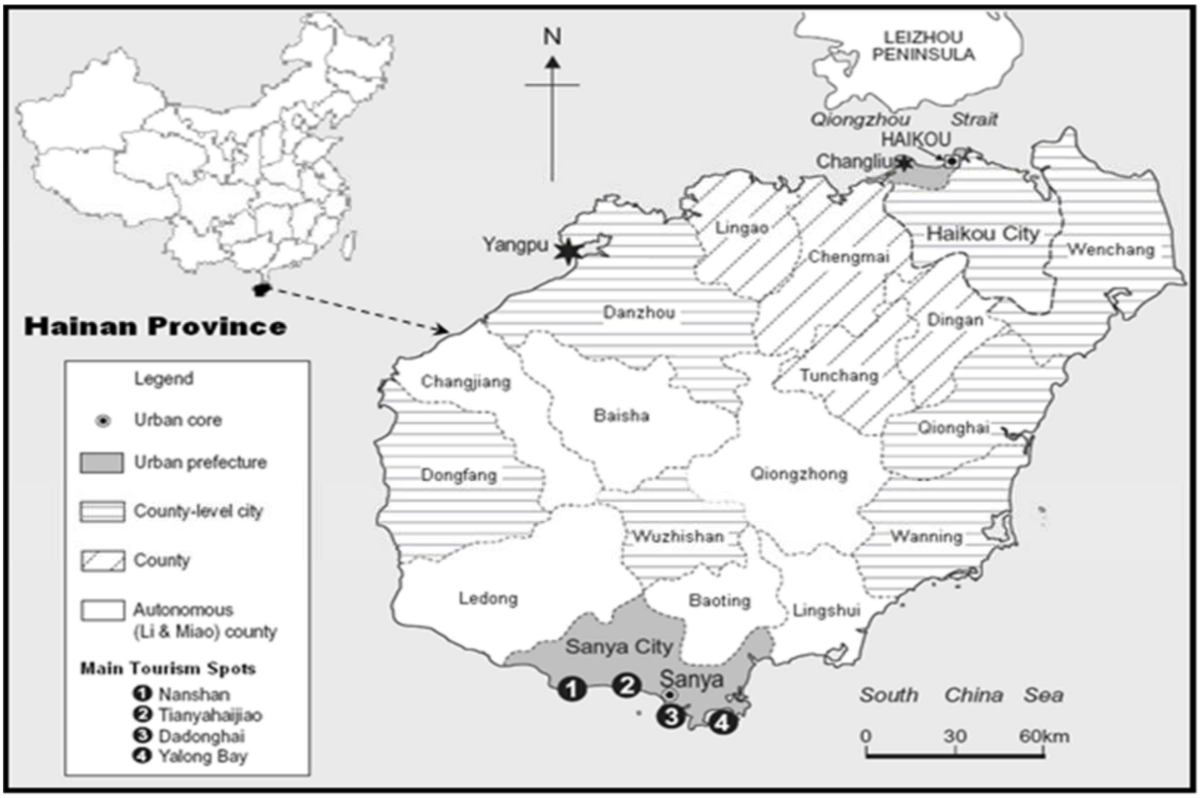

Figure 3.3: Map of Hainan Province[51]

Source: Adapted based on China Academy of Urban Planning and Design [CAUPD], 1988, 1999

[51] The legend of the map differentiates the administrative regions of the province and also reflects the hierarchy of the population density of the different types of regions.

(HPTB, 2002). With a forest coverage rate of 51.5 percent, Hainan is one of the most ecologically beautiful tourist and vacation sites in China as well as an important reserve of biological species (HPTB, 2002). Because of the warm climate year round, Hainan is always ready for planting in all four seasons (Han, 1997). The abundant solar radiation encourages the development of "Green Agriculture" and the extensive costal resources indicate a future of "Blue Agriculture" (Han, 1997).

3.2.2 Pre-departure

Before the departure for the field research, the author had contacted Hainan Department of Land, Environment and Resources [HLER] and some government officials based on his research network which was established in the previous field research. During the contacts, the author introduced the big picture and the research schedule of the field research to the officials by phone calls and emails. The contents of the discussions included the study purpose, objectives, some research questions, identified interviews subjects, data collection methods as well as the plan and schedule of the field research. In response, the contacted officials affirmed the significance of the study as it had been a long-term policy of Hainan to improve the rural livelihoods through rural community development projects. The officials also showed their support to the field research and provided suggestions of possible interviewees. The most important up-to-date environmental policy of Hainan province, "*saving energy and reducing emissions*", was mentioned by some officials. The preliminary contacts and discussions facilitated the settlement and the whole research process. At the same time, preliminary versions of the interview guides and survey questionnaire were prepared for different possible informants based on the evaluative framework developed through literature review. It was acknowledged that the research plan and questions might need minor modifications during the field research. Discussions and pre-testing of the questions were deemed necessary for enhancing the construct validity of the study.

3.2.3 Arrival and Orientation

The field study started with a one-week orientation in the capital city, Haikou. During the orientation week, some friends and key persons relevant to the field study were contacted. Also, a number of important places were visited so as to obtain materials and information about local context as well as to get more acquainted with the local people, language, culture, history, economy, industries, and development. These places included:

Hainan Department of Land Environment and Resources;

Hainan Chuangxin Bookstore
Library of Hainan University
The Patriotism-Hygiene Office of Hainan Province
The Provincial Government of Hainan
The Chinese Communist Party Committee of Hainan Province
Hainan Provincial Publicizing Department [HPPD]
The Civilization-Ecology Office [CEO] of Hainan Province
The Department of Agriculture in Hainan Province

Officers of HLER were helpful and supportive in the orientation week. HLER provided the author an office space and the author was allowed to work in the department in business hours and make frequent communication and discussion with the officers and colleagues in the department. After knowing about the scope of the field research, officers and university interns in the department presented many interesting and practical suggestions and information on rural development projects. The department issued the author a formal letter of recommendation, which introduced the author's identity and the research objectives. The letter suggested relevant individuals and organizations to provide coordination and assistance for the field research when necessary. The letter was helpful in developing potential interviewees and visiting rural communities. The research plan and inquiry questions were refined as more literature was searched, reviewed, referenced and added to the original versions. Other preparations were also made for carrying out the investigation. This included studying the research environment to identify factors that could facilitate and, more importantly, interfere with data collection.

3.2.4 Stakeholder Identification

Researchers and practitioners have become increasingly aware of the importance of stakeholders in the planning and management processes, and the need to assess levels of their interests and power for these can influence particular projects or organizational objectives. Stakeholder identification and involvement are major steps towards achieving the success of community development projects (Freeman, 1999). Identifying proper stakeholders for the field study is required by not only theoretical perspectives but also the practical objectives of the field study. The stakeholder identification of the study was accomplished based on literature review and discussions with officials and scholars in Hainan during the preparation stage of the field investigation.

Stakeholders are those who can affect or are affected by the actions, decisions, policies, or goals of an organization. Many scholars advocate the inclusion of stakeholders in the decision-making process of developing community development projects or plans and suggest that planners should consider the interests of all stakeholders before projects are implemented because plans can be difficult to implement if stakeholders do not cooperate (Freeman, 1984, 1999; Donaldson & Preston, 1995; Jones & Wicks, 1999; Brugha & Varvasovszky, 2000; Bryson, 2004; Butterfield, Reed, & Lemak, 2004). As the knowledge of planners concerning specific circumstances is inevitably partial, consensus-building with stakeholders can help them to understand organizational interests and the public interest, thereby making planning more inclusive (Innes & Booher, 1999). More importantly, the incorporation of stakeholder views and interests is likely to reduce conflicts in the long term by drawing on the knowledge and insights of stakeholders (Innes & Booher, 1999).

Since the roles of diverse stakeholders in determining the quality of plans and the success of implementation of community development projects are affirmed and emphasized in the literature, it is imperative for researchers to explore and assess the experiences and perspectives of different stakeholders for the purposes of fostering more effective policy-making and planning practice. As explicitly demonstrated in the research objectives, assessing the experiences and perspectives of multiple stakeholders of rural energy planning in Hainan involved all three dimensions of stakeholder theory. As the foundation of the field research, the evaluative framework highlighted what should be done in rural energy planning (normative). The field research would explore and describe how decisions were made in rural energy planning with an emphasis on stakeholders' roles in different stages of rural energy planning practice as well as how the roles measured up to the evaluative criteria (descriptive). Based on the assessment, the study would address how rural energy planning might be improved (instrumental).

Current stakeholder concepts employed in the literature of community development are built on the concepts from management science. Literature suggests that stakeholders of rural community development usually include sectors that are involved in the projects, such as governmental officials, non-governmental organizations [NGOs], technical experts, scholars, village leaders, and community residents (Selsky, 1991; Kiely, 1996; Leeuwis, 2000; Roseland, 2000; Selin, Schuett, & Carr, 2000; Ansari & Phillips, 2001; Foster-Fishman, Berkowitz, Lounsbury, Jacobson, & Allen, 2001; Gregory & Wellman, 2001). The author discussed with the officers in HLER and confirmed that stakeholders suggested in the literature conformed to the Hainan's case except for NGOs. Literature indicates that more and more NGOs have involved in community development projects in DRAs (e.g. Srikanth, 1996; Buckland, 1998; Bill, 2004), but officers in HLER suggested NGOs were not typical stakeholders of rural energy planning in Hainan[52]. Consequently, stakeholders of rural energy planning in Hainan were identified as the following four groups, including government, specialists (planners, technical experts, and scholars), village leaders and community residents. The experiences and perspectives of the four key groups of stakeholders would be explored and assessed in the field study.

3.2.5 Interview Guides and Questionnaire Design

After identifying the stakeholders of rural energy planning in Hainan, interview guides and survey questionnaires were designed to collect data so as to answer the research questions and thereby to fulfill the research objectives. With different foci for each design, the interview questions were specifically prepared for four groups of major informants, including government officials, specialists, village cadres and village residents. For government officials, specialists and village cadres, the study attempted to explore their roles in and perspectives on rural energy planning in Hainan. Consequently, face-to-face interview was the appropriate data collection instrument to understand their opinions and interview guides were designed for the three groups. For community residents who were end-users of the new energy technologies, their experiences and perspectives towards rural energy planning could be generalized based on an investigation on a sample of households. Hence, a survey was most appropriate for the group of informants. Information about community residents' experiences and opinions were to be gathered through both close-ended and open-ended questions. A standardized questionnaire was designed for the group on a household basis, and the distribution and collection of the questionnaire copies would be administered by the researcher. The respondents of the survey were expected to be adult villagers who were familiar with their family information on the energy intervention programs.

Based on the evaluative framework, the first Interview Guide (Appendix D) was designed for the government officials. Government at different levels were expected to provide: the process of rural energy planning in Hainan, their roles in the rural energy planning practice, the historical background

[52] First, the provincial–wide rural energy intervention program and other rural community development projects are initiated by the provincial government other than NGOs. Second, there is no NGO whose mission is to promote rural community development in Hainan. Technical centres and research institutions for rural community development in Hainan are established and supported by the government and are hence considered as part of the government. Third, international aid organizations, such as UN, WB and the Canadian International Development Agency [CIDA], may have been involved in some community development projects, but the involvement in fact turns out to be the support or cooperation with the government as the implementation of the projects is realized based on the directives of government. On the other hand, projects aided by international aid organizations are small in numbers and lack representativeness of the mainstreaming energy programs and other community development projects in the province.

and current status of energy use, the relationships and impacts of rural energy use towards rural environment, resources and livelihoods, the policies, plans and efforts for promoting more rational energy production and consumption in DRAs, perceptions of and attitudes towards rural energy planning, and suggestions for future improvement.

The second Interview Guide (Appendix E) was designed for the specialist group of rural energy planning, including planners, technical experts, and scholars. Although the government was at the central stage of the rural energy planning practice, perspectives from various sources would strengthen the research analysis in terms of validity and reliability. The interview questions addressed the roles of the specialists, if applicable, in the rural energy planning practice in Hainan. More importantly, the interview questions emphasized the potential informants' perspectives on the effectiveness of the existing rural energy planning practice. The majority of the interview questions in the Interview Guide were questions for open discussions. The subjects to be explored included: perspectives on rural energy planning in terms of the process, goals, objectives, approaches, budget and funding sources for planning, the policies and plans for rural energy production and consumption, scope and contents of rural energy plans, implementation, monitoring and evaluation of energy plans, constraints of rural energy planning, concerns and attitudes towards rural energy planning, and critiques/suggestions for rural energy planning.

The third Interview Guide (Appendix F) was designed for village leaders who involved in rural energy intervention program. The prospective feedback information from the village leaders were expected to facilitate the data interpretation and analysis process. In this part, the specific contents of the interview guides included the roles of the village leaders in rural energy planning, local challenges of implementing energy policies and plans, perspectives of energy intervention programs in relation to other community development projects, such as village renovation, developing economic agricultural products, establishing community-based industries, and public education, and critiques/suggestions for rural energy planning.

For community residents, the following topics were included in the questionnaire (Appendix G) – demographic and household profile information, perceptions of and attitudes towards the current energy use, involvement in energy intervention programs initiated by the government, concerns and suggestions for government officials who were in charge of rural energy planning. The design of the questionnaire included both closed and open ended questions. A 5-point Likert perception scale

(Babbie, 1989; Creswell, 2003) was used in the following questions regarding difficulties of participating in the energy intervention programs, impacts of the energy intervention programs on community capacity building, suggestions for improving the community participation channels, and suggestions for improving the current rural energy planning practice. Participants were asked to indicate their degree of agreement with each statement on the questions on a 5-point Likert scale (i.e. 1 = strongly disagree, 2 = disagree, 3 = neutral/don't know, 4 = agree, 5 = strongly agree). The questionnaire also included some open ended questions so as to collect more comments and concerns from residents and to encourage them to indicate their attitudes on rural energy planning.

3.2.6 Pre-testing of Inquiry Questions

Preliminary tests of both the interview guides and survey were undertaken before the project was conducted formally. To conduct pre-testing is not only a necessary requirement of social research for the purposes of ensuring the appropriateness and clarity of the questions (Creswell, 2003), but also an effective procedure to increase the validity and reliability of the data to be collected. As the research intended to provide a critical assessment of the current rural energy planning practice in Hainan, an evaluation of the government's performance turned out to be sensitive for potential informants especially in a one-party political system. Pre-testing of the inquiry questions needed to be phrased carefully. The pre-testing process of the study was accomplished within HLER where two officers and six university interns were involved. In these experiments, efforts were made to detect potential problems of inquiry questions and the layout of the inquiry documents. Participants of the pre-testing were asked if the questions were clear enough to be understood and if there was any question and/or wording too sensitive for people to be comfortable to answer. Participants were also invited to comment on whether the choice options for the closed questions were exhaustive and exclusive to each other as well as whether the open ended questions were too elusive to be readily analyzed. The pre-testing process helped making minor modifications in wording to clarify some questions, and indicated the time required for completing the inquiries. The questions were finalized based on the pre-testing and the suggestions from the Office of Research Ethics in the University of Waterloo.

3.2.7 Ethical Considerations

The field research received ethics clearance from the Office of Research Ethics at the University of Waterloo. The application for the clearance ensured that the field work to be conducted in an anonymous manner that respects local customs, culture and traditions[53]. The application for the ethics clearance required the field work to be conducted in an anonymous style which was reflected in the data collection process and the final write-up. The identity information of the informants would not be displayed.

3.2.8 Data Collection

a. Interviews

An interview is a research method for understanding and making sense of the lives of people at either the informal and formal level. Yin (1994) indicated that well-informed respondents could provide valuable insight into a case study. In face-to-face interviews, "*the interviewer is in a good position to be able to judge the quality of the response of the subjects, to notice if the question has not been properly understood*", and thereby to carry out appropriate methods to encourage the interviewees' full participation in the interview (Walliman, 2005, p. 284). In other words, face-to-face interviews can allow the researcher 'control' over the line of questioning, and get in-depth understanding and insight about interviewees' opinions and feelings, as well as organizational and personal goals (Creswell, 2003). Through qualitative interviews, information on motivations and opinions can be explored that are not easily obtained through quantitative techniques; information not previously thought about can be uncovered; issues can be explored deeply and can be more clearly defined; and personal or sensitive information can be more easily tackled (Babbie, 1989; Creswell, 2003).

Key-informant interviews were conducted first in the field research for three reasons. First, stakeholders or key informants of rural energy planning, especially the provincial government, were an important data source since they had more specific and broad information than any individual villager or the researcher had. Information obtained from the interviews could help in understanding the whole picture of the rural energy planning practice in Hainan. Second, the good relationship established with the government officials at the initial stage could contribute to facilitating the rest of the research. At the same time of reviewing local documents, the informant recruitment process started largely based on a 'snowball' method. Based on the previous research network, the informant recruitment process began from HLER and several government officials were met. The interviews with the initial government officials not only suggested possible stakeholders and informants of rural energy planning in Hainan, but also facilitated the rest of the field research. Officers from the HPPD

[53] In China, people often have the concern of their answers being leaked to the government. The emphasis of conducting the research in an anonymous manner will allow them to voice their perspectives freely.

helped in delivering the informant recruitment letters and notified the officers at the lower level about the author's field research.

Based on the responses of the recruitment, the author sent out structured interview guides prior to the interview. Prior to departure, contacts were made to inform the interviewees about the arrival date and a tentative interview time was requested. Interviews of the field research contained both formal structured interviews and informal discussions with government officials, technical experts, scholars of minority studies and village cadres (Table 3.2). The responses from the key-informant interviews were coded by the abbreviations of the group: Provincial officials (PO), City/County officials (CO), Township officials (TO), Planners (PL), Technical experts (TE), Scholars (SC), and Village cadres (VC). The abbreviations of the interviewee groups will appear in the following section In total, 68 key-informant interviews were conducted in a face-to-face approach. In some of the interviews, notes were taken and the interviews were recorded with permission. After each interview, the record was transcribed and rearranged to make the results recognizable and ready for analysis. Government at different levels were expected to provide: the process of rural energy planning, their roles in the planning practice, the historical background and current status of energy use, the relationships and impacts of rural energy use towards rural environment, resources and livelihoods, the policies, plans and efforts for promoting more rational energy production and consumption in DRAs, perceptions of and attitudes towards rural energy planning, and suggestions for future improvement.

b. <u>Self-administered survey</u>

Surveys were conducted among rural community residents to explore their involvement in and perceptions on rural energy planning practice in Hainan. A survey on a sample of community residents could reflect the energy use and participation in the energy projects of rural Hainan. According to Babbie (1989), survey research offers advantages in terms of the amount of data that can be collected, and the chance to sample a large population; however, survey research is somewhat artificial and relatively inflexible. It cannot measure social action; it can only collect self-reports of past action or of prospective or hypothetical action. With the assistance from the provincial CEO, 100 copies of the questionnaire were first distributed to the offices at the city/county level to ensure the coverage of rural people across the province. The officers were informed of the nature and process of the questionnaire by the researcher, and then helped in delivering the questionnaire to randomly selected households within their jurisdiction. The rural residents were asked questions about their demographic and household profile information, perceptions of and attitudes towards the

Table 3.2: Key-informant Interviews of the Field Research

Provincial officials (12)	Director of the Provincial CEO 1 official of the Department of Agricultural Science & Technology Vice director of the Reform and Development Office 1 official of the Department of Industrial Information 3 officials of the Theory Office (HPPD) 4 officers of Hainan Department of Lands, Environment and Resources
City/County officials (7)	Haikou: 2 officers of the CEO Wenchang: 1 officer of the Publicizing Department Qionghai: 1 officer of the Development and Reform Department Sanya: Vice director of the Rural Technology Bureau Baoting: General Secretary of the CEO Danzhou: 1 officer of the CEO
Township officials (10)	2 officials of Hongqi Township 1 official of Tanniu Township 1 official of Dongjiao Township 3 officials of Fenghuang Township 2 officials of Zhaling Township 1 official of Heqing Township
Planners (6)	Director & vice director of the Provincial Development/Planning Dept. 3 planners of the Provincial Dept. of Agri. Science & Technology 2 planners/professors of Hainan University
Technical experts (9)	1 officer of Haikou Environment Supervision Station 1 officer of Hainan Agricultural Practice Department 2 professors from the SouthChina Tropical Agricultural University 1 professor from Qiongzhou University 2 officers of Baoting Biogas Station 2 officers of Danzhou Biogas Station
Scholars (8)	3 researchers of the People's Government Research Office 2 professors of Rural Economics from Hainan University 2 scholars/professors of Li minority from Hainan University 1 Li & Miao socialist of Baoting Community Research office
Village cadres (16)	Benli Village (Haikou): 3 village leaders Bohou Village (Lingao): 1 village leader Dingshi Village (Baoting): director and other 4 village cadres Luofen Village (Wenchang): 1village leader Matou Village (Wenchang): 1 village leader Meimu Village (Haikou): 1 village leader Meiwan Xincun Village (Danzhou): director and vice director Shuijiao Village (Sanya): 1 village leader Zhalinger Village (Baoting): 1 village leader

current energy use, involvement in energy intervention programs initiated by the government, concerns and suggestions for officials who were in charge of rural energy planning. Some completed questionnaires were returned by postage-prepaid envelopes provided by the researcher and some residents chose to return them directly back to the CEOs. Among the 1,800 copies of questionnaire distributed, 271 copies were returned directly by mail and 427 were returned to the officers. A low response rate was expected before the distribution of the questionnaire as a survey might be new to the rural people and they might not be interested in participating. The involvement of local CEOs helped increase the response rate of the survey as the officers were also interested in the responses of the rural people and assisted in cooperation and participation among the rural people. Among the 698 copies returned questionnaire, 492 copies were completed and could be used for data analysis[54]. In addition to the survey, a separate self-administered survey was conducted among village leaders whose villages are involved in eco-village construction. The survey examined the village leaders' perceptions on the impacts of community development projects on community capacity building. Again, the provincial CEO aided the distribution of the questionnaire. Five eco-villages from each city/county in Hainan were randomly chosen from the eco-village list in the office. The questionnaire was sent to the village leaders of the 90 villages by mail and 78 usable copies were collected.

c. Workshop

A workshop, an important participatory research method, is particularly useful to give people, especially the previously silent ones, the opportunity to discuss and formulate ideas and to encourage more in-depth understanding of the studied issues (Symes & Jasser, 2000). Moreover, workshop is also a powerful tool for collecting information in a limited period of time (Mardrize, 2000). In order to allow broad community-based input for the field research, three workshops in Dingshi Village (Baoting), Luofen Village (Wenchang) and Meimu Village (Haikou) were organized to explore perceptions of rural people towards energy use, technical innovation and diffusion, and public participation in the rural energy intervention programs. The workshops were conducted in an open discussion format with the involvement of village leaders and ten to fifteen community residents. Each workshop lasted for about one hour. The free atmosphere helped discussion among the participants and provided valuable information. After the workshop, some participants invited the researcher to visit their households where they provided more stories about their experiences in and perceptions on community development projects.

[54] The rest 206 copies were either unfilled or not legible, and thus could not be used for analysis.

d. On-site observation

Observation is used to understand and interpret the meanings and experiences of a group (Burgess, 1984; Silverman, 1985). It involves the systematic description of events, behaviours and artifacts in the study environment (Neuman, 2003), and seeks to uncover, make accessible, and reveal the meanings people use to make sense of their everyday lives (Jorgensen, 1999). Observations can be adopted for "*recording the nature or conditions of objects*", and "*the observations of objects can be a quick and efficient method of gaining preliminary knowledge or making a preliminary assessment of its state or condition*" (Walliman, 2005, p.288). Through observation, a researcher can gain knowledge of local behaviours and events, and the meanings attached to those behaviours (Marshall & Rossman, 1989). Data from direct observation can usefully complement information obtained by virtually any other technique (Robson, 2002). After the interview with village leaders, the author performed on-site observations to gather and record ideas and images about the rural environment, agricultural plantations, public infrastructure, residential houses, living styles, leisure activities, and most importantly energy use. The author visited villagers' homes so as to understand their living standard—how their kitchens were organized; how their sanitary systems worked; how their livestock were raised; how biogas and solar energy were utilized; what electronic appliances they had, e.g. television, telephone, refrigerator. When free from the formal interviews, the researcher also spent some time talking with the villagers and the leaders, listening to the conversations among the villagers, and wandering in the villages. Field notes were taken and later transcribed. A large number of photographs were taken about various themes in the villages, including the rural environment, agricultural plantations, public infrastructure, residential houses, residential kitchens, raised animals, biogas reactors, electronic appliances etc.

e. Reports & secondary data

Secondary data are important sources of information about the socio-economic environment and administrative structure of rural energy planning. Secondary data sources often complement the primary data in a field study. The common sources of secondary data include relevant literature, newspaper articles, online information, official documents, reports, plans, and statistics. The purpose of collecting secondary data was to gain extensive knowledge about the rural energy planning process in Hainan. Information on state policies on local energy use, the history, the current situation and magnitude of rural energy use, the role of government in directing rural energy planning, the context in which rural energy planning was performed, and how rural energy planning evolved, helped the understanding of rural energy planning practice in Hainan.

Government reports and official documentation related to the study topic were collected and served as important secondary data from the HPPD, the CEO, the Environment Supervising Station, Institutes of Higher Learning, and Biogas Station. Other supplementary data were also obtained through the government website, press releases, newspaper articles, journals and published research reports and materials. Major government documents that were collected in the field research include the 11th National "Five-year Socioeconomic Development Plan" (2006-2010), Provincial Master Plan for Eco-province Construction, Provincial Master Plan for Civilized and Ecological Village Construction, The Investigation Reports of Eco-village Construction in Hainan, Collections of Civilization Construction in Hainan (2001 - 2005), and Collections of Reports on Eco-village Construction in Hainan. These documents were examined to understand the planning process, issues and constrains in rural energy planning. Planning goals, objectives and policies as well as the approaches and implementation of plans were scrutinized. Additionally, brochures, magazines, books, video CDs, and flyers related to rural development were collected and reviewed, which helped the researcher improving his understanding of the rural energy planning process, and provided additional insights into the issues associated with rural development in Hainan.

3.2.9 Data Analysis

The various data collection approaches in the field research led to the gathering of a variety of types of information which indicated that both qualitative and quantitative data analysis approaches were needed. Qualitative information was coded by classifying and categorizing individual pieces of data for analysis and interpretation. Content analysis[55] was performed on government documents, plans, reports, newspapers and articles to learn about the mainstreaming topics and perspectives on rural energy planning from the government, and the planning methods and approaches used in developing the plans. The information from content analysis was useful in supporting the concerns and issues identified by various interviewees and survey participants, and it provided valuable insights into improving the effectiveness of rural energy planning through bridging the theory-practice gaps. Based on the evaluative framework, information obtained from interviews was analyzed to identify the informants' roles in and perspectives on rural energy planning. The analyses identified the gaps between the insights from planning theory and the rural energy planning practice in Hainan, perceptions regarding the importance of the insights for improving the effectiveness of rural energy

[55] Content analysis is a technique for drawing conclusions by systematically identifying specific characteristics or patterns from various forms of information (Babbie, 1989).

planning, and the opportunities/barriers of integrating the insights into the prospective rural energy planning practice in Hainan. Quantitative data obtained mainly through the survey among community residents were coded and entered into a database for analysis by applying the SPSS program. Statistical methods employed in analyzing quantitative data include, descriptive statistics (mean, mode, maximum, minimum, standard deviation), frequency/percentages, cross-tabulations, and parametric/nonparametric tests such as two-sample T test, and Chi Square analysis. MS Excel was also used to create figures which aided the interpretation of data. Table 3.3 summarizes the main data collected in the field research and relative approaches used to analyze the data.

Table 3.3: Collected Data and Analysis Approaches

Data Collected	Analysis Approach(es)
Information on Hainan's EPS and CEV	Content analysis and synthesis
Hainan's Energy Policy and its relationship with the national energy policy	Content analysis and synthesis
Motivations of the energy intervention programs (5-point scale from provincial & local government)	Two-sample T test (assuming equal variance, two-tailed)
Hainan's rural energy planning: stakeholders, roles, & procedure overview	Content analysis and synthesis
Recognized challenges of rural energy planning	Descriptive statistics and synthesis
Emerging energy systems in rural Hainan	Descriptive statistics and synthesis
Awareness of energy problems and programs (adopters of new energy systems)	Descriptive statistics and synthesis
Rural people's knowledge on env. problems & policies	Chi-square test and synthesis
Levels of public participation in rural energy planning	Descriptive statistics
Information on the evaluation criteria in practice	Descriptive statistics and synthesis
Perspectives on the evaluation criteria	Descriptive statistics and synthesis

3.3 Research Considerations

The field research incorporated theoretical suggestions on strengthening the validity and reliability of the data in the processes of research design, data collection and data analysis. However, it was acknowledged that all forms of research have certain limitations. The data of the study also had some limitations due to the problems encountered in the field research.

3.3.1 A single-case study

A thorough case study can reach beyond the "what" (fact-based information) to the "why" (underlying reasons), allowing the researcher to probe into the background issues, helps to place in context, provides insights, and can be a rich source of empirical information (Yin, 2003). However, studying a single case has been criticized for a lack of empirical rigor and cross-checking comparisons with which the researcher and other reviewers can judge the validity and reliability of the inquiry. Since the research was designed to focus on a single case of Hainan's rural energy intervention programs, the study had weakness of lack comparisons with other cases of rural energy planning. Consequently, the validity and reliability of the study were recognized as crucial and conscious efforts were made in the processes of research design, data collection and data analysis to ensure the quality of the data. In the research design process, the evaluative framework was established based on a 'mixed-scanning' of planning theory and concurrent perspectives on community development, which formed a strong theoretical foundation for the field study. The research design also addressed the importance of various data and various approaches of collections. In the data collection process, the researcher used a variety of data sources and explored the perspectives of various stakeholders of rural energy planning in Hainan. Pre-testing, repeated interviews, on-site observation, and secondary data all helped to ensure the data quality. The data analysis contained both qualitative and quantitative analyses which strengthened the presentation of the research findings. The efforts on using triangulation approaches substantiated the research findings of the field research and could be helpful for building on a rich set of empirical studies on the rural energy planning literature.

3.3.2 Problems Encountered

Although triangulation approaches were employed in the field research for the purpose of increasing the validity and reliability of the study, it was undeniable that the field research had been hampered by the limited access to information sources. Based on the researcher's previous research network and the recommendation from HLER, the researcher was able to approach the HPPD and the CEO and the offices at city/county level during the field research. It ensured the progression of the field study as the departments are responsible for the planning and implementation of rural development policies in Hainan. However, access to other government departments, such as the Department of Industrial Information, the Department of Legislation, the Department of Supervision and Audition, the Department of Finance, and the Department of Education, was a persistent problem in the field research. Although the author tried to introduce the purpose of the visitation in regards to the field research, the visiting requests were either declined directly or shifted to the publicity offices where only general information or government documents were shown. The requests for scheduling an interview with the officers in these departments were declined with the excuse of either being busy or being non-relevant to the nature of their jobs. Another major problem in the field research turned out to be the lack of access to the reports and documents in the inaccessible departments. So, their roles (if there were some) in rural energy planning could not be explored. Also, rural residents had low interests in participating in the survey, which had slowed the progress of the field research.

3.3.3 Data Limitations

The data obtained from the field research had some limitations. First, the inaccessibility to other government departments other than the HPPD and the CEO and their offices not only prevented the researcher from obtaining a more extensive range of reports and documents, but also disallowed further exploration of the institutional challenges to rural energy planning. Second, most government interviewees were not familiar with planning theory or approaches. The interview guides in plain language helped them understanding the nature of the interviews. The government interviewees in the field research provided some information on rural energy policies and planning process in Hainan, but it was recognized that most of them were cautious and might have bypassed some weaknesses of their practice. This could be attributed to their awareness of being criticized for their shortcomings and the lack of transparency of the political system. The number of interviews conducted was also a concern. Thirdly, only 122 survey participants involved in energy intervention programs. The small sample size of residents that had participated in energy intervention programs might limit the use of certain quantitative models, e.g. Chi Square, in some cases.

3.4 Summary

As an introduction of the methodology of the field research, this chapter presented the details of the field study, including the research paradigm, how the conceptual framework came into being, the preparation of the field research, stakeholder identification, interview guides and questionnaire design, data collection, and data analysis approaches. This study employed interviews, survey, observations, workshops and secondary data to assess the rural energy planning practice in Hainan against the evaluative framework and to explore the opportunities and conditions of integrating insights from planning theory into the rural energy planning practice. While the information and data collected and presented in the study were believed to be factual, reproducible and objective, a consideration of the weaknesses was deemed important and thus discussed.

CHAPTER FOUR: RESEARCH FINDINGS

This chapter presents the findings of the field research undertaken in Hainan, exemplifying the process of energy planning in DRAs with a focus on various stakeholders' perceptions on and roles in the practice. The information obtained in the field research is organized and presented under a group of orderly sub-topics. The chapter is composed of two main sections of descriptions and analyses which were performed based on the data collected in the field research. The first section covers the broad context such as the general understanding of sustainability and the corresponding local Agenda 21 in Hainan (Section 4.1) as well as the existing energy policies (Section 4.2). The second section presents the overview of rural energy planning. After an introduction to the practice (Section 4.3), findings regarding stakeholders' perspectives on and roles in rural energy planning in Hainan are presented in a sequential form: operationalization (Section 4.4), implementation (Section 4.5), and monitoring (Section 4.6). The chapter is concluded with a summary (Section 4.7).

4.1 Sustainability in the Context of a Changing Hainan

After the concept of 'sustainability' became embedded in the global mainstreaming development theory, the Chinese government began to realize the importance of economic development with regard to environment and resources in the early 1980s (Palmer, 2000). Hence, China's environmental policies were shifting towards a more balanced mode of development that addressed reducing social inequality and emphasized less damage to the environment and resources (Kuhn, 2005). The Chinese government regarded development as the coordination and promotion among various subsystems such as the environmental, socio-economic, political and cultural systems, and the reconstruction of way of life, psychological aspect and views of value (Kuhn, 2005). As China has 34 administrative units at the provincial level, understanding how China's environmental policies are working at the provincial level offers insights into what China's capacity can be in the changing global developmental trend. Despite the short history of Hainan being a formal province of China, the provincial government incorporated the concept of 'sustainability' into its developmental plans (The People's Congress of Hainan [PCH], 2005). As an important part of the Local Agenda 21 (the *Eco-province Strategy* [EPS]), the "*Civilized and Ecological Village*" [CEV] program of Hainan demonstrated Hainan government's vision and determination of enhancing the rural quality of life as well as protecting the local environment and resources (PCH, 2005).

4.1.1 Evolution of China's Environmental Policies

Since the establishment of the new China, China's environmental policies have evolved with the increases of environmental awareness and the government's engagement in international affairs (Kuhn, 2005). The evolution of China's environmental policies illustrated the transformation of China's development trajectory from merely duplicating the exact former Soviet model to a more harmonious socialist developmental path with China's own characteristics [56] (Palmer, 2000). Evolving with the overall development plan, China's environmental policies grew and extended the relationships with and impacts on almost all realms of the gigantic social system. Also, the policies were the guidelines of decision-making and planning within the field of environmental management. The evolution of China's environmental policies had overwhelming influences on the development of energy policies and energy planning activities in the country.

As early as the 1950s, the Chinese government began to recognize some environmental problems and address the concern in its policy agenda (Palmer, 2000). With a long history of imperial regime and the impact from the recently established Soviet socialist model, China's embryonic environmental policies reflected the characteristics of both models and marked the beginning of the transition from a long-ignored realm to a strategic national development foundation. However, the early measures at that time were very limited and restricted in terms of both environmental policy-making and execution. The governmental concerns over the environment were limited to a few regulations targeting at problems such as water pollution, industrial waste management, and the loss of arable land (Jahiel, 2000; Palmer, 2000; Shen, Cheng, Gu, & Lu, 2002).

China's initial efforts on environmental protection were attributed to not only the negative impacts of the environmental threats, but also China's increasing desire of exalting its status in international affairs (Shen et al., 2002). Hence, China was increasingly participating in many key international treaties, for example, the 1972 United Nations Conference on the Human Environment held in Stockholm and the 1992 UNCED in Rio de Janeiro. The first national congress on environmental protection which was held in August 1973 aroused China's formal efforts on environmental and resource protection. A year later, environmental protection became institutionalized with the establishment of the environmental bureau under the authority of the State Council (Sinkule & Ortolano, 1995). Since then, extensive environmental institutions, at all levels, had been built up,

[56] Such as fundamental legal support and bureaucratic networks.

including the national–wide environmental protection bureaus, environmental monitoring bases and inter-agency coordinating bodies (Figure 4.1) (Shen et al., 2002). With the establishment of the national environmental protection bureau and its sub-institutions, a top–down system of environmental protection was established in China (Jahiel, 2000).

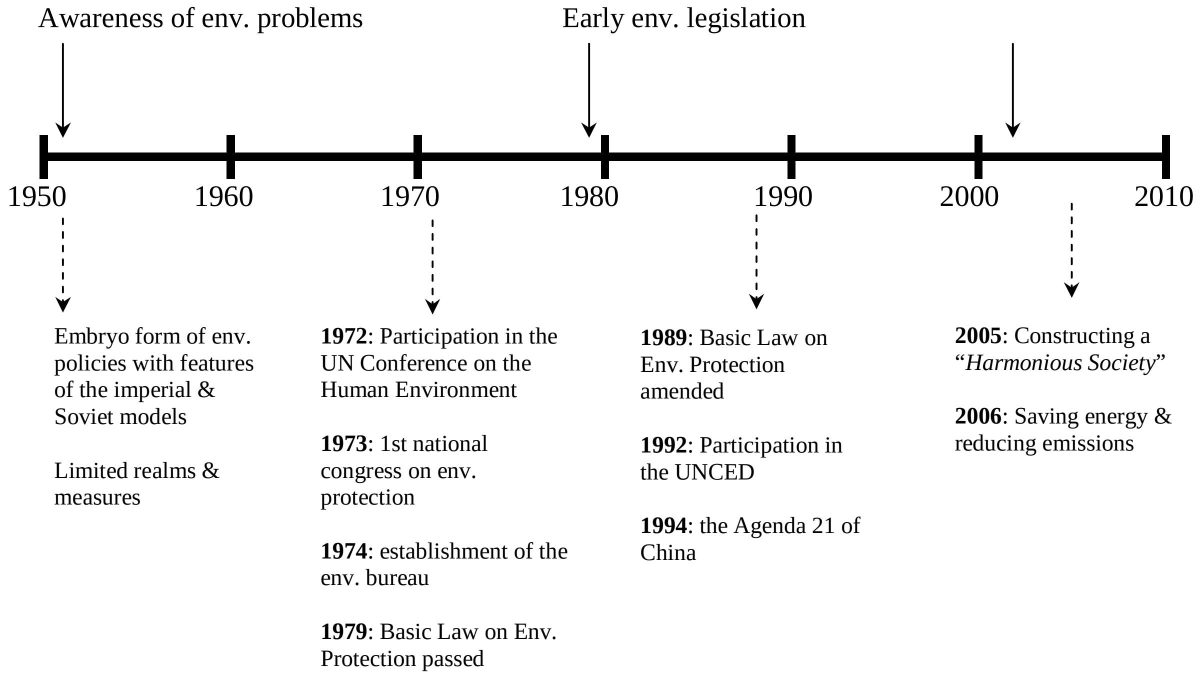

Figure 4.1: Timeline of China's Major Events Related to Environmental Policies

Source: Created by author based on literature review and collected documents

China's Basic Law on Environmental Protection was passed in 1979 and amended in 1989 (Shen et al., 2002). The law defined fundamental concepts for environmental protection and included the principle of '*Polluter Pays*' which had dominated in the environmental laws and decrees subsequently adopted in China (Ma & Ortolano, 2000). Under the Basic Law, a large number of more detailed laws[57] were constituted and implemented in this period[58]. Environmental policies in this period emphasized the overall consideration of the urban environment, the role of science and technology, and the concept of pollution prevention and clean production (Gan, 1998). Along with the concurrent 'open-door' policy, the Chinese government required that both economic development and environmental protection to be included in national and regional planning (Gan, 1998).

[57] Such as laws for marine, forest, grassland, fisheries resources, land, water, mineral and energy resources, the prevention of air pollution, water and soil conservation, wildlife protection, noise control and prevention, and others (Shen et al., 2002).
[58] As Jahiel (2000) views that, China's history of environmental protection as a continuous effort of building up institutions and vesting them with the necessary authority to implement environmental policies.

Unfortunately, China's economy achieved unprecedented growth with the costs of severe environmental pollution, including water source contamination, sewerage pollution, and air quality degradation. With both domestic and international pressure, the Chinese government, in 1994, published its action plan for enhancing sustainable development in Chinese society between 2000 and 2010 – the Agenda 21 of China (the White Paper on Population, Environment and Development of China in the 21st century) (CAG, 1994). The document is significant to China's environmental policies as it,

- Acknowledges the importance of sustainable development;
- Emphasizes issues of population, poverty reduction, and economic development[59];
- Points out problems associated with inefficient utilization of natural resources;
- Comes up with a few reward and punishment instruments for environmental protection[60];

China's Agenda 21 might not lead to immediate changes to the Chinese environment, but it symbolized the beginning of sustainable development deliberations and a growing environmental awareness in China (Bradbury & Kirkby, 1996). The emergence of some derivative ambitious environmental policies, plans and projects following the Agenda extended China's commitment to developing the national economy in a more sustainable style (Cann, Cann, & Gao, 2005).

Entering the 21st century, China's understanding of sustainable development embraced traditional cultural norms as well as innovative objectives. The implementation of China's Agenda 21 required the Chinese government and public to adopt "*Scientific Development Perspective*[61]" in socialist economic development (Hu, 2004). The perspective specifically reinforced that the pursuits of economic development include not only quantity and speed, but also quality and efficiency (Hu, 2004). The thrust of the perspective reiterated the importance of energy efficiency in China's economic development, especially in industries. In 2005, President Hu proposed the objective of constructing a "*Harmonious Society*[62]", which, in essence, was one that respected the rights of people, stuck to the principles of human civilization and abided by the laws of nature (Shah & Shen, 2006). The proposition was passed in 2006 Central Committee Symposium of the Chinese Communist Party, and became the new guideline of socio-economic development and environmental protection policies (Table 4.1) (CCC, 2006).

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[59] China's typical problems in development
[60] Including the principle of '*Polluter pays*', emission charges, financial incentives, and control and order procedures
[61] As in Chinese Pin Yin, Ke Xue Fa Zhan Guan. It was put forward in 2004 Chinese Symposium of the Communist Party.
[62] As in Chinese Pin Yin, He Xie She Hui.

Table 4.1: Objectives & Main Tasks of Constructing a Harmonious Society in China

By 2020, the following tasks will have been achieved:
• To build a better socialist democracy and legal system so that the principle of managing the country based on the constitution and laws is fully ensured; • People's interests are respected and protected effectively; • The widening trend of the urban–rural gap and regional disparity is gradually reversed; • A more reasonable and orderly income distribution pattern comes into being; • A general increase of family income and low unemployment rate are achieved and people lead more affluent lives; • A social welfare ensuring system which covers both urban and rural areas is established; • A more comprehensive public service system is established; • The administrative and ministrant capabilities are greatly improved; • The whole nation's ideological and moral qualities, educational levels, health conditions, social ethics, and inter-personal relationships are greatly improved; • The innovative spirit of the whole society is significantly strengthened and China is to be built as an innovative country; • The social management system and order are to be improved; • The efficiency of resource utilization significantly increases and the ecological environment is much improved; • To build a more harmonious society that makes full use of individuals and benefits all citizens.

Source: translated based on CCC, 2006

Along with the *Kyoto Protocol*, the requirements of China's *Scientific Development Perspective*" and "*Harmonious Society*" led to the important environmental policy of "*Saving Energy and Reducing Emissions* [63] " (Chinese National Development and Reform Commission [CNDRC], 2006a). According to the policy, China aimed to reduce energy consumption per unit of GDP[64] by 20 percent and overall emissions[65] by 10 percent from 2006 to 2010 (CNDRC, 2006a). To fulfill these goals, specific objectives were established for China's provinces and regions.

Kuhn (2005) summarized the characteristics of China's development model as an approach combining economic growth, a free market economy stimulated by a vigorous private sector, concerns for the welfare of all citizens, cultural enrichment and a synergistic approach to rectify economic imbalance – all of which lead, as Hu's vision, to a harmonious society. The contemporary

[63] As in Chinese Pin Yin, Jie Neng Jian Pai.

[64] China's GDP energy consumption in 2005 was 1.22 Tons of Coal Equivalent [TCE] per 10,000 Yuan RMB (Chinese Ministry of Environmental Protection [CMEP], 2006).

[65] In 2005, waste water 52.45 billion tons, Chemical Oxygen Demand [COD] 14.14 million tons, ammonia and nitrogen 1.50 million tons, SO_2 25.49 million tons, dust 11.83 million tons, industrial solid wastes 1.34 billion tons (CMEP, 2006).

Chinese system of environmental decision-making could be described as a vertical system which was built upon a modern and sophisticated set of laws, hampered by extensive yet underdeveloped environmental bureaucracies and poor policy and law enforcement, and facing great challenges if it was to be sustained (Palmer, 2000, Jahiel, 2000, Ferris & Zhang, 2005, Kuhn, 2005). The determination and efforts of the Chinese government towards environmental protection should be credited, but it was often not clear to what extent this system was able to address the emerging environmental issues and the question about sustainability. Despite the rapid and extensive legal construction, the intensifying environmental pollution in China demonstrated that the enforcement of China's legal efforts remained largely unfulfilled, which was manifested by the shortcomings including the elusiveness and ambiguity of the legal provisions, limited access for the public, slow promulgation, overlapping and competing bureaucracies, and lack of technical ability to enforce the law (Ferris & Zhang, 2005).

4.1.2 Local Agenda 21 of Hainan: The Eco-province Strategy

Following up the national environmental policies and development plans, the key to successful implementation was to be that each province chooses its own solutions to the problems that were needed to be overcome in order to move to a more sustainable path of development. In response to the decisions from the central government, the provincial government of Hainan committed to becoming an ecological province by exploring a policy of sustainable development which neither sought development at the expense of the ecological environment nor laid undue emphasis on environmental protection at the expense of development (PCH, 2005). This led to the formulation of the EPS. The strategy was approved at the 1999 People's Congress of Hainan and was amended in the 2005 Congress. As the local Agenda 21 of Hainan, the strategy addressed the key words of the national environmental policies, such as the "*Scientific Development Perspective*" and "*Harmonious Society*". It was a sustainable development plan for the island moving into the 21st century. Aiming at building Hainan as the first 'Eco-Province' in China, the strategy intended to promote a coordinated development of environmental conservation and fast economic growth, and finally to enhance sustainability on the island (Liu, 2004).

The EPS envisioned the prospective Hainan to have significant improvements in three major areas – a development mode that was economically productive and ecologically efficient, a collective culture that was systematically responsible and social harmonious, and a general landscape that was physically beautiful and functionally vivid (Wang, 2006). According to Hainan Development and

Reform Commission [HDRC] (2005, p. 1-2), the main contents of the eco-province construction included the following four aspects:

- *Accelerate the development of ecological economy, promote energy-saving, environment-friendly, and highly efficient economic development mode, achieve a faster and more harmonious economic development, so as to solidify the material foundation for a 'Xiaokang' society and the modernization construction;*
- *Perform environmental protection and ecological construction, balance development and resource/environmental protection, and build advantages of the ecological environment;*
- *Construct beautiful living environment with local characteristics, improve people's quality of life, create first-rate living/working conditions, and provide first-rate quality of life; and*
- *Promote the construction of an ecological culture, create a social ethics of cherish the environment, and protect and improve the environment, so as to provide spiritual support for a sustained, fast, healthy, and harmonious economic development.*

With the strategy, the Hainan government addressed the synchronization of economic development and environmental protection. Although Hainan had a relatively low level of industrialization, the government tried to limit polluting environment, devastating resources, and initiating low-level duplicated constructions. The former governor (Liucheng Wei) pointed out that the industrial development in Hainan had a long tradition of being "*extensive and wasting*", highlighting the fact that the provincial economic growth had a strong dependency on the input of resources with low efficiencies of utilizing resources[66] (Xinhua, 2006). Ironically, there had not been a radical change to the extensive 'wasting mode' in Hainan since the rise of the EPS. Problems of high energy input, resource wasting, and pollution still existed among Hainan's industries (HDRC, 2005). Hence, the amended EPS highlighted the priority of a new '*strong and efficient*' mode of development[67].

While the recognition of industrial gaps of Hainan in terms of both scale and quality spurred the government's determination of renovating the industrial structure, the government also realized the importance of improving people's living environment and increasing people's quality of life, especially in the DRAs. The objective of improving people's living environment and standard was to be realized by constructing eco-cities and eco-communities. At the city/county level, typical projects

[66] Specifically, in 2005 Hainan's per 10,000 Yuan RMB overall GDP consumed 5.7 times of the national average amount of water; the per 10,000 Yuan RMB industrial products cost water 1.9 times more than the national average; the per 10,000 Yuan RMB industrial products consumed electricity four times more than Guangdong province, and the per 10,000 Yuan RMB industrial products released more waste water than the national average (Xinhua, 2006).

[67] Measures included attracting big enterprises' investment, giving preferential admittance to big projects with high technologies, and setting intensive and efficient industrial development zones.

included purification projects which tried to improve the existing waste and sewage management system, 'greening' projects which focused on tree planting and greenbelt construction, as well as regional beautiful movement which tried to build greener appearances with regional characteristics (HDRC, 2005). According to the strategy, by 2010 cities including Haikou, Sanya, Qionghai, Wuzhishan and Danzhou would have been able to meet the basic requirements of an eco-city; and so would all other cities by 2015 (HDRC, 2005).

In the meantime, the provincial government aimed at increasing the environmental awareness among the public. As Wang (2006) identifies, human society is unlike biological communities in that human society is an artificial ecosystem which is dominated by human behaviours, sustained by natural life support system, and stimulated by ecological efforts. However, Wang (2006) sees a tendency of ecologically decaying culture in modern societies, especially where economic development is aggressively pursued. Sustainable development is to be realized based on the harmonious relationship between human mind and nature, efficiency of industrial production, and responsible human activities (Wang, Zhao, & Ouyang, 1996). Thus, the consciousness, creativity and capability of policy makers, entrepreneurs, and the public are the key for Hainan's ecological construction (Wang, 2006). Hence, a refinement of people's concepts, thoughts values, and manners towards environment and resources was encouraged in the EPS as a major objective in term of creating a province-wide ecological culture. The ecological culture construction was to build an ecologically sound and historically continuous culture in the area of cognition[68], paradigm or norm[69], arts, behaviour, tangible form[70], institution, ethics and health.

In short, Hainan's EPS focused on the shortcomings of the province and emphasized the necessary improvement of industrial development, living environment, quality of life, and culture in the province. Wang (2006) sees the implementation strategy is an integrated process in which the key is to integrate 'hardware' (technological innovation and integrative design), 'software' (institutional reform and system planning) and 'mindware' (behavioural inducement and capacity building). In the amended strategy, progresses of the eco-province construction were presented, including increases of the overall forest coverage (54.9 percent in 2004) and protected areas (8.1 percent of the total area, an increase of 126,000 hectares from 1998), effective control of industrial pollution, rapid

[68] Such as philosophy, science, and education.
[69] Such as religion, legislation, and morality.
[70] Such as architecture, landscape, and products.

development of industries with low energy-input, and generally improved appearance of cities and communities (HDRC, 2005). The document also stressed the necessity of developing a 'green' economy in Hainan which would promote the competitiveness of Hainan's economy and, more importantly, would prevent the provincial economy from suffering the increasing international 'green barriers'. The eco-province was to be continued as it fit the development needs of Hainan and the strategy was compatible with the national development guidelines and environmental policies (HDRC, 2005). Nonetheless, the document admitted the shortcomings and challenges of the strategy, emphasizing the lack of funding, environmental awareness, personnel, and technical support, because of which short-sighted activities of environmental pollution and resource devastation still happened in the province (HDRC, 2005).

4.1.3 Civilized and Ecological Village Program

The EPS specified human settlement improvement, which included the development of CEVs in DRAs as one of the key components of the strategy (Liu, 2006). Seeing EPS as a whole body, Luo (2006) describes CEV construction as the growth of cells in the body. Although CEVs had been built in Hainan sporadically before 1999, the province-wide CEV construction campaign did not start until 2001 when the "*CEV*[71]" program was legitimized and implemented (PCH, 2005). Liu (2004) suggests that the emergence and development of the CEV program in Hainan was not isolated or accidental. Rather, it is an outcome of "*subjective necessity*" and "*objective feasibility*" for the rural people in Hainan (Liu, 2004, p.10). Liu (2004) explains that the program is an inevitable outcome of socio-economic development and it is the symbol of rural people in Hainan trying to eradicate poverty and move towards prosperity[72] (Liu, 2004). With the improvements of socio-economic conditions, rural residents needed a better quality of life as government expected and the improved economic conditions would allow the rural people to spend on improving their living standard. It should be noted that despite the economic improvements the living standard of rural people in Hainan was still comparably lower than the national average level in China. As Liu (2004, p. 8) describes the overall living conditions of rural people in Hainan, "*problems of warmth and hunger are solved, yet rural people lack of affluence*".

[71] As in Chinese Pin Yin, Wen Ming Sheng Tai Cun.
[72] According to Hainan Provincial Bureau of Statistics [HPBS] (2004), Hainan's overall agricultural product value increased from 57.63 million Yuan RMB in 1988 to 395.68 million Yuan RMB in 2003 and the average income of rural people increased from 609 Yuan RMB in 1988 to 2,588 Yuan RMB in 2003.

As still a predominantly rural area, Hainan was one of the most economically backward provinces in China and the natural resources on the island were vulnerable to environmental damage (Asian Development Bank [ADB], 1995). Since Hainan was still dominantly rural, the key to the success of the EPS was to promote rural sustainable development. As a term originated from Hainan, "*CEV*" contained the philosophic connotations and local explanations of Hainan towards Chinese "*double civilization*" – material and spiritual civilization[73]. The former general secretary of the Hainan Communist Party defined the term in a broad sense, "*a CEV refers to an advanced village in which civilization grows both in the material and spiritual sides*" (Bai, 2006, p. 7). The governor of Hainan suggested that a CEV required simultaneous improvement and coordinated development of three aspects, including the eco-environment, economy and culture (Luo, 2006). From a theoretical perspective, Liu (2004) explains the assertion and emphasis on the three aspects are derived from the mutual-influencing nature among each other. Specifically, the eco-environment (including resources) was the foundation; the growth of eco-economy was the core; and spiritual civilization on eco-culture was the assurance of the program (Liu, 2004). In this regard, the CEV program was a rational response to the traditional rural development mode – aggressive pursuit of economic development without enough caring about environment and resource costs.

The CEV program aimed at turning half of the natural villages in the province into CEVs in five to eight years (HCEO, 2002). The province-wide implementation of CEVs across rural Hainan transported the theoretical perspectives into practice, as the three theoretical aspects were addressed in the objectives and became the keywords of the slogan of the program – improving the ecological environment; developing ecological economy and creating ecological culture (HCEO, 2002). In compliance with the EPS, the CEV program emphasized an overall planning strategy for rural villages which ensured that every rural household in an CEV had a practical, sanitary and beautiful courtyard while respecting the need for each village to have a '*typically unique style*' which was based on the existing rural settings (Liu, 2006). The unique style included one or several forms of renovation, conservation, production and development practice in the village (Figure 4.2). With the assistance from local government and technical institutions, rural people were encouraged to participate in these projects, by which community capacities could be enhanced (Zhou, 2007).

[73] As in Chinese Pin Yin, Wu Zhi Wen Ming, and Jing Shen Wen Ming.

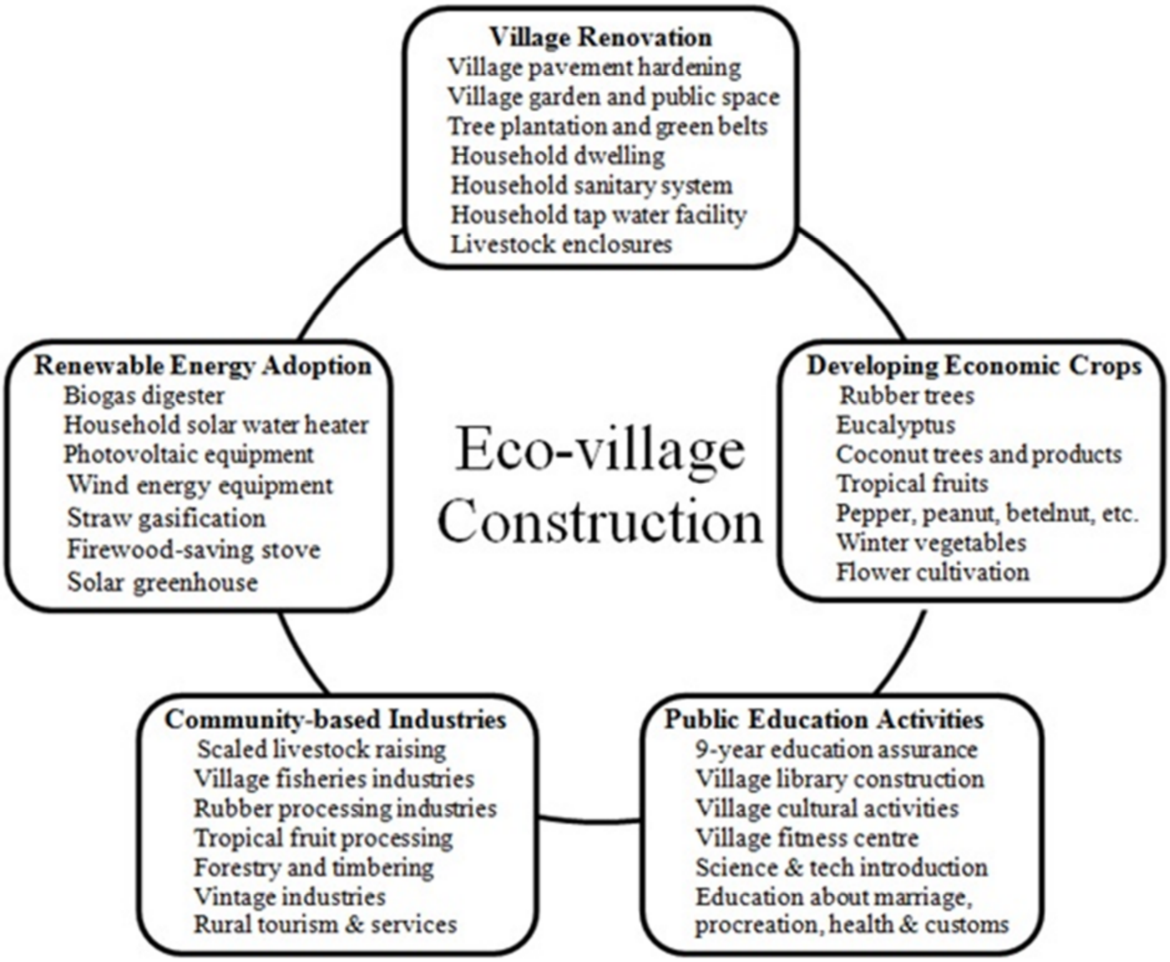

Figure 4.2: Contents of CEV Construction in Hainan

Source: Summarized and created by the author based on Liu, 2006

The CEV program in Hainan was implemented by engaging a series of successive steps (Figure 4.3). The pre-programmed planning procedure was top-down, yet stakeholders, including village leaders, local residents and technical specialists, were encouraged to actively respond to the government decisions and plans through participation (HCEO, 2002; Liu, 2006). The program emphasized the important roles of experts and village leaders in introducing and integrating new technologies into farmers' knowledge systems or existing technologies (HCEO, 2002). Similar with most cases of sustainable rural construction in the rest of China, the decision to adopt innovative forms of development in rural Hainan was mainly made by the local government officials with representatives from villages (usually village leaders) (Liu, 2006). Villagers were encouraged to participate in the program with their own labour and financial input, and sources from village fund and donations from outside village relatives, especially their overseas relatives (HCEO, 2002). After the periodic progress was inspected by technical experts, most households involved in the CEV construction often received certain government subsidies as financial incentives depending on their financial status and the need of support (HCEO, 2002; Zhou, 2007).

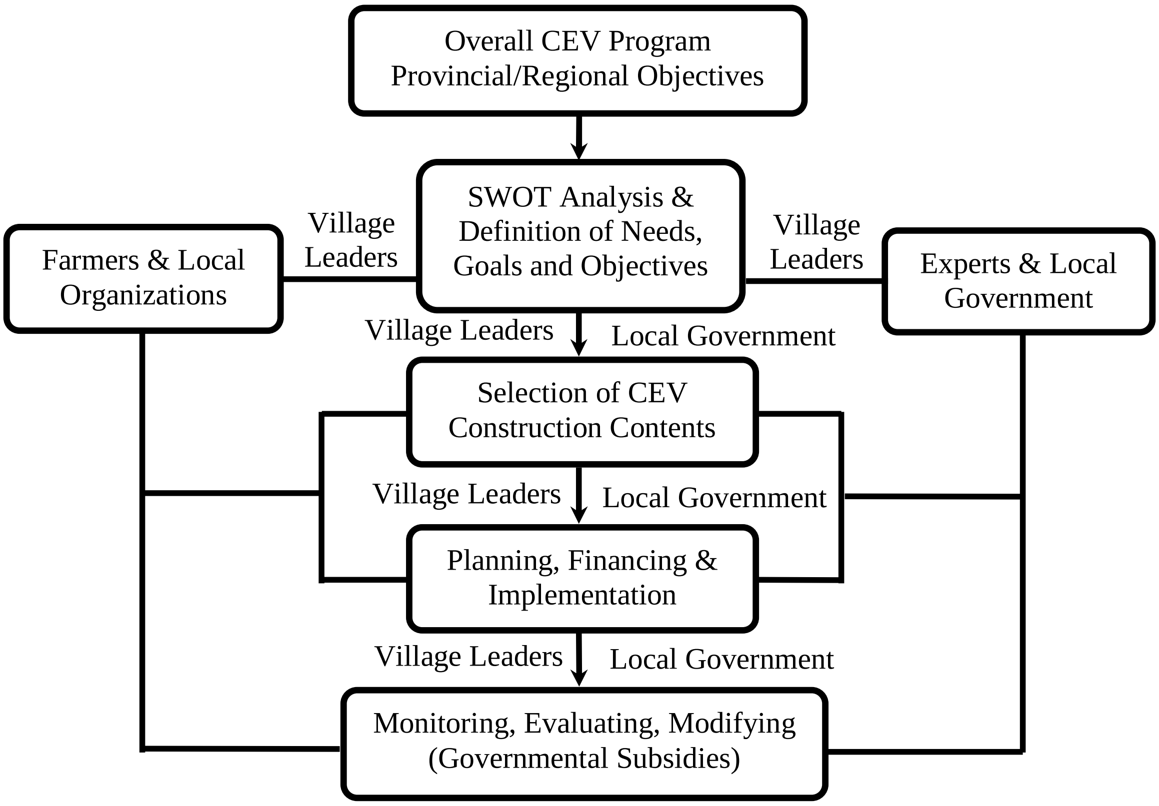

Figure 4.3: Procedures of CEV Construction in Hainan

Source: Created by the author based on Liu, 2006

According to the goal of the provincial government, half of the natural villages in Hainan would have been turned into CEVs by the end of 2009 (HCEO, 2002). By the end of 2006, 6,523 villages (28.1 percent of the total natural villages in Hainan) had been turned into CEVs which met the expectation of the provincial government (Zhou, 2007). Progress occurred in terms of improving rural environment, economy and culture (Liu, 2006). In spite of the progresses, Liu (2006) highlighted the fact that due to the extreme regional economic gaps, the objectives of CEV construction were set differently and the financial input and levels of construction varied from village to village. Although the number of CEVs increased dramatically, the level of construction in about 70 percent of the communities remained low. CEVs in Haikou, Sanya, Wenchang, and Danzhou had comparably higher level of construction as a result of more financial input (ranging from 100 thousand Yuan

RMB to 1 million Yuan RMB). CEVs in the middle mountainous areas, such as Qiongzhong, Baisha, Wuzhishan, and Baoting, usually had lower levels of construction.

4.2 Up-to-date Energy Policies

The ever increasing energy production and consumption in the world led to the "*global environmentalism*" or the expression of environmental concerns over the global pollution and climate change problems stemming from energy use (Brechin & Kempton, 1994). The worries spurred the adoption of the United Nations Framework Convention on Climate Change [UNFCCC] in 1992 (Duic, Juretic, Zeljkoc, & Bogdana, 2005). As the first step of international action to combat global warming, the UNFCCC aimed at stabilizing the atmospheric concentration of GHGs at a safe level for all economic development to proceed in a sustainable manner (Duic, et al., 2005). After years of difficult negotiations and finally in 1997, the parties adopted the Kyoto Protocol, which was a historic step in reversing the inexorable increase in the emission of GHGs (Dagoumas, Papagiannis, & Dokopoulos, 2006). According to the Protocol, developed countries referred in the Annex I of the Protocol were obliged to reduce their emissions of GHGs some 5 percent below their country specific 1990 levels in the period 2008-2012 with penalization clauses in case of non-compliance (UNFCCC, 2003). With ratification by Russia, the Kyoto Protocol entered into force on 02/16/2005 (Freeman & Jaggi, 2005). Not only had the progress led to quantitative obligations for industrialized countries to limit their emissions of GHGs, but it had also exerted intense pressure on developing countries to develop a strategic plan for making better use of the protection of the climate change treaties in a short term as well as limiting their use of carbon-based energy sources in a long run (Boyd & Ibarraran, 2002; Gupta, Olsthoorn, & Rotenberg, 2003).

China had experienced a booming economic growth since 1979 with an average 9.6 percent annual GDP growth (CNDRC, 2008). However, the rapid economic growth was built on a foundation of an unprecedented increase of energy input. Specifically, the economic growth doubled the total energy consumption of China between 1980 and 1999, making China the third largest energy producer and the second largest energy user of the world (Ehrlich & Ehrlich, 2004). Coupled with the impact from the ratification of the Kyoto Protocol, the increasing dependence on international energy resources and the reality of the worsening environmental quality forced the Chinese government to reconsider the strategic importance of its national environmental quality. Although China, as a developing country, was not subjected to the quantitative commitments of the Kyoto Protocol, the Chinese government identified the necessity of following the global trend – to increase energy efficiency and reduce emissions (CNDRC, 2005). Taking early action to follow the global trend had a number of advantages. It lessened the risks of passing thresholds that trigger 'surprises' of environmental deterioration in China. The spontaneity of taking actions to increase energy efficiency and control emissions would allow future generations' ability to choose greater levels of climate protection, and it led to faster reduction of other pollutants. From a sense of international relations, early action could also reduce the risks for China of being environmentally disadvantaged in the next round of international competition.

Consequently, the Chinese government ratified the Kyoto Protocol in 2002 and included "*saving energy and reducing emissions*" as a national strategic environmental objective in the 11th Five-Year Plan of China (2006 – 2010) (CNDRC, 2005). According to the Plan, China aimed at reducing its per GDP energy consumption by 20 percent[74], and its overall amount of emissions[75] by 10 percent from 2005 to 2010 (CNDRC, 2006a, p. 8-9). The objectives were determined based upon the comparison between the Chinese reality and the international levels. For instance, the Chinese per GDP energy consumption in 2000 was 1.27 TCE per 10,000 Yuan RMB which was 2.4 times of the world average level[76](Su, 2007). Experts conservatively estimated that China would have the potential of saving energy consumption of 0.3 billion TCE annually if the overall national energy efficiency increased to the average of world advanced levels (Su, 2007). In order to implement the *saving energy and reducing emissions* policy across China, the central government not only established specific objectives for industrial sectors (Table 4.2), but also set individual objectives of per GDP energy input reduction for provinces and regions in China (Figure 4.4).

The objectives were set based upon the levels of industrial development and existing pollution status of different provinces and regions in China (CNDRC, 2006a). For example, provinces with high levels of industrial development and pollution, like Jilin[77] and Shanxi[78], were subjected to high reduction rates of per GDP Energy Consumption. Provinces with comparably low levels of industries and less severe levels of pollution, like Hainan and Tibet, were tied with lower reduction rates of per

[74] The Chinese per GDP energy consumption in 2005 was 1.22 TCE per 10,000 Yuan RMB (CMEP, 2006).
[75] Specifically in 2005, waste water 52.45 billion tons, amount of COD 14.14 million tons, ammonia and nitrogen 1.50 million tons, sulphur dioxide 25.49 million tons, dust 11.83 million tons, industrial solid wastes 1.34 billion tons (CMEP, 2006).
[76] 2.5 times of the U.S. level, 4.9 times of the European Union level, and 8.7 times of the Japanese level (Su, 2007).
[77] Located in Northeastern China, Jilin is comparably industrialized in China because of its heavy machinery and oil refinery industries which also result in high levels of pollution.
[78] Shanxi is located in the West of China and is severely polluted due to its coal industries.

Table 4.2: Objectives of Reducing Energy Input for National Enterprises (2007 - 2009)

Sector	Objectives of Saving Energy	Objectives of Reducing Emissions
Iron & Steel	Reducing per GDP energy input by 16%	Reducing SO_2 emission by 16%, & COD emission by 23%
Electricity	Reducing coal input for generating electricity by 5.1%	Reducing SO_2 emission by 27.8%
Metal Machinery	Reducing per GDP energy input by 16%	Reducing SO_2 & COD emissions by 8% respectively
Transportation	Reducing per GDP energy input by 12.8% for aero-enterprises, and 14.2% for waterborne enterprises	
Chemical Engineering	Reducing per GDP energy input by 16%	Reducing SO_2 & COD emissions by 8% respectively
Coal	Reducing per GDP energy input by 16%	Reducing SO_2 & COD emissions by 8% respectively
Construction	Reducing per GDP energy input by 16%	Reducing SO_2 emission by 15%, & COD emission by 6%

Source: (CNDRC, 2006b)

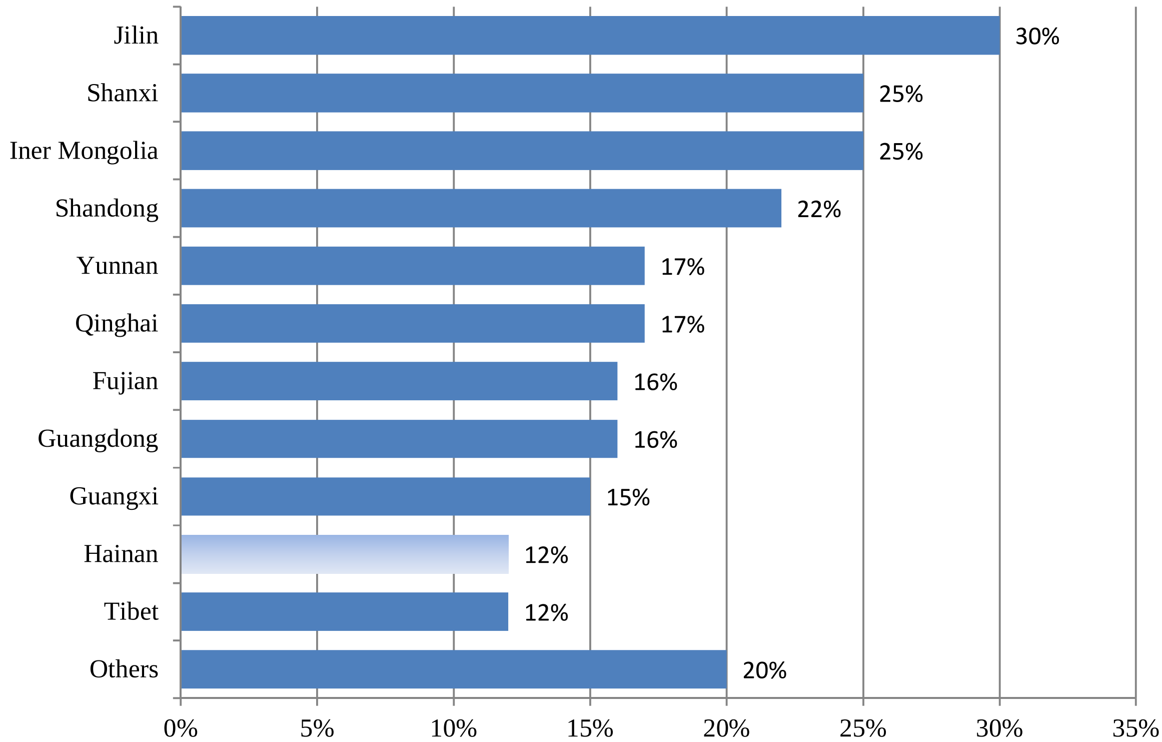

Figure 4.4: Objectives of Reducing Energy Input for Chinese Provinces (2005 - 2010)

Source: CNDRC, 2006a

rates of per GDP Energy Consumption. In particular, Hainan was to reduce the per GDP energy consumption by 12 percent from 2006 to 2010, decrease from 0.92 TCE per 10,000 Yuan RMB in 2005 to 0.81 TCE per 10,000 Yuan RMB in 2010 (CNDRC, 2006a). According to the 11th Five-Year Plan of China, Hainan had to limit the provincial overall annual COD emissions at 95,000 tons and SO_2 emissions at 22,000 tons between 2006 and 2010 because of the poor economic conditions and under-developed industrial capacity (CNDRC, 2006a).

4.2.1 Evolution of Energy Planning in Rural China

Energy planning and policies of rural China are developed and evolved with a focus on solving the problems of energy use in the rural areas. Since the foundation of the country in 1949, the Chinese government has paid as much attention to the energy problem as economic growth (Figure 4.5) (Zhu, 2007). Comparing to the attention that the Chinese government and scholars pay to the energy problems and studies in urban areas and industries, energy planning and policies for the rural areas have long been overlooked due to urban biases (Bajracharya, 1985). Most existing plans, studies and statistical works on energy in China focus on commercial fuels which are mainly consumed by urban residents and industries (Zhu, 2005). Energy plans and policies in China have a long tradition of "*favouring urban, industries and production, while ignoring rural, agriculture and life*" (Zhan & Yao, 2003). Rural people were not in a position to exert pressure on national planners and demand necessary action about rural energy security problem (Bajracharya, 1985). Although the Chinese government realized the need to study and solve rural energy problems as early as in the 1950s, it was not until the sixth "Five-year Plan" (1981-1985) that rural energy planning and policies first appeared in China's Master Plan. In the Plan, the central government raised a sixteen-word guideline[79] of rural energy policies, which translates literally as "*Suit measures to local conditions; make different energy sources mutually complementary; utilize in a comprehensive way; and seek practical benefits*" (Bajracharya, 1985, p.2). Emphasizing the principle of 'self-sufficiency', this guideline has become the foundation for determining priorities and planning appropriate energy mixes to fit local environment conditions in rural China (Zhu, 2007). From 1949 to the end of 1970s, the Chinese government paid attention to commercial energy construction projects, including large power stations, coal mines, and oilfields, which provide energy supply for the development of industries and cities, rather than for rural areas (Zheng, Yang, & Shao, 2004). Although energy security problems were severe in DRAs, in an era of energy shortage the Chinese government

[79] As in Chinese Pinyin, "*Yin Di Zhi Yi, Duo Neng Hu Bu, Zong He Li Yong, Jiang Qiu Shi Xiao*".

authorized industries and cities the advantage of energy consumption over the rural areas (Bajracharya, 1985). Rural energy policies focused on meeting people's energy needs based on local resources in a self-support manner (Bajracharya, 1985). Several objectives were raised by the government to meet the rural energy needs and to improve rural energy systems, but formal energy plans of implementing the energy policies were still lacking in the period (Zhu, 2005).

1950-1970s
- Develop small coal mines on spot for rural people
- Introduce biogas and solar energy to rural people
- Emphasize to develop forest resource actively
- Offer a favoured price of electricity for agriculture

↓ energy crisis in rural area

1980s
- Emphasize selecting measures based on local conditions
- Focus on multiple uses of resources and efficiency
- Introduce balancing development and conservation
- Give priority to energy conservation in consumption

economic development ↓ energy market opening up

In 1996
- Incorporate rural energy construction with agricultural modernization and rural development
- Stimulate the process of rural energy commercialization
- Promote firewood and coal saving stoves and briquette
- Introduce renewable energy

high priority in development ↓ alternative sources

2000s
- Promote renewable energy technology
- Provide financial support to RE technology adopters (Principle: Adopters can own, manage and get benefit from RE; Sources of Funding: mainly from rural residents & collectives, partly from state government)
- Give special focus on the energy security problem of remote no-power countryside
- Emphasize regional effects

Figure 4.5: The Development of Rural Energy Policy in China

Source: Adapted based on Zheng, et al., 2004

From early 1980s to mid-1990s, the pressure of rural energy security was alleviated with increasing supply of commercial fuels to the rural areas. However, most of the commercial fuels have been consumed by rural industries while most of rural people still depend on biomass energy to meet their daily energy needs (Yan, 1997). In this period, China experienced unprecedentedly fast economic growth which was fueled by a dramatic increase of energy input. The "self-sufficiency" principle of rural energy planning and policies continued. While rural energy development has included the provision of increasing quantities of energy from centralized sources, such as petroleum fuels, electricity from large grid systems based on large-scale power plants, and coal from large mines, development has also included aggressive promotion of small-scale, decentralized rural energy systems (Zhan & Yao, 2003; Zheng, et al., 2004; Zhu, 2007). The Chinese government saw that the development of decentralized energy systems provided the only practical means to solve rural energy problems for large quantities of energy are required to fundamentally solve rural household fuel problems; a reliance on centralized systems would place too great a strain on the national energy economy; also the energy produced by centralized systems would also involve major difficulties concerning the transportation of fuel (Zhan & Yao, 2003). Hence, rural communities have therefore been encouraged to develop decentralized small-scale energy systems to solve their household fuel problems based on local resources (Zhan & Yao, 2003). China's major efforts in decentralized rural energy development have included the development of small-scale coal mines, small-scale hydroelectric power plants, biogas, and a variety of methods for the local production of fuelwood (Zhu, 2007). However, the development efforts suffered from a lack of proper coordination, low technical skills, inadequate attention to quality, and managerial problems. The result of technology diffusion was far from satisfactory and rural economy and livelihoods were still restricted by the shortage of energy (Zhu, 2005).

In 1993, China became a net oil-importing country, which intensified China's concerns about the availability of fossil fuels (Zhu, 2007). In the ninth "Five-year Plan" (1996-2000), rural energy planning and policies were listed as a strategic component of sustainable rural development, marking the beginning of Chinese efforts in supporting and promoting RETs in DRAs (Zhu, 2005). Government at all levels in 1990 began to establish formal policies and plans, to build legal capacity and frameworks, to encourage technical development and to support projects relating to energy consumption, technologies, environment, biomass, and livestock management of rural areas (Table 4.3) (Zheng, et al., 2004). Financial incentives for adopting renewable technologies were brought forward. While wind, solar, tidal biodiesel and geothermal energy technologies were tested and developed in rural China, small-scale hydroelectric power plants, anaerobic digesters and energy-saving stoves received increasing promotion. Particularly, the Chinese government had allocated a national bond of 1 billion Yuan RMB per year to support the anaerobic digestion programs in DRAs since 2003 (Zhu, 2007). Given the important role of biomass in rural China's energy supply, rural

Table 4.3: Selected Policies and Plans in Relation to China's Rural Energy

Plans	**Key points regarding rural energy construction**	**References**
China's Agenda 21—White Paper of China's Population, Environment & Development in 21st Century	• Establishes action plans for integrated utilization and technical development of rural energy as priority projects. • Emphasizes "*to accelerate construction of rural energy and to prevent environmental deterioration due to over-consumption of biomass energy*" (Objective 13.12). • Suggests "*to develop techniques that use biomass energy to produce clean liquid fuel and to promote applied techniques of biogas*" (Action 13.20 & 13.57b). • To establish demonstration projects for the development and utilization of biomass energy from 1994 to 2000.	China's Agenda 21 Group [CAG], 1994
The Development Program of New Energy and Renewable Energy (1996-2010)	Prescribes energy development objectives, including accelerate technical improvements in utilization techniques for rural biomass energy; the development of firewood forests and firewood-saving stoves; and the comprehensive utilization of waste residues of crop processing and wastes from animal husbandry.	State Development Planning Commission [SDPC], 1995
The Ninth Five-year Work Plan for Resources Saving and Integrated Utilization	Provides that preferential policies, such as tax adjustment, financial subsidies, and discounted government loans, should be enforced in connection with the integrated utilization of energy and improving renewable energy techniques.	Chinese Communist Congress [CCC], 1995
Scheme of China's Policies on Energy Saving technology	• Sets out objectives of developing rural energy technologies, including gasification, liquefaction, and charring. • Raises the need of using agricultural substances to produce clean fuels in rural areas.	State Development Planning Commission [SDPC], 1996
China's Agenda 21—Action Plan of Agriculture	• Calls for rational use of agricultural straw resources. • To develop full use of agricultural straws through animal straw feed. • To promote the construction of rural energy systems.	China's Ministry of Agriculture [CMA], 1999
The Tenth Five-year Plan on Energy Saving and Integrated Utilization of Resources	Prescribes the objectives of studying and establishing "*incentive policies that can adapt to the requirements of the market economy and promote energy saving and the integrated utilization of resources*," including the "*transfer to tax and tax burdens*," "*public financial support*," and "*privileges in relation to loans*."	Chinese Communist Congress [CCC], 2001a
The Tenth Five-year Plan on State Environment Protection	The administration determined the need "*to popularize techniques for the integrated utilization and treatment of animal excrement*"; "*to vigorously promote integrated utilization approaches, such as the transformation of crop straw into manure and straw gasification; to develop new methods of industrial utilization of crop straw*"; and "*to develop new energy and new energy-saving technologies, such as marsh and energy-saving stoves*."	Chinese Communist Congress [CCC], 2001b
The Scheme of Sustainable Development of Science and technology in 2001-2010	The development of biogas technology and acceleration of improvements in technology for the utilization of rural biomass energy are noted as key areas for scientific and technical research.	the Chinese Ministry of Science and Technology [CMST], 2001
Key Points of Developing New Energy & Renewable Energy Industry in 2000-2015	Sets out the objectives and tasks of "*supporting technical service systems of renewable energy industry in 2006-2010*," and "*promoting construction of large- and medium-scale biogas projects and developing equipment that can effectively utilize biomass energy*".	State Economic and Trade Commission [SETC], 2003

energy policies have received new responsibility and missions of slowing down and adapting to the global climate change (Zhu, 2007). As shown in *China's National Countermeasures of Global Climate Change*" (CNDRC, 2007), the significance of promoting afforestation, bioenergy (biogas, ethanol fuel and biodiesel) and RETs becomes more apparent.

4.2.2 Characteristics of Energy Planning in Rural China

Given China's one-party top-down political system, decisions of the Chinese central government are implemented as obedience of the directives at lower levels (Zhao, 1998; Guo, 2003). Likewise, the procedures of rural energy planning and policy-making are highly centralized and depend overwhelmingly on the execution of government at lower levels as well as the participation of local people (Bajracharya, 1985; Qiu, 1991; Zheng, et al., 2004; Zhu, 2005; Zhu, 2007). Much different from the Western planning system, rural energy planning in China has its own characteristics.

Firstly, rural energy planning of China was excluded from the national dominant energy planning system which focused mainly on commercial fuels in urban and industrial sectors[80]. The exclusion of the rural energy planning system from the national dominant energy planning system had pre-determined rural people's reliance on local resources and decentralized energy systems to meet their energy needs (Wang, 1999). Hence, the overall rural energy policy of China was to promote wide application of anaerobic digestion, fuelwood afforestation, and energy-saving stoves in rural areas while developing decentralized hydro-power plants, small coal mines, wind energy power plants, photovoltaic cells, and geothermal applications in rural areas where local conditions permitted[81]. Zhou and Wang (2002) affirmed that the exclusion of the rural energy planning system from the national dominant energy planning system allowed that China had more resources to focus on urban and industrial development, they also identified that the exclusion had intensified the inequality between rural and urban areas. The contradiction between the rural energy planning guideline and national energy development focus on electricity industries[82] led to chronic insufficient electricity supply to the rural areas in late 1990s (Zhou & Wang, 2002). Disordered mining also occurred in rural China, which led to over-production and waste of coal resources (Zhou & Wang, 2002).

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[80] The 8th National Congress (1956) reached a conclusion that China was still at the early stage of Socialism with the contradiction between the laggard productivity and the increasing people's material needs as the basic antinomy (Guo, 2003). Hence, China had to give preferential support to urban areas and industries (Wang & Feng, 2002). Although China accelerated upgrading rural electrical grid in early 1990s, commercial fuels had limited roles in meeting rural energy needs (Zhao, 2008).

[81] Zhu (2007) called it "*a rural energy development road with Chinese characteristics*" (p. 21).

[82] Included in China's seventh "Five-year Plan" (1986-1990).

Secondly, rural energy planning of China was conducted in a top-down approach driven by experts with diverse backgrounds (Qiu, 1991). The overall rural energy plans and policies, as a part of the National Economic Development Master Plan, were developed by the CNDRC and then approved by the national congress (Qiu, 1991; Shi, 2006). Unlike the Western planning system, the Chinese government was both the planner and decision-maker of the overall rural energy planning and policies (Zhao, 2008). The overall rural energy plans were reviewed and modified as part of the Chinese “Five-year” Plans. The overall rural energy plans comprised broad and long-term (twenty-year) objectives and keystones for short (Five-year) terms (Qiu, 1991; Zhu, 2007). The overall rural energy plans provided principles and frameworks for subordinate divisions to expand and implement locally. Within the subordinate energy planning divisions, especially those at the municipal and county levels in less-developed areas, there was a shortage of trained energy planners with recognized expertise. A diversity of individuals and organizations were involved in the practice. A lack of consultation among local village leaders, experts, and local people during the planning process had been a common problem.

Thirdly, rural energy planning of China had multi-faceted objectives, which remained vague and hard to be fulfilled. As an important part of rural development planning, energy planning in rural China integrated considerations of energy production and consumption, economic development, and resource/environmental protection (Qiu, 1991; Zhu, 2005). Although the objectives of the energy plans were established to enhance the community capacity in different aspects, the objectives in most energy plans remained vague and hard to realize (Zhu, 2007). The fundamental sixteen-word guideline of rural energy planning, for example, was unclear for meeting the rural energy needs. Often, specific tasks of energy plans were determined in the process of local implementation. No doubt, rural energy planning in China aimed at meeting the energy needs based on local resources and decentralized energy systems, and more recently conserving local environment and resources (Zhao, 2008). However, it was often not clear to what degree the energy needs could be met or how the environment and natural resources could be protected.

Fourthly, due to the vagueness of the objectives, the tasks of the rural energy plans were hard to implement. Most rural energy plans at the local levels identified specific decentralized small-scale energy systems to build in specific communities. Many local plans also established specific adoption numbers or covering percentages as the objectives. However, the plans often lacked specific timetable for implementation (Zhu, 2007). As a result, when preparing new energy plans local energy planners only made partial or incremental adjustment to the energy plans based on energy planners' past experience, comparisons with previous plans, and the changing conditions. Monitoring and adjusting of existing policies, which were important steps in planning, were often ignored by the government. Again, local energy plans in rural China ignored the effectiveness of implementation and became documents of development suggestions. Zhu (2007) argued that it was not that the energy planners did not want to spend effort on meeting the objectives. Rather, it was that most local energy planners were not sure about how to implement the energy plans or simply could not implement the plans due to realistic constraints (e.g. technical, financial, physical, personnel etc.). Academic critiques of defects in rural energy planning, such as the absence of proper legislation and regulation, resource over-consumption and weak implementation, had become one of the main subjects addressed in Chinese academic literature on rural energy and development studies (Zhan & Yao, 2004; Zhu, 2005; Shi, 2006; Zhu, 2007; Zhao, 2008).

Fifthly, the implementation of the rural energy plans was directed by different departments at local levels. Based on the rural energy plans, China had established "*The Leading Group of the National Rural Energy Comprehensive Construction*" since early 1980s (Zhu, 2007). Based on the specific energy programs to be implemented, the group divided and delivered responsibilities to different governmental organizations at local levels. Specifically, the Department of Agriculture was responsible for the construction of anaerobic digestion and energy-saving stoves; the Department of Hydro-electricity was in charging of organizing the construction of small hydro plants in rural areas; and the Department of Forestry fulfilled the responsibility of fuelwood afforestation activities (Zhu, 2007). The departments with responsibilities of fulfilling parts of the energy plans, although directed by the leading group, usually lacked of coordination or assistance with each other. The departments initiated the energy intervention programs by delivering and communicating the plans and policies with local community cadres, who extended the plans and policies to local community residents. In many rural areas, public participation often meant only the involvement of rural people in the energy intervention programs with financial and labour input, rather than expressing their perspectives on the energy programs (Zhu, 2007). The absence of considering local opinions led to potential questions on the effectiveness of the energy plans.

4.2.3 Rural Energy Policies in Hainan

The national characteristics of rural energy planning summarized based on literature review were reflected at the provincial level with Hainan as a good example. With the enactment of *saving energy* *and reducing emissions* as a current top national energy policy across China, rural energy policies in Hainan inevitably took on the mission of contributing to the overall energy efficiency of the province. Much different from the impetus of energy production and consumption in the urban areas and industrial sectors, energy use in rural Hainan mainly limited to fuelling people's daily needs rather than economic growth. Hence, the establishment of rural energy policies in Hainan was based on meeting the necessary living energy needs of the rural people with the initiatives of protecting the rural environment and resources (PO1, 2007). Following the establishment of the province in 1988, Hainan's rural energy policies stuck to the national policies and emphasized the 'self-sufficiency' principle. While the rural electrification project continued to progress, rural energy policies in Hainan specified the priority of comprehensive use of local resources and meeting local energy needs with small scale agricultural energy systems (SC1, 2007). Although the policy of *saving energy and reducing emissions* did not quantify the obligations of rural energy production and consumption in fulfilling the national requirements, accomplishments of energy saving and emission reduction in rural Hainan were statistically counted as part of the provincial achievements in executing the national energy policy [83] (PO2, 2007). Given the existing status of energy production and consumption in urban areas and industrial sectors, PO2 (2007) demonstrated that it was challenging for Hainan to meet the objectives assigned by the central government.

Hainan's enforcement of the *saving energy and reducing emissions* policy started in 2006 with the development of "*the Comprehensive Working Plan of Saving Energy and Reducing Emissions in Hainan*" which targeted the working prominence of energy use in urban and industrial sectors and specified tasks and respective functionaries[84]. Battling with the need of economic growth and rigidity of increasing energy efficiency, the actions in Hainan were carried out mainly in two aspects—controlling the access of new industries and improving the performance of existing industries (SC1, 2007). Since 2006, the provincial government of Hainan had become more careful in examining the establishment, rebuilding and enlargement projects of fixed industries in the province to control the access of new industries with high energy input and emissions. The provincial government did not approve new projects until the projects passed all related examinations[85]. Without governmental

[83] Obviously, the provincial government gave considerable leeway in the urban areas and industrial sectors in meeting the requirements by taking advantages of energy-use improvements in DRAs.
[84] Main responsible organizations include the Provincial Industrial Economy and Information Bureau, the Provincial Development and Reform Commission, the Provincial Land, Environment and Resources Department, the Provincial Construction Department, the Provincial Business Department, financial institutions, government at city and county levels etc.
[85] Main tests included matching industrial policy & market access rules, project preparation & initial assessment, land use assessment, environmental impact assessment [EIA], energy input & emission assessment, & meeting financial, security & urban

approvals, a new project would not be granted the right of land use or loans. Instead, new projects with potential to save or replace petro-products had gained preference from the government. While the government encouraged alternative sources of energy other than petroleum, research and development of RETs had made considerable progress in Hainan. At the same time, the government required existing industries to increase energy efficiency and reduce emissions on their own and designated specific objectives for important industries to achieve. Small-scale industries[86] of high energy consumption and emissions had received more and more restrictions from the government since 2006. Not only had the export of products from these industries been controlled, but small factories in kind with poor environmental performance had been restricted from electricity supply and were being eliminated gradually. The results of saving energy and reducing emissions in Hainan, however, were not satisfying in 2006 and 2007. The per GDP energy consumption did not reduce by 2.5 percent as expected in both years. Rather, both the overall energy input and the per GDP energy consumption in 2007 rose slightly from 2006 (Li, 2008). Although the existing industries in Hainan did reduce the per GDP energy consumption in 2007, a number of new industries[87] of intense energy consumption came into production which offset the energy-saving efforts from existing industries. Also, the overall emissions also increased slightly in both 2006 and 2007, mainly because there was no new sewage plant project being accomplished and coming into use in the last two years and the sulphur removal project of Huaneng Power Plant in Haikou was yet to be finished (Li, 2008).

Ironically, the provincial government affirmed the positive role of rural energy projects in helping meet the objectives of *saving energy and reducing emissions* for the province, but it remained unclear that to what extent the rural energy projects could contribute (PO3, 2007). Given the difficulties for the urban areas and industrial sectors to meet the energy and emission objectives, energy policies and achievements in rural Hainan could not be excluded from the urban areas and industrial sectors (PO3, 2007). The provincial government reached a consensus of reinforcing the effectiveness of rural energy policies and plans so as to maximize the potential of rural Hainan in increasing energy efficiency and contributing to the provincial overall statistics.

Although Hainan had a short history of being a formal province in China, state energy policies had been vigorously followed and implemented by the Hainan government, which held a positive attitude

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planning principles.

[86] E.g., small-scale industries of cement, iron & steel production, electricity generating, rubber processing, solid clay brick production, & mining.

[87] Including the 0.6-million-ton methanol project developed by China National Offshore Oil Corporation in Dongfang.

towards meeting the rural energy needs and played a critical role in protecting rural environment/resources and formulating rural development strategies. Hainan's establishment as a formal province of China occurred soon after the announcement of the six "Five-year Plan" (1981-1985). The provincial government followed the national sixteen-word guideline and emphasized the principle of "self-sufficiency" in meeting rural energy needs. Hainan's rural energy policy focused on making comprehensive use of local resources and developing small-scale, decentralized rural energy systems. At the same time, the provision of commercial fuels kept improving and increasing with the fast rural economic growth and construction of energy systems. Although the development of small-scale rural coal mines was flourishing in mainland China, it was not the case in rural Hainan due to the lack of coal resources. Based on local resources and conditions, small-scale rural hydroelectric power plants were being constructed sporadically under the leadership of city/county government in Ledong, Qionghai, Changjiang, Wuzhishan, Chengmai, Dongfang, and Qiongzhong (PO4, 2007). In the meantime, household anaerobic digesters, energy-saving cook stoves, and renewable energy applications were introduced and promoted in DRAs.

According to Zhou (2007), the policy of promoting small-scale rural energy systems in DRAs of Hainan was established based on three major considerations, including energy efficiency, self-sufficiency and long-term effectiveness. First, new small-scale rural energy technologies and systems had proved functions of increasing energy efficiency. Upgrading the rural energy system represented a revolution of eradicating laggard methods of rural resource utilization. Small-scale rural energy systems could complement the shortcomings of rural energy infrastructure, especially for commercial fuels such as electricity, oil and gas. They not only could help rural people meet their daily energy needs, but also could contribute to increasing rural energy efficiency. Second, a self-support energy consumption pattern allowed the provincial government to focus on the weakness of the industrial structure of the province and to stimulate the development of industrial sectors with high added values, such as tourism and petro-chemical related industries. Hainan's local resources and geographical location should be utilized to develop new industries with high added values so that the provincial economy of Hainan could propel successively. With that recognition, the construction of rural energy infrastructure remained much slower than the urban and industrial sectors and the provision of commercial fuels in DRAs was often compromised. Consequently, promoting small-scale rural energy technologies and systems in DRAs of Hainan was a reconciling strategy of improving rural livelihoods under the biased provincial vision of 'growth poles'. Once the rural energy needs were met with less input, the provincial government would have more resources to satisfy the prospective and existing industrial drivers of economic growth. Third, promoting small-scale rural energy technologies and systems helped control the rural ecological susceptibility to environmental damages and would have long-term benefits as a sustainable development initiative. Rural Hainan not only accommodated the less-educated population with poor productivity, but also played a significant role in the provincial ecological security system. Rural Hainan had the largest and most concentrated tropical rainforest of China and the headwaters of the main rivers[88] in Hainan. Small-scale rural energy technologies and systems helped rural people make use of local resources more properly and would contribute to protecting rural environment and resources. This, in turn, would set a positive step of the long-term sustainable development vision. Hence, Hainan's rural energy policies should be carried out spontaneously rather than being forced by the central government (PO5, 2007).

With the implementation of the "*CEV*" program across rural Hainan since 2001, Hainan's rural energy policy integrated into the program as an important content of CEV construction. The objectives of promoting new small-scale rural energy systems with higher efficiency were in compliance with the sustainable development vision of the CEV program. As introduced in previous sections, the precondition of the emerging CEV program in Hainan was the combination of rapid rural development progress and the rural people's desire of a better quality of life. The general objectives of the CEV program highlighted the importance of protecting rural environment and resources, which synchronized the motives of promoting energy systems with higher efficiency in DRAs. The rural energy policy aimed at assuring rural people energy security and more importantly improving energy efficiency, which contributed to the long-term sustainable development vision of rural Hainan. In this regard, new small-scale rural energy systems with higher efficiency were not only symbols of rural quality of life improvement but also direct artifices of protecting rural environment and resources.

Hainan's rural energy intervention programs involved various prevailing small-scale energy technologies being introduced or promoted in DRAs of the world, such as anaerobic digester, energy-saving cook stove, solar water heater, liquefied petro-gas tank, and photovoltaic applications. In addition to the different objectives and uses, the new energy technologies have different statuses and degrees of promotion in rural Hainan on a provincial level (Table 4.4). In spite of the differences, the

[88] Three main rivers include Nandu, Changhua, & Wanquan River, which provide the fresh water for the whole province.

various energy intervention programs shared a common ground of introducing alternative energy uses that are cleaner, more efficient, and less dependent on firewood. An exploration of the decision-making, implementation, and monitoring processes of these programs would give us a better understanding towards the possible gaps between planning theory and energy planning practice in DRAs.

Table 4.4: Details of Intervention Programs for Various Technologies

Energy Technologies	**Main Objectives and Uses**	**Status of Promotion**	**Degree of Promotion**
Anaerobic digester	• Replacing traditional open-fire firewood stove • Reducing reliance on firewood & agricultural wastes • Meeting energy needs on daily cooking • Using digester slurry & increasing soil nutrients • Improving kitchen environment & health conditions	Vigorously introduced	Very high
Energy-saving cook stove	• Replacing traditional open-fire firewood stove • Increasing efficiency of burning firewood & straws • Improving indoor environment (kitchen)	Pervasively promoted	Very high
Solar water heater	• Providing convenient & clean ways of heating water • Increasing quality of life (formal hot water shower) • Nurturing habits of spontaneously adopting green/clean energy technologies	Purposefully guided	High
Liquefied petro-gas tank	• Providing alternative energy source for cooking purpose • Alleviating reliance on firewood & agricultural wastes • Saving energy input and increasing energy efficiency • Making rational consumption on commercial fuels	Gradually introduced	Medium
Photovoltaic application	• Generating electricity to run small-power electronic devices • Reducing reliance on commercial electricity	Sporadical & experimental	Low

Although the significance of promoting new small-scale rural energy systems with higher efficiency was recognized among government officials, it remained ambiguous whether the energy intervention programs were necessary or top contents in Hainan’s CEV program. Based on the basic initial intention of converting traditional underdeveloped villages’ image of being ‘dirty, messy and disordered’, Hainan’s CEV program took improving the overall rural appearance as its fundamental content. Along with other characteristically extended alternatives, the energy intervention programs were regarded as advanced contents of the CEV program (PO3 & 7, 2007). The CEV program required progress of village renovation as the bottom line for each village, villages with capabilities were encouraged to further implement advanced projects as extensions of the CEV construction. Although village renovation had instant effect of improving the appearance of rural settlement, the village beautiful movement did not address as much of being 'ecological' as the energy intervention programs did (PO6, 2007). However, promoting new energy systems with higher efficiency in DRAs was up against many challenges, indicating that the energy intervention programs could only be implemented with flexibility across DRAs (PO8, 9, & 10, 2007). Based on the local conditions of villages in charge, local government and village leadership determined the necessity of incorporating energy intervention programs in the CEV construction.

4.2.4 Motivations and Expectations of Government

Although government reports and publications (e.g., Zhou, 2007) identified some basic considerations for implementing the energy intervention programs (i.e., energy efficiency, self-sufficiency and long-term effectiveness), interviews with government officials in Hainan revealed a spectrum of diversified motivations which energize, direct and sustain the energy intervention programs across rural Hainan. The motivations included rural people's needs of energy security and a better quality of life, pressures or forces from the upper government, desire for a more sustainable society, and perceptions of environmental/resource damages of traditional energy use. Table 4.5 provides specific motivation elements that were included in the interview guides as well as responses from government interviewees. Responses of government interviewees represented the agreement degree of each motivation item towards the energy intervention programs. The table not only presents government interviewees' perceptions towards each motivation item as a whole, but also explores the similarities and differences in perspective between provincial government and local government officials. Based on the table, it was clear that the major driving forces of implementing energy intervention programs across rural Hainan stemmed from improving rural people's benefits in terms of energy security assurance (overall[89] mean = 4.59) and rural livelihood improvement (overall mean = 4.45), followed by the perceived damages of traditional energy use on forest resources (overall mean = 4.24), rural environment/resources (overall mean = 3.97). Government in Hainan was aware of the potential costs for ecological rehabilitation (overall mean = 4.00) and hoped to establish positive images of the jurisdictions (overall mean = 4.24). In spite of the achievements of promoting renewable technology in DRAs of the mainland China and the ever-increasing sustainable

[89] Including provincial and local government interviewees.

development discourse, the government claimed that Hainan's sustainable development initiatives were not subject to the pressure from nearby provinces (overall mean = 2.72) or surrounding countries[90] (overall mean = 2.48).

Table 4.5: Motivations of Implementing Energy Intervention Programs

Items[a]	Overall N = 29		Provincial Government n = 12		Local Government n = 17		Comparison t-statistic[b]
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Energy needs of rural people	4.59	0.501	4.58	0.515	4.59	0.507	-0.025
Improving rural livelihoods	4.45	0.736	4.33	0.778	4.53	0.717	-0.700
Setting green images of jurisdiction	4.24	0.739	4.50	0.522	4.06	0.827	0.844
Loss of forest resources	4.24	0.511	4.25	0.452	4.24	0.562	0.075
Costs for ecological rehabilitation	4.00	0.707	4.17	0.718	3.88	0.697	1.898^{+}
Threats to environment/resources	3.97	0.680	3.83	0.718	4.06	0.659	-0.875
Fulfilling the provincial mission	3.55	1.055	4.42	0.900	2.94	0.659	5.106^{***}
Pressures from nearby provinces	2.72	0.702	2.92	0.793	2.59	0.618	2.682^{*}
Pressures from nearby countries	2.48	1.022	3.08	0.900	2.06	0.899	3.419^{**}

a Scales of items based on, 1 = strongly disagree; 2 = disagree; 3 = neutral/don't know; 4 = agree; 5 = strongly agree. The items are sorted by the overall mean.

b $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$ (assuming equal variance, two-tailed)

The shows that government officials in Hainan had similar levels of agreement on energy security assurance, rural livelihood improvement, setting green images of jurisdictions, loss of forest resources and threats of traditional energy use to rural environment/resources as major drivers of implementing energy intervention programs in rural Hainan. However, statistically significant differences were discovered between the groups of provincial officials and local officials in terms of the agreement levels to following-up upper decisions ($t = -6.203$, $p < 0.001$), pressures from nearby provinces ($t = 2.682$, $p < 0.05$), pressures from surrounding countries ($t = 3.419$, $p < 0.01$), fulfilling provincial mission ($t = 5.106$, $p < 0.001$), and costs to ecological rehabilitation ($t = 1.898$, $p < 0.10$). The result indicated that the decision-making of local government in Hainan towards new rural

[90] In fact, the EPS and CEV program of Hainan emerged as pioneer sustainable development projects in LDCs (PO6, 2007).

energy technologies was largely subject to decisions and policies from the upper government. Although the provincial government provided outlines of sustainable development initiatives and woke up to flexibility in local implementation, some local government officials still relied on the upper decisions while selecting community development projects. Among the items that had significantly different agreement levels, the group of provincial officials had higher agreement levels over the group of local officials except the item of 'following-up upper decisions'. This implied that provincial officials were more concerned about the long-term sustainability as well as the overall reputation of the province.

The government in Hainan recognized the necessity and potential benefits of new small-scale rural energy systems and technologies in assuring rural energy supply, increasing energy efficiency, and contributing to rural environmental/resource protection. The government, as a whole, expected new energy systems especially RETs could be widely adopted across rural Hainan and to be continuously utilized by rural people. Based on the interviews, it was clear that the government had expected the efforts could benefit rural people in terms of poverty reduction, quality of life improvement, and alleviation of pressure on rural environment/resources. Since it was impossible for all villages to get involved in the energy intervention programs immediately, the government had taken a series of gradual steps with different expectations (PO3, 2007). First, with the top-down delivery of the provincial decisions and policies on decentralized rural energy systems, the government expected rural people had a stronger awareness of protecting the rural environment and making more rational uses of local resources while meeting their energy needs. They expected rural people to understand the severe outcome of resource depletion. Second, the government expected rural people to be more familiar with new energy systems especially RETs through local technical centres and media where available. Third, in villages where new energy systems were planned, local governments took into account local resources, past experiences, economic feasibility, and perceived difficulty of the projects. The local governments expected to enhance rural people's knowledge of the new energy systems with the help of technical specialists. They tried to infuse the ideas that under the proper technical instruction and training the villagers were able to build and make use of the new energy systems. With regard to the newly established energy systems, the government expected sustained use among the adopters.

4.2.5 Emerging Energy Systems in Rural Hainan

Under the rural energy policy of promoting decentralized energy systems, a variety of small-scale rural energy systems were emerging in the DRAs of Hainan, especially after the implementation of the CEV program. The typical emerging energy systems included household energy-saving cook stoves, solar water heaters, anaerobic digesters, liquefied petro-gas tanks, and solar photovoltaic systems. In the meantime, community-based anaerobic digesters, hydroelectric power plants and wind power plants were being built by rural entrepreneurship and government-involved partnerships. According to the provincial government, rural energy systems in the energy intervention programs were selected based on the empirical evidence of technical feasibility from villages with similar socio-economic-environmental context from mainland China and other international developing communities. Household energy-saving cook stoves, solar water heaters, and anaerobic digesters were highly promoted energy systems since these types of rural energy systems had more than two decades' history of application in rural communities of mainland China and had demonstrated sufficient evidence of saving resources, increasing energy efficiencies and making use of renewable energy resources. Hainan's government regarded the three types of rural energy systems were highly matured and technically feasible for rural people to adopt. With the development of science and technology, liquefied petro-gas tanks and solar photovoltaic systems were burgeoning in urban areas of China. However, Hainan's government considered the rural energy systems as immature to be widely promoted in rural Hainan. The costs for financing the applications were the top consideration. Hainan's government encouraged technical innovation and diffusion, particularly industries and businesses that made use of local resources and had the potential of creating employment opportunities for local people. Hence, community-based anaerobic digesters, small hydroelectric power plants, and wind power plants were also emerging in rural Hainan. Unlike the household-based emerging energy systems, community-based energy systems had fixed and standardized procedures of operation, production, management and maintenance. Rural people who were hired in the industries and businesses were often trained and certified by technical specialists before they could work. However, community-based energy systems were only being built sporadically in rural Hainan.

Among the 492 rural household respondents, 156 (32 percent) had experiences of adopting new energy systems/technologies (Table 4.6). The 156 respondents recognized the importance of protecting the rural environment and resources, along with considerations of children's well-being, nature/agriculture, and quality of life among the top factors. Within the 156 households, the main

Table 4.6: Questionnaire Survey Responses – Energy Systems

Survey question	Responses (N=156)	Community residents	
		# of responses	% of responses
How do you evaluate the local environment/resources?	Very good	23	15
	Good	49	31
	Poor	84	54
Is protecting rural environment/resources important to you? If yes, why?	Yes	156	100
	Nature/Agriculture	75	48
	Quality of life	68	44
	Water resources	23	15
	Climate	32	21
	Well-being of kids	95	61
What was the main source(s) of energy in your household before the energy intervention programs?	Firewood	139	89
	Agricultural wastes	128	82
	Gas	3	2
	Electricity	11	7
What new energy systems/technologies did you adopt in your household through the energy intervention programs?	Energy-saving stove	103	66
	Solar water heater	88	56
	Anaerobic digester	126	81
	Liquefied gas tank	22	14
	PV application	5	3
After you adopted the new energy systems/technologies, what was the main source(s) of energy in your household?	Firewood	101	65
	Agricultural wastes	92	59
	Biogas	65	43
	Solar energy	40	26
	Electricity	11	7
	Liquefied gas	7	4
Have the new energy systems/technologies become the primary energy providers in your household?	Yes	33	21
	No	67	43
	Not sure	56	36
Have the energy intervention programs impacted your livelihoods in a positive and/or negative way? How?	Positive only	33	21
	Negative only	25	16
	Both	98	63
Positive livelihood effects cited	Energy supply	78	50
	Energy efficiency	68	44
	Envir./Resources	93	60
	Convenience	45	29
Negatives cited	Financial costs	78	50
	Labour input	56	36
	Occupying space	23	15
Overall, are the energy intervention programs good or bad?	Good	86	55
	Bad	18	12
	Not sure	52	33

sources of energy were firewood mainly obtained by deforestation and agricultural wastes before the energy intervention programs. 89 percent of the 156 households claimed firewood as a main source of energy and 82 percent of the households highlighted agricultural wastes. It was worthy pointing out that 113 households (72 percent) of the 156 households claimed both firewood and agricultural wastes as the main sources of energy before the energy intervention programs. The data disclosed rural people's high reliance on biomass resources as the main sources of meeting energy needs. In the energy intervention programs, household anaerobic digester, energy-saving stove and solar water heater were the main energy systems being promoted and adopted. Although the emergence of new energy systems changed the energy consumption pattern of the adopters as new energy systems had become important sources of energy, it was clear that the many adopters did not give up the use of traditional sources of energy. Firewood and agricultural wastes were still claimed as main sources of energy in some respondents' households, as 65 percent and 59 percent of the participants respectively still claimed firewood and agricultural wastes as main energy sources after the programs. Overall, the adopters of the new energy systems claimed the positive factors of the energy intervention programs (energy supply assurance, improving energy efficiency, protecting environment/resources, and convenient to use) more than the negatives, such as the financial costs, labour input and occupancy of space in the premises. However, 33 percent of the respondents were not sure about whether the energy intervention programs were good or bad.

(a) <u>Anaerobic Digester</u>

The typical volumes of a household anaerobic digester in rural Hainan were 6 m^3 and 8 m^3. A digester was usually built in the backyard of rural households, occupying an area of 12 m^2 to 18 m^2 (Figure 4.6). The average construction costs were around 1,400 Yuan RMB. It connects with the household toilets and livestock enclosure, allowing both human and animal manure to flow directly into it. Agricultural wastes were the raw materials of the digesters. The digester was connected to a stove by a plastic pipeline. Before biogas could be used, 90 percent of the hydrogen sulphide (H_2S) was removed by a deodorizing machine. A barometer was installed in the anaerobic digestion system to indicate available biogas pressure which for cooking purposes should be between 4 and 6 pounds. Excess slurry from the digester had to be removed whenever pressures exceeded 8 pounds. Otherwise, the efficiency of anaerobic digestion was decreased. Using a metal pot, adopters removed the slurry once per week and stored it in a 1 m^3 cement container in the backyard. The slurry was carried in a bucket and spread onto the farmland, vegetable and fruit gardens to enrich the nutrients of the soil.

(b) Energy-saving Cook Stove

Energy-saving cook stoves in rural Hainan were built from bricks with cement covers. The stove usually occupied a space of more than 3 m^3 in the kitchen of a rural household. The dimension of the stove is about 1.3 X 1.25 X 2 m (Figure 4.7). Average construction costs were around 350 Yuan RMB. The new cook stove had a more efficient inner structure. Connected with a chimney, the energy–saving cook stove provided a safe way to emit smoke from incineration. Within the new stove, it was more convenient to light fire. Fuels could burn efficiently in the stove, transferring more chemical energy to thermal energy through combustion. It kept and concentrated heat which could increase the energy utilization rate. It was also easier to dispose of the ashes from the stoves. A traditional cook stove in rural Hainan usually needed 5 kg of biomass fuels to provide enough energy to prepare dinner for a rural family. The new energy-saving cook stove usually used 30 percent to 50 percent less firewood for a family dinner and reduced the preparation time about 25 percent to 30 percent.

Figure 4.6: An Anaerobic Digester in Hainan

Figure 4.7: An Energy-saving Stove in Hainan

Source: From on-site observation in field research

(c) Solar Water Heater

Solar energy appeared to be one of the most effective sources to alleviate the tensions among rural energy shortage and environmental/resource protection. Although domestic solar water heating is a dominant and widespread solar thermal application around the world, the way to utilize solar energy is new to the people in DRAs, especially those in China. A solar water heater usually cost about 800 Yuan RMB. The main object of the solar water heater in rural Hainan involved mainly the family bath. Adopters in rural Hainan added inside plumbing for bathrooms in their households (Figure 4.8.a). With the solar water heaters, bathing became more accessible, hygienic, and efficient for rural residents. The fifty-gallon-volume heaters fit ideally into the daily life of the adopters for satisfying the hot water needs and saved firewood and water.

(d) Other Energy Systems

Liquefied petro-gas tank and photovoltaic solar application were also emerging in the DRAs of Hainan. As a commercial fuel, liquefied petro-gas tanks were supplied and utilized in urban areas of Hainan. With the rapid economic development of rural Hainan, liquefied petro-gas tanks were also purchased and used as energy suppliers by some rich rural households. A typical liquefied petro-gas tank in rural Hainan usually had a volume ranging from 4 to 8 litres. In a market of Haikou, a full four-litre tank contained 4 kilogram of liquefied gas and cost about 40 Yuan RMB (Figure 4.8.b). Considering the priority of ensuring the energy supply in urban and industrial sectors, the use of liquefied petro-gas tank in rural Hainan was not promoted as much as anaerobic digester, energy-saving cook stove, or domestic solar water heater. Also, the fast growth of photovoltaic systems in urban and industrial sectors triggered Hainan government's attempt of promoting the technologies in DRAs. However, the photovoltaic cells were too expensive for most rural people. The government in Hainan could only experiment with the technologies in a few designated villages (e.g. Meiwan Xincun Village in Danzhou). The government provided a subsidy which covered almost the entire cost of the photovoltaic equipment. Rural people installed and made use of the applications under the guidance of local technical specialists. In Meiwan Xincun Village, each photovoltaic system was 2 square metres and could generate enough power to run small electronic devices with rated power no more than 80 watts (e.g., fans, lightbulbs, and tape recorders/players) (Figure 4.8.c). The power could provide the electrical needs of a family for up to 7 days after one sunny day, provided they used storage devices such as lead-acid batteries. The Hainan government was also trying to test the feasibility of community-based anaerobic digesters, small hydroelectric power plants and wind power plants in a few villages which were close to local technical centres. Unlike the individual household energy systems, the community-based energy systems required more standardized construction, operation, and management. While providing energy supply to rural residents, the community-based energy systems also created some employment opportunities for rural people.

4.2.6 Issues and Problems

Evidently, the emerging new energy systems partially changed the energy consumption pattern in rural Hainan. The new energy systems provided rural people with alternative sources of energy,

a. Solar Water Heater   b. Liquefied Petro-gas Tanks   c. Photovoltaic System

Figure 4.8: Other Emerging Energy Systems in Rural Hainan

Source: From on-site observation in field research

which represented higher efficiency and more convenience than the traditional ones. The changes were positive, as the Hainan government's conception of improving rural livelihoods through the energy intervention programs was put into implementation with practical achievements and improvements. Despite the efforts, Hainan's rural energy intervention programs, according to some scholars, acquired only modest achievements and experienced similar problems that are common in the technology diffusion programs of other developing contexts. While being interviewed, government interviewees were trying to avoid topics related to the existing issues and problems of the rural energy intervention programs. However, the officials acknowledged that the promotion of new energy systems and technologies in DRAs had encountered a lot of problems that did not meet the expectations of the government and thus diluted the positive effects of the intervention program. Issues and problems of Hainan's rural energy intervention programs were also mentioned by most other stakeholder interviewees, including planners, technical specialists, scholars and village leaders. The typical problems of the program included slow construction pace, poor construction quality, lack of effective maintenance and operation, and limited use of the technologies. Many projects often did not demonstrate viability or benefits which the government expected. Without viability, many projects in rural Hainan lacked mechanisms for equipment maintenance, sustainable uses, and incentive structures for sustained operation. As a result, many projects were viewed as failures for reasons of poor performance, poor suitability to users and locations, and short-sighted replications.

The survey results revealed the conditions of the new energy systems in rural Hainan and indicated the existing problems of rural energy planning in Hainan (Figure 4.9). Among the surveyed households who adopted anaerobic digesters, only about 52 percent of the anaerobic digesters were

Figure 4.9: An Abandoned Anaerobic Digester in Maoshan Village (Wenchang)

Source: From on-site observation in field research

in use and about 10 digesters were only used occasionally (no more than twice a week) after 1 year. The anaerobic digesters did not become the primary energy sources as the government expected. Only 43 percent of the respondents regarded biogas as one of the main energy sources in their family. An investigation conducted by the Haikou Municipality also confirmed the existence of problems with the energy intervention programs in Qiongshan region. According to the report, 2,174 anaerobic digesters (a total volume of 14 thousand m^3) had been built by the end of 2006. However, only 914 digesters (42.12 percent) were in proper working condition at the end of 2007. The energy intervention programs in Qiongshan also demonstrated regional inequality in terms of project numbers. While the most active township had 553 digesters, the least active township had only 20 digesters constructed. Because of the ease of installation, energy-saving cook stoves and solar water heaters in the households being surveyed had slightly higher utilization rates than anaerobic digesters. However, only 61 percent of the newly built energy-saving cook stoves and 57 percent of the solar water heaters were working at the time of survey. Government reports on the usage of newly built energy-saving stoves and solar water heaters from Danzhou, Changjiang, Wuzhishan and Wanning also claimed similar results, indicating that limited usage of new energy systems had become a common problem across rural Hainan. It was not surprising to find that traditional sources of energy, like firewood and agricultural wastes, were not replaced by energy sources of higher efficiency. Pressures from the loss of mangrove areas and the decreased forest coverage caused by deforestation were still concerned by the provincial government and environmentalists.

Based on a province-wide investigation on the energy intervention programs in 2006, the government of Hainan not only reported the typical construction problems which might restrict the usage of digesters, but also reflected on some administrative shortcomings of the energy intervention programs. The report mentioned that a majority of the household anaerobic digesters in rural Hainan had technical defects due to nonstandard construction. For instance, a number of digesters were not compatible with washroom and livestock enclosures and human and animal manure could not flow into the digesters. Some digesters had larger-than-standard inlets, which posed security risks. Many adopters did not install the biogas pipes in the appropriate way, which not only incurred visual indelicacy but also shortened the lifecycle of the pipes. A few adopters did not follow the technical guidance to renovate the kitchen or to set up hearths for biogas uses. The report indicated the administrative inadequacy of some local governments to be the auspice of limited use of the new rural energy systems. Specifically, the report pointed out that the energy intervention programs in some townships remained as ordinary summons due to the negligence of local government. In some cases, there existed financial management corruption which prevented the full release of governmental subsidies to the adopters of new energy systems. Across rural Hainan, the ignorance of maintaining new energy systems became a common shortcoming. Many officials focused on the numbers of the constructed anaerobic digesters without enough concerns on the post-construction management work to help maintaining the digesters.

4.3 Process of Energy Planning in Rural Hainan

Energy planning in rural Hainan occurred at several administrative levels (i.e. provincial, city/county, and village) with different contents, tasks and executives. The process involved in the rural energy planning practice could be characterized by a series of stakeholders' partnership activities[91] under the leadership of the provincial government, including interaction, coordination, conflict resolution, enforcement, and public participation. With different roles and stages, partnership activities occurred

[91] Partnership activities of stakeholders refer to arrangements of several actors in order to perform specific tasks, achieve certain objectives, or solve particular problems or key issues associated with the energy intervention program in rural Hainan.

throughout the whole process of rural energy planning, including the stages of policy/decision-making, implementation, and monitoring and evaluation. In these partnerships, each stakeholder had certain role(s), authority, and responsibilities. Based on the different positions and capabilities, stakeholders' partnership activities in rural energy planning functioned as a vehicle of conveying working guidelines of responsibility classification and distribution, defining goals/objectives, setting priorities and preferences, making joint plans and decisions; developing management strategies, empowerment and participation, sharing various burdens, evaluating progress, and seeking compromises. According to PO4 (2007), stakeholders' partnership activities in Hainan's rural energy intervention programs unfolded under four main conditions, including willingness for achieving a common vision and goals, agreements on the roles of each stakeholder, consensus regarding mechanisms for interaction and communication, and openness of stakeholders in finding solutions for problems. The presentation of the energy planning process in rural Hainan began with an introduction to the stakeholders and their roles, an overview of the procedural dimension, and the existing challenges which were identified by key informant interviews. Detailed results of assessing the operationalization, implementation, and monitoring processes of energy planning in rural Hainan are presented with a focus on stakeholder interviewees' attitudes towards insights of planning theory and the actual actions in practice.

4.3.1 Stakeholders and Roles

The identification of stakeholders in Hainan's rural energy planning was accomplished in the initial stage of the field research in two major steps. At first, several groups of possible stakeholders were enumerated. Through the discussions with officials and scholars in Hainan, the stakeholders were identified as four groups, including government[92], specialists (planners, scholars, and technical experts), village cadres and community residents. After the field research, the roles of the stakeholders were analyzed and summarized (Table 4.7).

The provincial government of Hainan was the key player in directing energy planning through policies and implementation activities in Hainan. The provincial government officials functioned as responders of the Chinese central government, the overall planners of the provincial rural energy policies, directors of implementing overall energy plans and policies, regulators of the energy markets, and arbiters of competing interests. Based on the national requirements and guidelines, the

[92] Although the provincial government and local government are categorized in a group, the analyses show that they have different functions and roles in Hainan's rural energy planning. Accordingly, their roles are presented separately in the thesis.

Table 4.7: Stakeholders and Their Roles of Hainan's Rural Energy Planning

Stakeholders	Roles and Responsibilities
Provincial government	• Respond to national energy policy and coordinate among institutions • Envisions the prospects of rural areas and depicts development blueprint • Coordinate different interests and objectives of rural development • Direct and administer the overall rural energy implementation program • Administer and allot government subsidies
Local government	• Study and publicize provincial energy policies and decisions • Formulate local energy plans and details of energy intervention programs • Coordinate relative institutions and provide political support • Facilitate and foster the rural energy intervention programs • Ensure the dispatch and provision of human and financial resources • Monitoring and reporting progresses of the energy intervention programs
Planners/ Scholars	• Design and conduct field research on the energy intervention programs • Provide analysis on political, economic, social and technological trends • Provide suggestions for policy-making and revising • Suggest and provide training and workshop schedules for villages • Identify and suggest the changes needed to amend new plans and policies
Technical specialists	• Provide technical workshops to rural residents • Introduce rationale and benefits of the energy technologies and systems • Provide guidance and assistance during construction or installation • Inspect energy systems and report progresses to local government • Be ready to answer villagers' technical questions
Village leadership	• Administer and coordinate community affairs • Provide suggestions for governmental decision-making on villages • Extend government policies and decisions to rural residents • Organize technical workshops and experience-sharing seminars • Be pioneer adopters of energy technologies and systems
Villagers	• Respond to government policies and collective decisions • Attend technical workshops and experience-sharing seminars • Input labour and financial costs of construction and installation • Maintain and use new energy technologies and systems • Fix dysfunctional energy systems and sustain the use of the systems

Source: Created by the author based on interviews

provincial government developed the overall vision, blueprint and strategies which highlighted the directions of rural energy planning, declared keystones and working emphases of rural energy policies, and reviewed local government's reports on periodic progress and difficulties. Within the

HDRC, the HCEO was the main provincial government bureau that was in charge of developing rural energy and policies in Hainan. The main responsibilities of the institution included preparing propositions of energy policies, organizing public consultation meetings, developing energy policies and master plans, reviewing the local implementation of the energy policies. As a section of HDRC, the HCEO coordinated the relationships with other government organizations and incorporated rural energy policies with the overall rural development policies and plans. Within the organization, it administered and ensured the implementation of rural energy plans by its sub-sectors at lower government levels (i.e. the CEVs at the city/county level).

As the leaders of their jurisdictions, governments at the city/county level were rural energy policy inheritors, makers, coordinators and facilitators of the provincial rural energy plans and policies. They studied and publicized policies and decisions from the upper administrative organizations. They had authority and responsibilities for extending and implementing the provincial rural energy plans and policies. They worked with local technical institutions and village leadership to specify the contents of community development projects. As the planners at the local level, they determined goals, directions, and contents of the energy intervention programs. They were responsible for the implementation of the energy intervention programs, in which they established political support, provided guidance, and ensured the dispatch of human and material resources. As facilitators or catalysts of the energy intervention programs, they took part in motivating or encouraging participants, initiating and building communication networks; increasing awareness and educating participants, and providing support. They were also in charge of monitoring and reporting progress. Within each jurisdiction, the government at the city/county level assigned specific officials duties to various villages[93] to ensure the implementation of the energy programs.

Hainan's professional planners could be classified into two categories based on the ownership of their employment institutions. The first group possessed expertise in land-using planning and property management, but they did not participate in rural community development. They worked for private firms – usually real estate enterprises and development companies (most in urban centres). The second group worked for government-administered institutions. This group had similar roles with scholars that worked in institutions of higher education or research. In the rural energy intervention programs, planners and scholars worked as researchers, educators, facilitators, and

[93] Usually no more than three villages for each official

governmental consultants. The government selected planners and scholars based on a few criteria, including credibility and trust, range of knowledge, ability to do unstructured work, ability to do teamwork, and passion of working in rural communities. Planners and scholars provided up-to-date research and suggestions to the government administrators. This included information on political, social, economic, and technological trends that might be considered and adopted by the government. They suggested and provided training and workshop schedules for rural communities. They reviewed, identified and suggested the changes needed to support the new plans and policies.

Most technical centres in Hainan were located in urban centres not far away from the government office buildings. Technical specialists formed the primary workforce that introduced energy technologies and systems in DRAs. Very few branches of the technical centres were established in the DRAs. Directed by local government, technical specialists worked with designated officials and village leadership to provide technical workshops to the rural residents. In the workshops, technical specialists often introduced the rationale and potential benefits of the energy technologies and systems. The specialists offered technical guidance and assistance to rural residents when they adopted new energy technologies and systems. Because of the dispersed locations of rural communities, technical specialists often worked outside the offices. Usually, a technical specialist had to work in a village in the morning and rush to another one that is several miles away. Technical specialists were also responsible in inspecting the quality of the energy systems and reporting progresses to local officials. In the technical centres, assistance hotlines were established to provide technical assistance and suggestions to the rural residents. In the libraries of the technical centres, many technical instructions, reports and books were available for borrowing.

Village leaders formed the administrative group of rural communities in Hainan. As captains of rural communities, village leaders were usually selected by local residents in village meetings and acknowledged by local government. With comparably higher levels of education and charisma, village leaders were administrators of community affairs as well as the connectors between local government and rural residents. The administrative group of a village usually comprised five to eight members, among which there was a village leader and two or three vice leaders. The group assigned each member with certain responsibilities on different community affairs and required each member to report the work and progresses to the village leader periodically. In the energy intervention programs, they acted as the connectors between local government and rural residents. For local government officials, village leaders were the best sources of information on rural communities.

Hence, village leaders were often invited in the meetings about developing rural energy plans. In this regard, village leaders, who represented local people, were a major force in planning activities and decision-making on the communities. Village leaders passed governmental policies, plans and programs to rural residents. They helped publicize the policies and organize the public to attend technical workshops and experience-sharing seminars. Moreover, village leaders were pioneers of adopting new energy technologies and systems. In many villages of Hainan, village cadres were among the first that adopt new RETs.

According to TO3 (2008), rural residents or villagers were the key players of the rural energy intervention programs because of their special roles. As the expected beneficiaries of the new energy technologies and systems, rural residents were the adopters and end-users of the energy equipment. The government hoped to increase the overall rural environmental awareness and expected rural residents to realize the importance of protecting rural environment and resources. Consequently, rural residents were encouraged to participate in the government-initiated program by adopting and using new energy technologies and systems energetically. To do that, rural residents should respond to the energy program and collective decisions actively. They needed to participate in technical workshops and experience-sharing seminars. They needed to take a part in the program by inputting labour and financial costs of building or installing the new energy equipment. Rural residents were responsible for building qualified energy systems, maintaining and continuously using the energy systems. For dysfunctional energy systems, rural residents were responsible for fixing and putting them back to good working condition as quickly as possible.

4.3.2 Overview of Procedures

China's rural energy planning occurred in a top-down manner at several administrative levels, including national, provincial, and regional level. The planning activities at regional level extended the national and provincial visions, specified the overall energy policies with local implementation strategies, and put the plans into practice. Consequently, rural energy planning at the local level was crucial to the success of local energy projects as well as the effectiveness of the rural energy plans and policies. This research focused on energy planning at the local level in rural Hainan, aiming at critically assessing stakeholders' attitudes towards the theoretical perspectives on planning and their activities in practice against the criteria of the evaluative framework which was established based on literature review.

Rural energy planning at the local level was conducted under the arising and vigorous national environmental policy context of sustainable development and subsequent provincial CEV construction movement as the local agenda 21. Many rural alternative energy initiatives encouraged by the central and provincial government were advocated and targeted by the local government in rural Hainan. As introduced in previous sections, local Civilized and Ecological Offices were responsible for rural energy planning and implementation of energy plans. The duty of the organization was to identify existing rural energy problems and alternative sources of energy which could substitute traditional low-efficiency energy use, to prepare local energy plans and details of the energy intervention programs, and ensure the implementation of the energy plans in their prefecture through stakeholders' partnership and participation. The local energy plans were usually accomplished by local officials from the Civilized and Ecological Offices in a strong objective-driven approach with specific numbers of new energy systems to be constructed or coverage of new energy systems among village households as the working goals. The plans were often reviewed and renewed at the end of each year.

According to officials in rural energy planning, the planning process usually included several steps: reviewing past achievements, analyzing current conditions, identifying goals and objectives, developing implementing strategies and schedules, formulating the plans, and implementing the plans. The officials invited technical specialists, scholars, planners, and village leaders to participate in the planning process with assignments of doing research, analysis and reports, and gave credits to their suggestions. After local officials developed the initial energy plans, the Civilized and Ecological Offices sent drafts of the plans to its upper officials for review, comments and approval. The reviewing process usually took no more than two weeks. If the plans were approved, the city/county government would keep them on record with copies sent to the provincial government. After the provincial government obligated subsidies funding with the coordination of different jurisdictions, the plans were ready to be implemented. In some cases, energy plans needed to be revised and resubmitted for approval, but almost all plans on the rural energy intervention programs were approved eventually. Local government administer and control the energy planning process with limited input from rural residents. No public consultation meeting was available and the public accessibility to the planning documents only existed in name as rural residents did not examine or impact the decisions in the plans on their own initiative. Local authorities were also responsible for implementing the rural energy plans.

The local energy plans focused on specific villages with numbers of accomplished energy projects as the main objective. The government plans typically contained reviews of the past achievements and problems, objectives on projects to be finished in the coming year, tasks to be noticed and emphasized, and schedules of technical workshops and equipment construction. However, the plans did not provide specific information of the analyzing process in which decisions were made regarding the graveness of local environmental problems, whether the energy intervention programs were necessary, comparison of alternative solutions to the problems, and the suitability and feasibility of the chosen projects. The energy plans neither specified the principals who were responsible for monitoring and evaluating the energy projects, nor addressed specific dates when the projects were to be inspected or examined. The plans did not detail how to evaluate the projects or how to determine the success or effectiveness of the plans. The limited reviews of the progress and problems in the work of previous years focused on the number of energy projects accomplished and the adopting rates of new energy systems of rural households. The reviews did mention the number of new energy systems that were put into practical use after the construction or installation was finished. However, the reviews usually did not provide details on whether or not the new energy systems were being utilized continuously by the adopters. In many plans, reports on dysfunctional energy systems were missing for either lack of investigation or intentional information avoidance. Measures or strategies to prevent or repair dysfunctional energy systems remained nominal without practical suggestions. Although officials who were interviewed in the field research addressed some points regarding the need to get stakeholders to cooperate and participate in the energy intervention programs, they also could not identify any approach to planning in the practice. The local energy planning in rural Hainan appeared to be making project proposals which stressed number of energy projects to be accomplished in villages with putting new energy systems into use as the end. TO2, 7 and 8 (2008) even viewed the energy intervention programs as a rural dwelling renovation project that was carried out on the existing settings with better indoor environment and outside appearance as the goals. Based on the ingress of western planning and the suggestions from planners and scholars, some professional planning analyses began to be performed during the energy planning practice. For instance, a SWOT analysis on the energy intervention programs was recognized and conducted in some rural energy planning practice (Liu, 2006). However, the analyses generally lacked professional expertise in the chosen energy projects. Based on the overview of the energy planning procedures in rural Hainan, there was no lack of evidence about the local government's ignorance on the importance of ensuring the quality of the energy systems and continuously using the new energy systems among the rural adopters, and the lack of planning expertise among them.

4.3.3 Recognized Challenges

Interviews with key informants on the existing challenges of energy planning and project implementation led to a variety of barriers which were categorized into groups of financial, technical, social & culture, institutional and other barriers[94] (Table 4.8). Interviewees' perceptions on the existing challenges of rural energy planning confirmed the challenges which were addressed in the literature. Also, some interviewees provided a few types of challenges that were different from those in the literature. In fact, some challenges were unique in rural Hainan.

Financial, technical, and social/cultural constraints were among the most frequently mentioned challenges that impeded the practice or energy planning and implementation in rural Hainan. Interviewees acknowledged that funding resources that could be dedicated to the rural energy intervention program were limited, which was manifested by the lack of access to capital or credit to adopters, lack of financial institutions and financial instruments, and unsteady funding opportunities or support for adopters. Additionally, there were general perceptions of the high costs to buy energy equipment and construction materials, and to maintain the operation of the new energy systems. The conflicts between limited funding opportunities for adopters and perceived high costs of maintaining/fixing the new energy systems made rural residents doubt about the affordability of the new energy systems. With suspicions about the economic viability of the new energy systems, the financial problems and perceptions were considered among the top challenges that impeded technology innovation and diffusion in rural Hainan. Interviewees pointed out that the financial mechanism of borrowing/lending between rural residents and financial institutions had not emerged in rural Hainan yet. If rural people were in urgent need of extra money for an emergency, they usually borrowed from their friends, neighbours, or relatives. Borrowing from financial institutions with certain terms of interests and payback did not exist in the DRAs of Hainan. Under this circumstance, the rural energy intervention programs were financed mainly through rural residents' savings and government subsidies. Rural residents were cautious in making financial decisions. Interviewees considered Hainan's market of energy equipment was running properly and not a barrier to the energy intervention programs. PO7 (2008) explained that Hainan's markets for energy equipment were established around urban centres and there were enough equipment and materials for rural people to choose. In a market economy, competition among energy equipment suppliers pushed them to assure the quality and post-purchase services of the energy equipment. Besides, the prices of

[94] The classification is performed to facilitate the comparison with the challenges summarized based on literature review.

Table 4.8: Challenges Identified by Interviewees

Existing challenges	**Responses** (N = 68)	**Interviewees**	
		# of responses	% of responses
Financial		68	100
Challenges cited	Lack of access to capital or credit to adopters	68	100
	Lack of financial institutions and financial instruments	53	78
	Unsteady funding opportunities or support for adopters	44	65
	Perceptions of high costs on energy equipment	52	76
	Perceptions of costs on maintenance/fixing	32	47
Technical		68	100
Challenges cited	Lack of technical centres and institutions	41	60
	Lack of skilled personnel/training facilities	55	81
	Insufficient public education on energy systems	32	47
	Construction complexity for adopters	44	65
	Operation/maintenance difficulties for adopters	35	51
Social & Cultural		63	93
Challenges cited	Poor education levels of rural residents	56	82
	Poor environmental/resource awareness in rural areas	53	78
	Preference or priority of pursuing economic growth	23	34
	Custom of using traditional energy sources	49	72
	Lack of innovative atmosphere or culture	17	25
	Lack of awareness on energy system upgrading	27	40
	Lack of public support of energy technologies	48	71
Institutional		25	37
Challenges cited	Lack of interested private institutions (facilitators)	23	34
	A governing atmosphere of obedience other than cooperation	6	9
	Limited involvement of actors in decision-making	3	4
Other		8	12
Challenges cited	High risk perception for energy technologies	3	4
	Environmental/resource and settlement constraints	2	3
	Location of villages	2	3
	Policy conflicts of state reign vs. minority autonomy	8	12

the energy equipment tended to be reasonable due to market competition.

Technical barriers were also mentioned repeatedly in the interviews of the field trip. Interviewees acknowledged that with years of experiments and experiences both locally and internationally, small-scale rural energy systems and technologies that were involved in Hainan's rural energy intervention programs were technically mature, but remained hard to be diffused in rural Hainan because of the technical constraints. There were not enough technical centres and institutions, or skilled technical specialists/training facilities across rural Hainan[95]. Consequently, public education on energy systems and technologies among rural people could not be guaranteed. Energy systems and technologies involved in Hainan's rural energy intervention programs were abstract and peculiar to most rural residents. Except energy-saving stoves, rural people had difficulties in understanding the working rationale of solar water heaters, anaerobic digesters, liquefied gas tanks and PV systems, which inevitably led to construction complexity and operation/maintenance difficulties for adopters especially in the situation of limited on-site technical assistance.

Social and cultural constraints were also among the most frequently mentioned challenges that impeded energy planning and implementation in rural Hainan. It was commonly recognized that rural people had low levels of education and poor environmental/resource awareness. Because of the under-developed local economy, most rural people considered economic growth or increasing family income as their task of top priority. When it came to the use of energy sources, the custom of using traditional energy sources was entrenched in rural people's livelihood pattern and was difficult to eradicate or replace. There was a lack of innovative spirit or culture among rural people. Accordingly, most rural people did not consider it a must to upgrade their energy systems, and there was a lack of public support for new energy systems and technologies.

Institutional problems were not mentioned by most interviewees except for several planners and scholars. Planners and scholars perceived that there was a lack of private institutions or facilitators that were devoted to protecting rural environment/resources or improving rural welfare because of limited profit prospects. Within the government organization, an atmosphere of obedience was dominant rather than cooperative. Three scholars recognized and mentioned the deficiency of limited involvement of all stakeholders in decision-making. Interviewees did not mention much about planning expertise, procedures, and practices. Obviously, the administrative stakeholders recognized

[95] PO 11 (2008) mentioned about the fact that university/college students prefer and try to get employed in urban rather than rural areas after graduation. Most students from urban areas do not consider of working in rural or agricultural settings and those from rural areas strive for working in urban areas for a better quality of life. Few people are inclined to working in rural areas unless being directed by their institutional supervisors (usually government officials).

some external challenges that impeded the implementation of rural energy policy and plans in rural Hainan. However, there was a lack of internal assessment or examination which was also crucial towards the success of the energy intervention programs.

In addition to the financial, technical, social/cultural, and institutional constraints identified above, some interviewees remarked on a few other challenges that impeded energy planning and implantation in rural Hainan. Based on their experiences in technology diffusion in rural areas, three technical specialists claimed that many rural residents possessed high risk perceptions for energy technologies, such as anaerobic digestion, liquefied petro-gas combustion, and PV. The security problem of energy systems and technologies was not only a vital precondition for technology diffusion projects, but also a top concern for rural adopters. A couple of interviewees identified rural environment/resource, settlement and location might be constraints of new energy technologies. For example, rural residents of Zhonghe Township (Danzhou) had strong interests in trying anaerobic digestion mainly because the flourish of the technology in other jurisdictions of Danzhou. However, the consideration of introducing the technology into the communities had to be aborted due to the high population density and the congested rural dwelling settings[96]. Eight government officials claimed the existence of policy contradiction between state regulation and ethnic autonomy in minority regions. The Chinese central government allowed and encouraged ethnic autonomy to assure ethnic unity across China. According to the policy, the affairs of minority regions were to be administered by minority leaders who were chosen by their people. The proposition of promoting new energy systems and technologies was often considered policy interference or intrusion upon the ethnic self-administration by many minority people.

Hainan's rural energy intervention programs were challenged by a variety of constraints and barriers, which are similar to most technology diffusion programs in the developing world. The dissatisfactory utilization rates of new energy systems and technologies, however, did not cool the enthusiasm of Hainan's government in stimulating new energy systems and technologies in DRAs. It could be imagined that the prospective energy intervention projects to be undertaken in rural Hainan would have the similar outcomes as those accomplished earlier unless substantial efforts were made to overcome the recognized challenges. It was imperative for the government to meditate and improve the planning process, for the effectiveness of planning depends on the soundness of the planning

[96]As introduced in a previous section, a 6 m^3 or 8 m^3 volume anaerobic digester usually occupies an area about 12 m^2 to 18 m^2. If the rural dwelling settings are too crowded, an anaerobic digester cannot be built for each household.

process in which stakeholders could cooperate and unify to overcome the external challenges. In case there are challenges that cannot be overcome and a failure result is expected, should the rural energy intervention programs remain rigid? What changes or adjustments should be made to avoid futile efforts in promoting new energy systems and technologies? Should the number of adopted new energy systems remain as the main objective of the energy plans, or the utilization rates? These questions deserve elaboration for implications on how to prevent Hainan's rural energy planning practice from being a mere oxymoron.

4.4 Operationalization

As the initial stage of planning, operationalization represents a series of prescribed steps in which planners identify existing problems, conceptualize the goals, alternatives, consequences, and choices, and develop workable plans to solve the problems. As the foundation of the planned projects, the operationalization process illustrates the necessity of intervention, guides the implementation of projects, and determines the overall direction of the projects. Like most rural development plans in Hainan, available plans of Hainan's rural energy intervention programs did not explicitly state the principles that had directed the decision-making or conceptualization process. The plans compiled by local government did include descriptions about the existing problems of energy use in rural Hainan as a whole and the motivations of proposing the energy intervention programs. Instead, local rural energy plans only targeted the numbers or rates of new energy system adoption among rural residents. Few local rural energy plans addressed specific problems of local energy use, trade-off among alternative projects, or expectations of the proposed projects. The operationalization process of Hainan's rural energy planning was explored and assessed against two main criteria, i.e., equity and flexibility, through various research instruments, including interviews, surveys and direct observation. The exploration of the operationalization process valued stakeholders' perspectives on each underlying criterion and presented findings on whether each criterion had been met in Hainan's rural energy planning practice. Although the principle of equity was recognized by most stakeholders, not all criteria were considered or fulfilled in Hainan's rural energy planning practice, the principle of flexibility remained contentious among key informant interviewees and singularly executed.

4.4.1 Equity: Recognized but not Totally Fulfilled

The exploration and test of insights drawn from planning theory in Hainan's rural energy planning practice began with the principle of equity. Of all the sustainability principles and the justifications for planning, the equity principle is most notable by its appearance throughout literature and public discourses. The principle respects stakeholders' perceptions and highlights the importance of human rights throughout the intervention programs. The equity principle considers four tests in rural energy planning practice. While the first two tests deliver the visionary substance of sustainable development and planning in general, the last two tests try to integrate the communication and advocacy principles of planning theory into rural energy planning practice.

(a) Improving the welfare of all people

The criterion of 'improving the welfare of all people' reached a high level of agreement among the interviewees. As shown in Table 4.9, all interviewees agreed that it was important and necessary to consider and aim at improving the welfare of all people, especially the poor and disadvantaged, in rural energy planning. Over 75 percent of the interviewees recognized the criterion. Among the different groups of stakeholders, the group of planners/scholars had a higher level of consent on the criterion than other groups of stakeholders as about 93 percent of the planners/scholars who involved in the field research strongly agreed with the criterion. Other groups of stakeholders had a similar level of agreement on the criterion (around 75 percent). Consequently, planners and scholars thought it an important and necessary step or consideration in formulating rural energy plans to target improving the welfare of all people, especially the poor and disadvantaged.

Table 4.9: Perceptions on the Necessity of Equity in Rural Energy Planning (1)

Criterion: *Aiming at improving the welfare of all people, especially the poor and disadvantaged*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	0	28	72
Technicians	0	0	0	22	78
Planners/Scholars	0	0	0	7	93
Village cadres	0	0	0	25	75
Overall	0	0	0	22	78

In compliance with the interview results, an examination of available newspaper stories, government reports, and energy plans identified improving rural livelihoods as one of the main objectives of

Hainan's rural energy intervention programs. No private profit-driven initiative in the energy intervention programs was found in existing relative documents. Indeed, rural people who participated in the energy intervention programs were the direct beneficiaries of the programs. Unlike most real estate development projects which are driven by prospective profits, energy intervention programs in DRAs worldwide are initiated with the identification of traditional energy use as threats local resources and environment and are expected to meet rural people's energy needs and at the same time alleviate the tensions between energy use and local environment/resources. As analyzed in previous sections, Hainan's rural energy intervention programs shared the same objectives of improving rural livelihoods and protecting rural environment and resources. Although external pressures and upper decisions had been part of the motivation, Hainan's rural energy intervention programs identified the problems of traditional energy use and aimed at helping rural people meet their energy needs, improve rural livelihoods, and protect rural environment/resources. Although appearing as interference, the energy intervention programs considered rural people's benefits and long-term viability of local environment/resources. In this regard, the rural energy intervention programs could be considered as an aid project that strived to do good to the rural poor in a perceived context of ever-widening gaps between the Chinese urban and rural areas.

Although the criterion of improving welfare of rural people was recognized by most interviewees, it was not clear whether the criterion had been performed in all energy planning practice throughout rural Hainan. As for the responses to the criterion, rather over half (55 percent) of the respondents indicated that the rural welfare had been considered in rural energy planning practice, roughly 29 percent of the respondents replied with "no", and 16 percent of them admitted that they were "not sure" whether the issue had been covered in practice. One possible explanation to the divergent responses could be the different roles or responsibilities of stakeholders in energy planning. For example, it is understandable that a technician is not sure about the execution of the principle if he only fulfills upper decisions. PO 3 (2008) extended that the concerns of rural people's welfare, especially the poor and disadvantaged did not remain at the conceptual or superficial level in Hainan's rural energy planning practice. Rather, the economic conditions and regional disparities of different communities were considered at the initial stage of formulating rural energy plans, as evidenced by the subsidy policy which specified the subsidy amount based on the local economic conditions and real needs of the adopters. For communities deemed suitable for energy intervention programs, concerns of equity were included in energy plans and favourable support was provided to poor and disadvantaged families. However, PO 3 (2008) claimed that the rural energy intervention programs could not be completely equitable for all rural communities across rural Hainan as the selection and implementation of the program were subject to many challenges.

(b) Intra-generational and inter-generational equity

The criterion of 'considering and addressing both current and future generational equity' was accepted by almost interviewees. Table 4.10 clearly shows that about 24 percent of the interviewees agreed and 74 percent strongly agreed with the criterion. Government officials and planners/scholars had comparably higher levels of agreement than other groups of interviewees (86 percent and 93 respectively). Technicians and village cadres had lower levels of agreement (44 percent and 50 percent respectively). It indicated that the WCED's definition of "*sustainable development*" was generally accepted by the Chinese government officials, planners and scholars of Hainan province. Particularly in the rural energy planning practice, Hainan's decision-makers and scholars gave credit to the importance and necessity of considering and addressing issues of both intra-generational and inter-generational equity. As SC1 (2008) commented that,

Table 4.10: Perceptions on the Necessity of Equity in Rural Energy Planning (2)

Criterion: *Considering and addressing both intra-generational and inter-generational equity*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	0	14	86
Technicians	0	0	11	44	44
Planners/Scholars	0	0	0	7	93
Village cadres	0	0	6	44	50
Overall	0	0	3	24	74

"*Hainan's rural energy intervention programs are very positive to the rural environment and resources. Its impacts can be generalized and described by a traditional Chinese eight-word idiom—'the contemporary efforts lead to instant goods to the current generation and will benefit the future generations in a long run'. The program contra-poses the conflicts between traditional energy use and the negative impacts on local environment and resources. The program is well worth being promoted and sustained as it can alleviate the tension between rural energy use and environmental/resource damages. From another angle, the protection* *of local environment and resources is a conscientious and responsible work to reserve the development potentials of future generations*".

Except for three interviewees who claimed "unknown" or "not sure", all key informants admitted that issues of both intra-generational and inter-generational equity had been considered and reflected in Hainan's rural energy planning practice. In reviewing available newspaper stories, government reports and energy plans, it was found that the potential positive impacts of the rural energy intervention programs on both the current and future generations appeared repeatedly. One may argue that the repetition of the benefits for current and future generations in various media is only a measure by which the government tries to promote new energy technologies and systems in rural Hainan. However, it is incontestable that the understanding of 'sustainable development' have been incorporated into Hainan's efforts of promoting more rational uses of energy resources that do less harm to rural environment and resources. At least, the issues on intra-generational and inter-generational were considered and addressed in conceptualizing rural energy policies and plans.

An equity issue frequently raised by interviewees throughout the talks was which generational equity was favoured in the rural energy planning practice, inter-generational or intra-generational. Scholars have long argued the suitability and feasibility of highlighting the inter-generational equity principle in the context of a developing country like China, where the priority has been the requirement to meet the basic needs of its present citizen and of economic development. As Mitchell (2002) identifies, while developed countries have focused considerable attention upon inter-generational equity issues, the focus of developing countries has been more upon intra-generational issues. Hainan's rural energy planning practice, however, did not seem to conform to the argument. Hainan's government officials did not distinguish the generational priority addressed in rural energy planning practice. Rather, they emphasized that inter-generational equity issues were as important as intra-generational equity issues. PO4 (2008) indicated that China is a socialist country where the concept of fairness is more emphasized and widely used. In general, Chinese socialism denies the existence of social classes politically. In the absence of perceived bias or discrimination, the intra-generational equity issues were addressed in Hainan's rural energy planning as the fair distribution of available resources among rural residents. In particular, the fairness issue of the current generation embodied the provisions of preferential and favourable subsidies to extremely poor rural residents and minority fellows. Under the current situation of general financial shortage, the considerations and practices of the preferential subsidy policy were commendable. PO5 (2008) pointed out that intra-generational equity and inter-generational equity were not isolated in Hainan's rural energy planning. She commented that the energy intervention programs were established based on the perceptions of the inappropriate energy use in rural Hainan as threats to future generations' benefits. Performing the energy intervention programs in DRAs, the livelihoods of the current generation could be improved. At the same time, the program actualized the concerns of future generations. She further suggested that rather than discrete attention, equity issues of both the current and future generations should be addressed in all sustainable development discussions and programs.

(c) Elaboration of problems and objectives

The criterion of 'specifying the existing problems of energy use and the objectives of the energy programs' were recognized by 78 percent of the interviewees (n = 53), among which 21 interviewees strongly agreed with the standard and confirmed its necessity and importance at the early stage of rural energy planning (Table 4.11). SC7 (2008) suggested that,

> "*Since the campaign of stimulating new energy technologies and systems in rural Hainan emerged as an intervention program to the long-lasting traditional style of energy use, it is vital to arouse the awareness of the rural residents before the energy programs are to be implemented. The identification and specification of the problems, the objectives of the energy programs, and the perceived solutions of the programs to the energy problems, form the logic and rationale of the implementation. A clear statement and a powerful education on these factors among stakeholders have the potentials to improve rural people's environmental awareness as well as advocacy of the energy intervention programs*."

Among the interviewees, government officials and planners/scholars had higher levels of agreement with the criterion than technicians and village cadres. The elaboration of problems and objectives lacked of attention among the conductors of the energy intervention programs, especially technicians and village leaders. The differential levels of agreement on the criterion also indicated different degrees to which the existing energy problems and the objectives of the energy intervention programs were specified in practice. Overall, 22 percent of the respondents claimed "yes", 54 percent acknowledged "no", and 24 percent responded "neutral" (unknown or not sure). By groups, government officials [GO] had the highest percentage of elaborating the nature of the energy intervention programs (34 percent), most of which were claimed by provincial officials. Although planners/scholars [P/S] had a high level of agreement with the criterion, most of the respondents in the group (71 percent) were not sure whether enough clarification of the program rationale was performed in rural communities (Figure 4.10). Perhaps most scholars and planners interviewees did not actually participate in the local implementation of the energy intervention programs. Technicians [TE] and village cadres [VC] had similar responses on the experiences of clarifying the program rationale. Specifically, 67 percent of the technician and 69 percent of the village cadre interviewees acknowledged the absence of clarifying the program rationale among the adopters of new energy systems and technologies.

Table 4.11: Perceptions on the Necessity of Equity in Rural Energy Planning (3)

Criterion: *Specifying energy problems and objectives of energy intervention programs, which are fully informed among all stakeholders, particularly local people to be intervened*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	7	59	34
Technicians	0	0	33	56	11
Planners/Scholars	0	0	0	36	64
Village cadres	0	0	63	31	6
Overall	0	0	22	47	31

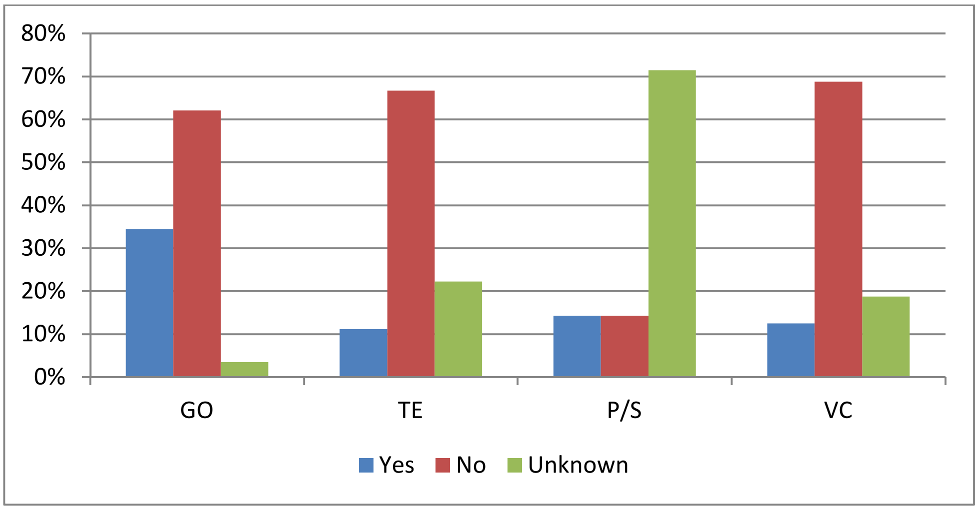

Figure 4.10: Execution of Equity Principle 3 in Rural Energy Planning Practice

Source: Created by author based on literature review and collected documents

The review of existing government documents and local energy plans validated the findings. Specifically, the existing problems of traditional energy use, potential threats to the rural environment and resources, the objectives of the energy intervention programs, and the perceived solutions of the energy programs to the energy problems were only generally mentioned in the provincial macro policies and plans, such as the plans of the *EPS* and the *CEV*. Most existing local energy plans did not address these issues except for the objectives of the energy intervention programs in terms of the schedule of construction, and the numbers or percentages of the new energy systems and technologies to be adopted. The ignorance of the criterion was procedurally unwise as the rural residents to be intervened might not be completely convinced about the compulsoriness of the programs without realizing the existing energy problems and the potential solutions.

There was a significant difference between the provincial vision and the local implementation regarding the necessity of elaborating problems and objectives to the potential adopters of new energy systems and technologies. One likely explanation was that the ignorance of the procedural equity issue has been a high-profile endemic planning vulnerability within the top-down administrative system. Although the provincial government and scholars recognized the fundamental role of elaborating the rationale of the energy intervention programs, the operationalization step of the planning practice lacked the justification of the energy programs. Perhaps the local responses to the provincial vision came up with actions of performing the individual duties in a perfunctory manner. In other words, the significance of planning rationality only remained at the conceptual or superficial level, and it was seldom, if ever, delivered in Hainan's rural energy planning practice, especially at the local level. Theoretically, the forfeiture of rationality is contrary to the insights of rational comprehensive planning and advocacy planning. In practice, the implementation of the energy intervention programs without proper procedures of education or convincing appears to be a reckless imposture to the rural residents.

Predictably, a large proportion of the rural residents in Hainan did not realize the existing problems of traditional energy use or the objectives of the energy intervention programs. In addition to the originally limited access to science and knowledge, the passively executed public education procedures did not help rural people understand the nature of the rural energy intervention programs a lot. The survey responses to a group of selected questions from the adopters of new energy technologies and systems substantiate the prediction (Table 4.12). Before adopting the new energy systems, the surveyed 156 adopters of new energy technologies and systems were not fully aware of or familiar with the policy contexts, existing problems of traditional energy use, the objectives of the energy intervention programs, or the rationale of the energy systems to be adopted. It was interesting to find out that rural residents had comparably higher levels of awareness on the overall EPS and the Civilized & Ecological Village Program than the details of the energy intervention programs. Perhaps more publicizing efforts had been spent on the overall provincial policies than the details of the energy intervention programs. Regardless, it was discomforting that rural people's knowledge or awareness of the existing problems of traditional energy use, the objectives of the energy intervention programs, and the rational of the energy system(s) to be adopted were very low. Only 3 percent, 7 percent, and 13 percent of the respondents claimed good knowledge or awareness to the existing problems of traditional energy use, the objectives of the energy intervention programs, and the rational of the energy system(s) to be adopted respectively.

Table 4.12: Adopters' Awareness of Problems and Programs (N = 156)

Before adopting the new energy system(s), were you aware of or familiar with the facts/programs of…	**Yes**	**A little**	**No**
	#/(%)	#/(%)	#/(%)
The EPS	34/(22)	63/(40)	59/(38)
The Civilized & Ecological Village Program	36/(23)	77/(49)	43/(28)
The problems of traditional energy use	5/(3)	23/(15)	128/(82)
The objectives of the energy intervention programs	11/(7)	32/(21)	113/(72)
The rationale of the energy system(s) to be adopted	21/(13)	65/(42)	70/(45)

The limited knowledge of policies, existing problems and objectives of the intervention programs was a common fact among rural residents in Hainan. Table 4.13 compares and tests the responses from both the surveyed adopters (N = 156) and non-adopters (N = 336) of new energy systems and technologies. For non-adopters, their knowledge about relative policies, existing problems and objectives of the intervention programs was also limited. Statistically, there was no significant difference between the two groups in terms of the responses to the knowledge about the EPS (χ^2 = 1.4366, p = 0.4876), the CEV Program (χ^2 = 1.7614, p = 0.4145), or the problems of traditional energy use (χ^2 = 1.9305, p = 0.3809). However, significant differences did exist between the two groups in terms of the responses to the knowledge about the objectives of the energy intervention programs (χ^2 = 13.4053, p = 0.0012) and the rationale of the energy technologies and systems (χ^2

= 78.2924, p < 0.0001). Non-adopters of new energy systems tended to have much less knowledge about the energy systems and programs.

Table 4.13: Chi-square Tests of Homogeneity on Responses of Knowledge[97]

		Yes	A little	No
Knowledge about the EPS	Adopters	34 37.1	63 65.63	59 53.27
	Non-adopters	83 79.90	144 141.37	109 114.73
	$\chi^2 = \sum \frac{(Obs - Exp)^2}{Exp} = 1.4366,\ p = 0.4876$			
Knowledge about the Civilized & Ecological Village Program		Yes	A little	No
	Adopters	36 36.78	77 70.71	43 48.51
	Non-adopters	80 79.22	146 152.29	110 104.49
	$\chi^2 = \sum \frac{(Obs - Exp)^2}{Exp} = 1.7614,\ p = 0.4145$			
Knowledge about the problems of traditional energy use		Yes	A little	No
	Adopters	5 5.39	23 18.39	128 132.22
	Non-adopters	12 11.61	35 39.61	289 284.78
	$\chi^2 = \sum \frac{(Obs - Exp)^2}{Exp} = 1.9305,\ p = 0.3809$			
Knowledge about the objectives of the energy programs		Yes	A little	No
	Adopters	11 37.1	32 65.63	113 53.27
	Non-adopters	10 79.90	37 141.37	289 114.73
	$\chi^2 = \sum \frac{(Obs - Exp)^2}{Exp} = 13.4053,\ p = 0.0012$			
Knowledge about the rationale of new energy system(s)		Yes	A little	No
	Adopters	21 10.78	65 33.93	70 111.29
	Non-adopters	13 23.22	42 73.07	281 239.71
	$\chi^2 = \sum \frac{(Obs - Exp)^2}{Exp} = 78.2924,\ p < 0.0001$			

Responses from various informants demonstrated that the existing problems of traditional energy use and the objectives of the energy intervention programs had not been fully specified or elaborated in

[97] The cells show the observed and expected numbers of responses. The χ^2 and p-value were calculated based on the numbers.

rural Hainan, especially at the local level. For most scholars and planners, emphasizing the rationale of intervention programs is undoubtedly a familiar and important procedure in planning practice. Yet, they did not have the motivation to challenge the ignorance of the criterion in the top-down political system, which otherwise might have incurred some degree of political sensitivity. Consequently, planners/scholars' call for elaborating the existing problems of traditional energy use and the objectives of the energy intervention programs at the local level only appeared as a vain attempt in the Hainan's rural energy planning practice.

(d) Accessibility & communication of data and information

The criterion of 'making pertinent data and information accessible to all and communicate relevant information to stakeholders' was recognized by all interviewees, among which 81 percent (n = 55) strongly agreed with the criterion and confirmed its necessity and importance in the process of conceptualizing rural energy policies and plans. There was no interviewee that disagreed with the criterion (Table 4.14). TE5 (2008) commented on the criterion with his own experiences in the rural energy planning practice. He suggested the rural energy planning practice should involve various stakeholders with different roles and responsibilities. In this regard, the availability and acceptability of data determine the smoothness of information delivery and the efficiency of planning and project implementation. Also, feedback or suggestions based upon data can lead to timely adjustments of policies, plans, and actions. He suggested that rural energy planning practitioners, especially plan conductors, were very concerned about the abundance or comprehensiveness of data. More

Table 4.14: Perceptions on the Necessity of Equity in Rural Energy Planning (4)

Criterion: *Making pertinent data & information accessible to all and communicate relevant information to stakeholders*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	0	17	83
Technicians	0	0	0	22	78
Planners/Scholars	0	0	0	7	93
Village cadres	0	0	0	31	69
Overall	0	0	0	19	81

importantly, the validity and reliability of data also needed to be ensured, which was exactly the area that needed improvement in Hainan's rural energy planning practice. Based on his experiences, TE3 (2008) suggested that it was not difficult to publicize provincial policies and plans with the help of modern technologies and media. However, it was challenging to ensure the effectiveness of the publicizing or the communication among rural residents, which was largely subjected to rural people's capability and subjectivity of learning.

In practice, the overall policies and plans of Hainan's rural development projects, including the energy intervention programs were well publicized and communicated among the administrative organizations and technical centres[98]. Due to the affiliation of the *Civilized and Ecological Office* with HPPD, policies and plans on rural development initiatives in Hainan were endowed with advantages of being publicized and communicated through various media. In fact, the provincial policies and plans on rural development were publicized through TV, radio, documentaries, Internet, pamphlets, display boards, and reports. As a result, the provincial policies and plans had good accessibility and were effectively communicated among administrative organizations and technical centres. However, the delivery of policies, plans, data among rural residents in Hainan remained unsatisfactory. In the views of PO8, TO1, and TE5 (2008), great effort had been spent to deliver government policies and plans to local residents through various media, but it seemed that it had always been "*getting half the results with twice the efforts*". TE5 (2008) specified that publication and education through modern technology or equipment, such as TV, radio, and Internet, turned out to be insignificant because a large proportion of rural people in Hainan did not have access to the equipment. Thus, it was meaningless to publicizing the programs through such media. Even for rural people had access to the equipment, most of them were more likely to seek entertainment rather than political or policy news. Almost all technical experts confirmed the availability and accessibility of relative policies and plans within the local technical centres, but they also indicated that few rural people come to the centres to seek or request such information. Efforts had been made to publicize the provincial policies and plans on rural development by handing out pamphlets among rural residents of a few villages, but few rural residents took the pamphlets seriously (TE2, 2008).

It was clear that the decision-makers of energy policies and plans of rural Hainan had recognized the importance of the accessibility and communication of data among all stakeholders of the energy

[98] Data in this section refer to relative policies and plans. Data regarding the effectiveness of the plans, like the rates of utilization, will be discussed in following sections of continuity and reflectivity to maintain the consistency of the assessment and analysis.

intervention programs. The government officials and technical specialists had spent efforts to provide stakeholders with access to relative data of the government documents and decisions. For most rural residents, however, access to relevant data of the rural energy policies and plans existed in name only as modern media (e.g., the Internet) were not available. Additionally, the low education levels of the rural people added difficulties to effective publicizing and communication of data. The government officials and technical specialists recognized and acknowledged the shortcomings. Yet, it remained in question whether it was congruent to publicize the energy intervention programs through modern media with the concurrent settings of DRAs. The futility of providing data to the rural people not only discouraged decision-makers' faith in opening accessibility and communication of data, but also conduced to their proneness to the inexecution of the criterion. Publicizing is about providing open access of data/information and delivering useful information to people. Publicizing efforts which cannot serve as effective vehicles of getting people acquainted with the issue of concern can only be attributed to showing-offs. That is the reason why the effectiveness of the existing measures of delivering relative data to rural people in Hainan deserves re-examination and revolution.

4.4.2 Flexibility: Contentious and Singularly Executed

In conceptualizing and preparing rural energy policies and plans, the principle of flexibility is practically important in complex, redundant, time-consuming, and expensive situations. The principle suggests planners concentrate on a limited number of key factors, respect opinions of various stakeholders, and prepare alternative or back-up options for the proposed program. The execution of the flexibility principle can contribute to efficiency in developing workable policies and plans and can offer alternative options to solve the existing problems. Addressing the importance of key factors and the inputs from various stakeholders, the exploration and test of the flexibility principle highlight energy sustainability as the target of energy planning, and the possibility of achieving the goal by various measures that are executed flexibly and adaptively.

(a) <u>Focusing on a limited number of key factors</u>

The exploration and test of the criterion 'concentrating on a limited number of key factors leading to the identified energy problems and providing reliable information for decision-making' in Hainan's rural energy planning practice resulted in diverse responses and debates. While all interviewees agreed on the necessity of providing reliable information for decision-making, the delimitation of concentrating on a few key factors instead of a comprehensive set of factors was at the centre of debates. Overall, 57 percent of the interviewees agreed with the criterion and 33 percent of the interviewees held negative opinions. 10 percent of the interviewees were cautious and conservative in the discussions of the criterion (Table 4.15). The debates on the criterion were derived from two branches of methodological beliefs, which were mutually exclusive.

Table 4.15: Perceptions on the Necessity of Flexibility in Rural Energy Planning (1)

Criterion: *Concentrating on a limited number of key factors leading to the identified energy problems and providing reliable information for decision-making*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	14	28	3	48	7
Technicians	0	11	56	11	22
Planners/Scholars	7	14	0	36	43
Village cadres	31	6	6	25	31
Overall	15	18	10	35	22

The supporters of the criterion believe that it increases the efficiency of developing energy policies and plans to concentrate on a limited number of key factors that lead to the identified problems. Further, they pointed out the easiness of adjusting policies and plans in case of policy malfunction. CO3 (2008) explained that, "*To adopt prompt measures to deal with perceived rural energy problems is not only the requirement of the upper government, but also the practical needs to minimize the energy problems. The dual pressures do not allow too much hesitation or sluggishness in decision-making and project implementation. It is practically efficient to focus on a limited number of key factors in making decisions.*" CO5 (2008) agreed with the argument and added that, "*The causes of conflicts between traditional energy use and rural environmental/resource degradation are multi-faceted. When the conflicts of traditional energy use are perceived to threaten the long-term sustainability of rural environment and resources, it is imperative to adopt immediate and effective measures to alleviate the tensions rather than to waste time on collecting comprehensive evidence of negative impacts or projecting future damages. The delays in adopting prompt measures to deal with the perceived problems can only lead to further environmental and resource damages which may be more difficult to rehabilitate.*" CO1 (2008) enumerated the main factors that had been considered in his experiences of rural energy planning practice, including whether the traditional energy use were or would be threatening the rural environment and resources, whether there were alternative sources that had the potential to reduce rural people's reliance on traditional energy sources, whether the chosen energy technologies or systems had empirical evidence of applicability and feasibility, and whether the chosen energy technologies or systems aroused public interest and acceptance.

The opponents of the criterion questioned the validity and reliability of limiting the scope of consideration. Much impacted by the scientific and explicit norms of responsible decision-making, they argued that the limitation of empirical and projecting analyses would inevitably reduce the credibility of the decisions, which would be detrimental in convincing stakeholders and eventually reduce their enthusiasm and participation. CO2 (2008) acknowledged the methodological advantages of concentrating on a limited number of key factors in terms of efficiency and flexibility, but she suggested it was more important to ensure the validity and reliability of energy policies and plans in Hainan's rural energy planning practice by examining a comprehensive set of factors and conditions. She indicated that reasoning and logic based on comprehensive scientific analyses are fundamental in decision-making because rationality was the precondition of motivation. In the campaign of promoting new energy technologies and systems in DRAs, public resonance on explicit rationality from extensive analyses would make more sense to get people involved. She said, "*Repetitive, lengthy, and tedious speeches of exhortation only lead to passive acceptance or participation. Nevertheless, extensive scientific analyses speak louder than words.*" CO4 (2008) introduced his experiences of being questioned by rural people about the degree to which traditional energy use were to jeopardize local environment and resources by the public. Due to the absence of scientific evidence, he was often embarrassed in justifying the necessity of the energy intervention programs, and not surprisingly the questioners were often disappointed and frustrated. Hence, he suggested that 'muddling through' in energy planning practice was infeasible. Rather, rural energy policies and plans should be established based on extensive scientific analyses.

Although the methodological efficacy of 'focusing on a limited number of key factors' remained contentious among the interviewees, it was apparent that impact assessment was bypassed by most energy planners at the local level. In reviewing government documents and existing rural energy plans, problems of energy use and potential impacts of new energy technologies and systems were only generally addressed without support of scientific data and evidence. Although extensive scientific rationality was advocated by a few stakeholders, necessary impact assessment was not performed in most cases and reliable information was limited in most rural energy plans. Responses from interviewees also indicated the criterion was not met in Hainan's rural energy planning practice. Specifically, 56 percent of the interviewees were not sure about the execution of the criterion in practice. 38 percent acknowledged the absence of the course. Only 6 percent of the interviewees claimed the execution of the criterion. The absence of and uncertainty on the uses of the criterion in practice not only increased the controversial degree of the criterion, but also reflected another matter – how convincing were the information provided in Hainan's rural energy plans. There was a simple failure to deal with this extended question. Hainan's rural energy planning bypassed the process of identifying, scientifically examining and articulating key factors that had led to the energy problem. The benefits of the new energy technologies and systems sere not entirely clarified. Even under argument, the failure to execute the criterion was proven by the fact that there was a serious lack of any capability to carry out appropriate environmental impact assessment or socio-economic appraisal.

(b) Considering energy sustainability in local settings

The criterion of 'Considering factors of energy sustainability, including accessibility, efficiency and acceptability against local geographical and economic conditions as well as the barriers of proposed energy intervention programs' was recognized by a majority of interviewees. Overall, 60 percent of the interviewees strongly agreed with the criterion; 31 percent of the interviewees responded with general agreement with the criterion; and 9 percent of the interviewees showed conservation on the criterion by responding 'neutral' on the criterion (Table 4.16). Although the basic ideas of flexibility and adaptation were generally consentient, it was unsurprisingly found that there was a serious lack of familiarity with the precautionary and adaptive principles among the interviewees[99]. The use of the principles in Hainan's rural energy planning practice remained scarce. In particular, the importance and necessity of adopting precautionary or adaptive principles in rural energy planning practice was repeatedly questioned and argued throughout the interviews. Many interviewees regarded the principles as overthrows of the orthodox planning procedures in Hainan, even in China. Most interviewees alleged that it was reasonable to consider factors of energy sustainability, including accessibility, efficiency and acceptability in rural energy planning practice. By upgrading traditional energy use with new energy practice, the energy intervention programs in rural Hainan endeavoured to ensure the energy supply that meets rural people's daily needs, increase energy efficiency which rural residents used to be unconscious of, and incorporate new energy technologies and systems into rural people's livelihoods. Since the new energy technologies and systems had abundant evidence of

[99] Both principles were explained in lay language by the researcher in the interviews along with the test of the criterion.

applicability and practical profitability, considerations of energy accessibility, efficiency and acceptability were unavoidable in rural energy planning practice.

Table 4.16: Perceptions on the Necessity of Flexibility in Rural Energy Planning (2)

Criterion: *Considering factors of energy sustainability, including accessibility, efficiency and acceptability against local geographical and economic conditions as well as barriers of proposed energy intervention programs*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	3	31	66
Technicians	0	0	22	44	33
Planners/Scholars	0	0	0	29	71
Village cadres	0	0	19	25	56
Overall	0	0	9	31	60

Interestingly, most government interviewees agreed with the exertion of the adaptive principle in choosing community development projects while fulfilling the requirements of the CEV program. However, they expressed determination of carrying out energy intervention programs in villages where decisions of the energy programs had been made. They were incognizant of or even disagreed with the precautionary principle or an adaptive approach in the energy intervention programs. They could not presume the existence of complexity and uncertainties which might be detrimental to the effectiveness of the projects. They acknowledged the existence of challenges, but they overrode the existence of complexity and uncertainties. Many believed that in front of perceived energy problems, being over-cautious or over-critical on the energy plans could only lead to denial and abandonment of the energy intervention programs. In dealing with the perceived energy problems with the attempts of promoting new energy technologies and systems, the interviewees affirmed that advocacy and enthusiasm on the energy intervention programs were much more needed than critiques or discouragement.

Unmistakably, the mainly command-and-control political system in China has created a major obstacle to adopting the precautionary and adaptive principles in rural energy planning practice because the political system has extensive and embedded influence on executives' political ideology. As Ferris and Zhang (2005) point out that, China's local planners have customarily inherited or replicated the policies and plans established at the central level and rarely moved beyond the boundaries set of the national decisions. Hainan’s rural energy planning practice also contained procedural misses that had restricted the uses of precautionary and adaptive principles. Local rural energy plans were developed by local government and were subjected to provincial government’s funding allocation and approval, which would eventually be granted. With the pre-dedicated funding opportunities, few government officials considered giving up the proposed energy intervention programs for which the funding opportunities would be reclaimed due to the abandonment of the energy plans. Hence, no major changes would be made to the rural energy plans upon the precautionary and adaptive principles. In fact, except for their limited considerations of the suitability of energy intervention programs against local conditions and barriers in choosing community development projects, most local government officials turned out to be unconsidered of alternative adjustments or being critical over the proposed energy intervention programs. As a result, the limited understanding on the precautionary and adaptive principles and the procedural shortcomings had brought on the ignorance of complexity and uncertainties. Accordingly, Hainan’s rural energy planning practice lacked flexibility, especially at the post-approval stage.

According to SC2 (2008), the Chinese government gives priorities to sustainable initiatives under the globally influential call for sustainable development. Given the imbalanced economic growth between the urban and rural areas, rural sustainability initiatives are strongly supported by the central government. Even though there is a general lack of funding, rural sustainability initiatives will finally get some financial support. Local government often get into the swing of rural sustainable development projects for two main reasons. First, they vigorously respond to the upper decisions to show their loyalty to the communist party. Second, local government officials are eager to demonstrate their accomplishments or achievements within their tenures for reputation establishment and future promotion opportunities. As supported by the national policies, the energy intervention programs become good initiatives for local officials for which funding can be granted and monuments can be erected in the honour of improving rural livelihoods and protecting rural environment/resources. Under the political ethos, local decisions on energy intervention programs, once made, are hardly changeable or replaceable.

(c) Respecting and adopting stakeholders’ opinions

Although a participatory decision-making process is widely recognized by western scholars, the necessity of stakeholders’ opinions in the environmental decision-making process still remains largely controversial in many developing countries with a top-down administrative system, like China. The controversies were well reflected by the diversity of stakeholders' perceptions in the case of Hainan's rural energy planning practice. The extensive arguments of the interviewees on the necessity of the criterion indicated the low levels of valuing public opinions in Hainan's rural energy planning practice, reflecting the ingrained rigidity of the autocratic governance as well as rural energy planning and implementation.

As is shown in Table 4.17, the criterion of 'Considering various opinions by involving interested and affected public, professional, social groups and government bodies throughout the decision-making process' triggered extensive debates on its necessity and importance in rural energy planning practice. Overall, 46 percent of the interviewees agreed with the criterion; 25 percent did not express an opinion; and 29 percent of the interviewees disagreed with the criterion. The debates on the necessity and importance of the criterion in rural energy planning practice occurred not only in the administrative body as a whole, but also within individual stakeholder groups. Large proportions of opponents were identified through the interviews. 41 percent of the government interviewees and 44 percent of the technical specialists disagreed with the criterion. Most of them suggested that the diversity of opinions would add difficulties in implementing plans and projects. 33 percent of the technical specialists, 29 percent of the planners/scholars, and 44 percent of the village cadres were conservative on the criterion. Despite the objection and reservation, some stakeholder interviewees recognized the necessity and importance of the criterion in rural energy planning practice – 48 percent of the government interviewees, 22 percent of the technical specialists, 57 percent of the planners/scholars, and 44 percent of the village cadres.

The different perceptions on the criterion led to questions on the impact of public hearings and outside opinions on rural community development decision-making. The doubtful points further led to critical questions about the rural energy planning practice – whether stakeholders' opinions, especially those of the rural residents, were properly respected and adopted in rural energy planning practice; and to what degree could stakeholders' opinions affect the feasibility and flexibility of the rural energy intervention programs. As SC1 (2008) identified, "*It is exhilarating that the new trend of thought in China has started sprouting the respect to the policy flexibility based on public opinions since the late 1980s. A few government officials, planners and scholars in China have recognized and appealed the need of valuing stakeholders' opinions in strengthening policy flexibility. However, because of the long-time influential adherence to the traditional rational-bureaucratic approaches to* *planning and implementation, the impact of public opinions on the policy flexibility in China still remains limited and the rise of local democracy in rural China will be a long and challenging process*".

Table 4.17: Perceptions on the Necessity of Flexibility in Rural Energy Planning (3)

Criterion: *Considering various opinions by involving interested and affected public, professional, social groups and government bodies throughout the decision-making process*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	17	24	10	34	14
Technicians	0	44	33	22	0
Planners/Scholars	0	14	29	21	36
Village cadres	0	13	44	13	31
Overall	7	22	25	25	21

Most of Hainan's rural energy plans did not address whether or not public hearings had been conducted before the decisions on the energy intervention programs were made. In practice, most local government interviewees did not recognize the connection between public inputs and policy flexibility. In fact, there was a strong reluctance to incorporate public opinions in the process of conceptualizing rural energy plans among many local decision-makers. TO3 (2008) suggested that it was unusual for rural residents to criticize the appropriateness of the energy intervention programs. For programs intended to improve rural livelihoods, local decision-makers would welcome public support rather than critiques. Under the dictatorial administration, outside opinions often did not have much impact on the adjustment or alteration of the plans and policies. TE2 and SC1 (2008) claimed that the nature of their jobs had strong association or affiliation with the decisions of the local government. Even in case of being invited to comment on the decisions, most technical specialists and scholars understood ahead that local government officials were seeking support for the decisions and they were not supposed to offer contradictory opinions. As a result, it was not usual for technical specialists or planners/scholars to oppose the feasibility of the energy programs and most decisions were not subject to change because of the invited comments.

Another problem with the use of the flexibility criterion was the timing of the invited comments or public hearings, if any, in finalizing rural energy plans. A rationale for respecting and adopting stakeholders' opinions in planning practice is to gain diversified suggestions on most-needed and alternative community development projects at the beginning of the decision-making cycle. In addition to increased flexibility, respecting and adopting stakeholders' opinions moves away from always being passively responding and execution. Instead, it helps build public advocacy, and perhaps prevent failures of program implementation. Timing of valuing public opinions, in this regard, is critical in determining the smoothness and effectiveness of the energy intervention programs. In Hainan's case, even when the invited comments on the decisions of local government were advisory or critical, the process occurred too late to alter the decisions of implementation. Under the province-wide sustainable rural development call, most local decision-makers had predetermined the community development projects within their jurisdiction before the conduct of possible public hearings. TO3 (2008) introduced, although Hainan's CEV construction encouraged diversity and a variety of programs were being conducted vigorously across the province, most programs of village renovation, developing economic crops and community-based industries, and public education were conducted as extensions of former community development efforts. Compared with these initiatives, TO3 (2008) claimed that the necessity of the energy intervention programs was easier to justify and to gain upper support and funding opportunities. In this situation, many local decision-makers had targeted energy intervention programs without much comparison or consideration. SC1 (2008) saw the predetermined decisions on energy intervention programs by and large inviolable for the decisions had excluded critical opinions or alterations before they could even be expressed. This situation explained that procedural shortcoming could have been a major obstacle of policy flexibility for community development projects in DRAs. In order to avoid abusing funding support and to increase policy flexibility, not only the current ideology of valuing outside opinions must be changed but also the procedures for approving projects and funding allocation need re-examination and revolution. Given the conflicting perceptions and the evidence drawn from the interviews, it became apparent that no mutual agreement had been reached in Hainan at this stage as to whether or not valuing various stakeholders' opinions, especially those of the public, was perceived as an integral part of conceptualizing rural energy plans. The criterion did not arouse a marked level of attention among the stakeholders of Hainan's rural energy planning practice, not to mention to what extent the criterion had contributed to policy flexibility in practice.

(d) Preparing alternative or back-up programs

The criterion of 'Preparing alternative options for the proposed energy intervention programs upon the identified problems' also received diverse responses from the interviewees (Table 4.18). Overall, 30 percent of the interviewees agreed that it is needed to prepare alternative or back-up programs for the intended energy intervention program. However, the criterion seemed insensible to 56 percent of the interviewees and was not agreed with 15 percent of the respondents. Among the stakeholder groups, planners/scholars had proportionally higher levels of agreement with the criterion; large proportions of technical specialists and village cadres (78 percent and 75 percent respectively) neither agreed nor disagreed with the criterion; and government officials who disagreed with the criterion accounted for a majority of the opponents. In practice, few perceived risks of program failures or alternative projects were outlined in available rural energy plans. Even for local officials who agreed with the criterion, most of them acknowledged the scantiness of alternative or back-up programs in the rural energy plans within their jurisdiction.

Table 4.18: Perceptions on the Necessity of Flexibility in Rural Energy Planning (4)

Criterion: *Preparing alternative options for the proposed energy intervention programs upon the identified problems*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	14	21	48	10	7
Technicians	0	11	78	11	0
Planners/Scholars	0	0	29	29	43
Village cadres	0	0	75	25	0
Overall	6	10	54	18	12

As an important process of building policy flexibility, preparing alternative or back-up programs is based on the perception that a policy or program may fail, and then the decision-making process can benefit from learning, adjustments and new understanding of the energy policy or programs at stake. Many government opponents of the criterion, however, did not foresee the risks of program failures. Rather, they regarded preparing alternative or back-up options as hesitant procedures, which predicted forbiddingly high political risks of the failures for the proposed energy intervention programs. CO3 (2008) confirmed that the existing Chinese political system was not responsive to or gave credit to these perceived program failures. Often, perceived risks of program failures could lead to disapprovals of the access to government funding. Under the Chinese bureaucratic hierarchy, local policy changes and plan adjustments in the face of complexity and uncertainty were hardly acceptable for upper officials. As a result, most local decision-makers of Hainan's rural energy intervention programs, at the earliest possible stage of conceiving the programs, were not aware of or tried to deny that they were experimenting with rural energy policies and the prospective energy intervention programs were open admission that there might be chances of program failures. CO2 (2008) added that it was not normal to articulate perceived program failures or alternative programs, if any, in proposals that were subject to upper approval or funding allocation. In competing for budget approval, the existence of perceived program failures and alternative programs might place the proposals of the energy intervention programs in a disadvantageous position, which often involved repetitious modification tasks and procedures and might lose the timing advantages of gathering both upper and public support. In practice, she would rather consider alternative programs as separate community development projects which were deemed as collateral projects of the energy intervention programs.

Although of Hainan's rural communities were involved in energy intervention programs that included multiple new energy technologies and systems, neither the responsible government officials nor village cadres distinguished the principal-subordinate relationships among the new energy technologies and systems. In other words, the introduction and diffusion of multiple new energy technologies and systems in some villages were treated as separate projects. The responsible government officials and the village cadres did not consider the risks of program failures for any new energy technology or system in a concern. They did not prepare alternative solutions for the identified rural energy problems in case that the proposed energy intervention programs failed. In this regard, instead of increasing the flexibility of the energy intervention programs, the diversity of new energy technologies and systems being adopted simultaneously in rural communities exaggerated the blindness of irresponsible planning and project implementation because of increased risks of program failures and post-failure dilemmas.

More than the fact that the planning integrity was badly off because of the lack of planning expertise, the nonexistence of alternative or back-up plans for Hainan's energy intervention programs indicated that serious procedural deficiencies existed in approving rural energy plans as well as appropriating funds. The shortcomings not only restricted the flexibility of the rural energy intervention programs, but also foreshadowed the breeding ground for irresponsible rural energy planning and project implementation, which as SC2 (2008) described, "*if succeed, everybody would take credit to himself; but if fail, nobody would take care of the rest*." In such a bureaucratic atmosphere, the concerns about the spread of reckless rural energy planning and implementation are no longer pure alarmism but also suggestions of examination and reform. The proper intentions of improving rural livelihoods through the energy intervention programs ought not to end up only being approved and implemented. Instead, it is the essence and key of rural energy planning to ensure the effectiveness of the energy intervention programs which continuously benefit rural people. In finalizing rural energy plans, the whole administrative body needs to respect possible errors or failures. Fear of or standing aside from failures is useless and unrealistic. Rather, respecting factors that may lead to program failures and preparing alternative programs are necessary steps to reduce the likelihood of program failures and to avoid bewilderment in case failures are inevitable. At the same time, the processes of approving rural energy plans and appropriating funds must involve administrators' scrutinized assessment and monitoring to prevent the emergence and spread of irresponsible rural energy planning and program implementation.

4.4.3 Synthesis of Section

The findings from the criteria questions designed for exploring and testing the equity and flexibility principles of the Hainan case may provide helpful insights into China's practice of general environmental planning, and the particular emphasis it lays on the rural energy planning process. In conceptualizing and finalizing rural energy plans, if the operationalization process is to maintain the integrity of both rationality and resilience, the process needs testing whether the theoretical insights of equity and flexibility principles are upheld and performed. The assessment of the Hainan case indicated that both principles had only been partly recognized by the administrative stakeholders. In particular, intense debates existed around the necessity and importance of the flexibility principle in Hainan's rural energy planning practice. Some critical procedures of both principles were demonstrably missing, including but not limited to, identifying and articulating existing energy problems and objectives of the energy intervention programs, ensuring the effectiveness of delivering pertinent data, necessary initial impact assessment, precautionary and adaptive decision-making, valuing stakeholders' opinions, estimating possible program failures, and providing alternative or back-up plans. The absence of the critical procedures greatly reduced the equity and flexibility of Hainan's rural energy plans. The causality of missing the critical procedures contained not only subjective flaws but also objective restrictions. The critical procedures of the equity and flexibility principles were new to most rural energy planning practitioners. Without the obligation of standardized procedural requirements or norms, most local decision-makers might have followed and performed the task like 'business as usual' without realizing the inappropriateness of the practice.

The ingrained bureaucratic administrative system restricted the recognition and exertion of the critical steps of the equity and flexibility principles. The rigid processes of approving programs and appropriating funds led to the possibility of short-sighted decision-making and project implementation. Consequently, both the local planning expertise and the administrative systems are up against scrutiny and reform in consideration of the missed procedures.

4.5 Implementation

As a critical stage of a policy or program cycle, the implementation process marks a series of procedures and actions being undertaken to put relative policies or plans into practice. Based on the policies or plans developed in the operationalization stage, decision-makers define and assign tasks or responsibilities to stakeholders. Then, they mobilize stakeholders to fulfill the mutually agreed responsibilities to turn decisions into realities. Inevitably, this stage often involves actions of coordinating various interests and coping with challenges and obstacles. It requires program implementation to be a mutually adaptive process between the user and the institutional setting—that specific project objectives and measures to be made concrete over time by the stakeholders themselves. The implementation process of Hainan's rural energy planning was explored and assessed against two aggregate sets of criteria, i.e., efficiency and participation, through a number of research instruments, such as interviews, surveys and direct observation. The assessment showed that the principle of efficiency was commonly accepted by most administrative stakeholders but was performed without enough scrutiny in practice. Meanwhile, administrative stakeholders of Hainan's rural energy planning acknowledged that proactive stakeholders' participation was necessary and important in program implementation. Yet, public participation in rural Hainan remained low and would be a long and challenging process to move up.

4.5.1 Efficiency: Accepted but Performed without Enough Scrutiny

In carrying out rural energy policies and plans, the principle of efficiency is crucial for both decision-makers and executers to mobilize stakeholders, coordinate various interests, and to get the projects done. In complex, redundant, time-consuming, and expensive situations, the pursuit of efficiency highlights the need of skilful measures to reduce conflicts, coping with challenges, and solving problems. Often, an organization's or a rural energy intervention program's performance is usually judged as efficient or inefficient by comparing the human, physical and financial input against the output of the quantities of new energy technologies and systems adopted and utilized or the household coverage of the new energy systems in a village. This principle respects the existence of challenges and possible failures, which can provide illumination to avoid projects' further stumbles. However, pursuing the efficiency of project implementation does not mean to compromise or sacrifice the success or effectiveness of the projects. Rather, it prioritizes program effectiveness and seeks time/cost effectiveness. In line with the analysis and synthesis of literature in Chapter Two, the exploration and assessment of the efficiency principle centred around four tests in the implementation phase of Hainan's rural energy planning practice: Has the effectiveness of experimental projects in limited locations been tested before the commencement of wide implementation and promotion of the energy intervention programs? Have the stakeholders sought for time/cost effectiveness while implementing the energy intervention programs based on local conditions? Have the administrative stakeholders acknowledged 'learning by doing' and acquired insights from both successful and unsuccessful experiences; and have the administrative stakeholders prepared incentives to stimulate public participation in the programs? The four tests incorporate the precautionary principle which underlines project effectiveness and the implementation efficiency.

(a) <u>'Trial and error'</u>

Given the uncertainty and complexity pertaining to environmental planning and management, there is a need for a 'trial-and-error' approach to the rural energy planning and implementation processes. When rural energy planning is conducted in the context of numerous challenges, uncertainty and complexity, the adaptive planning principle is appropriate in developing more resilient assessment, planning, and management processes and administrative systems. The integration of the 'trial-and-error' approach in rural energy planning practice can not only reduce and avoid the likelihood of program failures if the 'error' in 'trials' are reflected in decision-making, but also increase the implementation efficiency by applying successful experiences of the 'trials' into the program promotion and diffusion in similar contexts. In Hainan's rural energy planning case, the criterion of 'Acknowledging 'trial and error' – testing the effectiveness of experimental projects in limited destinations before wide implementation and promotion' received high levels of agreement from the key-informant interviewees. Although most of the interviewees did not have much access to western planning theory, they acknowledged the necessity and importance of 'trial and error' in rural energy planning practice. Overall, 18 percent of the interviewees showed reservation about the criterion and 82 percent of the interviewees agreed with the norm (Table 4.19). An unexpectedly high proportion (60 percent) of the interviewees strongly agreed with the criterion. Based on the responses of the four groups of interviewees, there was no significant difference on the levels of agreement for the criterion.

Table 4.19: Perceptions on the Necessity of Efficiency in Rural Energy Planning (1)

Criterion: *Acknowledging 'trial and error' – testing the effectiveness of experimental projects in limited destinations before wide implementation and promotion*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	17	21	62
Technicians	0	0	22	22	56
Planners/Scholars	0	0	14	14	71
Village cadres	0	0	19	31	50
Overall	0	0	18	22	60

Despite the high levels of agreement about the 'trial and error' approach in rural energy planning, discrepant and contradictory responses were obtained regarding the question whether the implementation of rural energy plans and policies were ongoing, adaptive and responsive to *wide implementation and promotion of the rural energy intervention programs*". Overall, only 13 percent of the respondents claimed "yes", 65 percent acknowledged "no", and 22 percent responded "unknown" or "not sure". By groups, 17 percent of the official interviewees [GO], 11 percent of the technician interviewees [TE], 14 percent of planners/scholars [P/S], and 6 percent of the village cadres [VC] claimed the use of the approach in practice. High proportions of the technician and village cadres (33 percent and 44 percent respectively) were not sure whether the approach was used in practice. Of the four groups, respondents who claimed no use of the approach in practice exceeded those who claimed 'yes' or 'not sure' by large margins.

As for the 'trial and error' approach, the discrepancies between the understanding and practice among the key informant interviewees in Hainan reflected the grave political restraints and serious administrative disjunction which had led to reckless pursuit of efficiency without adaptive assessment or scrutiny in implementing the rural energy policies and plans. From a provincial overview of the rural energy intervention programs, the implementation of the programs was in a gradual manner which was reflected in the fact that new rural energy technologies and systems had indeed been introduced and practised in a few villages before the province-wide rural changes in practice. Figure 4.11 shows the responses from interviewees regarding "*whether it has been conducted to test the effectiveness of experimental projects in limited destinations before* energy intervention programs took place. However, the phasing could not be convincing enough to demonstrate the adoption of the 'trial and error' approach in practice for three main reasons.

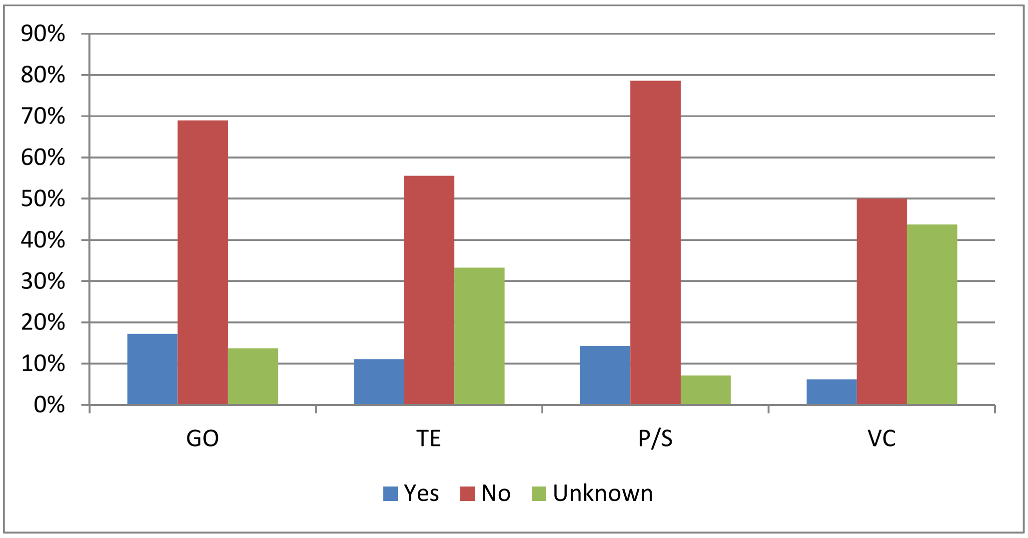

Figure 4.11: Execution of Efficiency Principle 1 in Rural Energy Planning Practice

Created by author based on literature review and collected documents

First, the fundamental purpose of introducing and practicing new rural energy technologies and systems was to demonstrate the feasibility of the applications in a few villages of Hainan. When the model projects finished and were put into practice, reports were produced and highlighted the numbers or household coverage of the new applications. Few reports attempted to analyze or summarize the experiences of success or failure. Without mutual agreement or legislative requirement, the use of the 'trial and error' approach remained absent as the implementation of the rural energy intervention programs elsewhere could only be regarded as separate projects which did not take into account the factors that may lead to project success or failure. Instead of generating experiences that might contribute to project efficiency and effectiveness, the gradual manner of implementing the rural energy intervention programs in Hainan was only a proof of '*the rural energy intervention programs being restricted by numerous challenges*'. Second, the political sensitivity and risk of acknowledging project or policy failures were forbiddingly high. The rigid top-down political system of China does not expect or welcome stories of project or policy failures. Under the general administrative context of avoiding reporting error or failures, the use of the ‘trial and error’ approach was restricted to fully exert its functions of increasing program efficiency and effectiveness from the beginning of implementing the rural energy intervention programs. Third, serious problems of disjointed responsibilities were found among the local administrative stakeholders of Hainan’s rural energy planning practice to restrict the use of the ‘trial and error’ approach. Local government officials and technical specialists worked together to introduce new rural energy technologies and systems within their jurisdictions to fulfill the upper assignments. But few of the administrative stakeholders involved in analyzing or summarizing the factors that had led to project success or failure. Consequently, there was always a lack of experience of success or failure that could be of reference in implementing future projects. The division of potencies and responsibilities among the local administrative might have impeded the use of the approach and the sharing of experience of program success or failure among local administrative stakeholders. Each local official was responsible for administrating community development projects in no more than three villages. When the responsibilities were dispatched, most local officials quickly responded to the assignments and initiated the implementation the rural energy plans without testing the applications in a few households which had been regarded as sluggish conduct of tasks. The quick responses and implementation of the rural energy policies and plans might resemble working efficiency to some extent, but the lack of scrutiny and the use of ‘trial and error’ was practically unwise because of the potential high risks of program failures in contexts of challenges, uncertainty and complexity.

(b) Adaptation and time/cost effectiveness

As an instrumental standard of economic performance, efficiency in project implementation requires fast and effective use of scarce resources and mobilization of stakeholders to accomplish the project. Adding to the rhetorical power of efficiency of promoting new energy technologies and systems in DRAs is the close association of governance with public participation. Local government officials in rural Hainan—also the energy planners of the local energy intervention programs—desire efficiency to fulfill their administrative responsibilities and to realize the potential benefits of the new energy technologies and systems so that the tensions between the traditional energy use and rural environmental/resource degradation can be alleviated.

Of the four efficiency criteria drawn from planning theory, the criterion of ‘adaptation and time/cost effectiveness’ was the most widely known and highly accepted norm among the administrative stakeholders of Hainan’s rural energy planning. Except two village cadre interviewees who claimed ‘not sure’, almost all administrative stakeholders agreed with the criterion (Table 4.20). Specifically, 19 percent of the interviewees agreed with the criterion and 78 percent of the interviewees showed strong agreement with the criterion. The high levels of agreement with the criterion might reflect a prevailing tendency among Chinese policy and decision-makers to allocate resources to their most economically productive use. As CO11 (2008) commented, “*Because of the urgency of eradicating the traditional ‘non-environmental friendly’ ways of energy use and the importance of using scarce resources effectively, efficiency is a primary requirement and objective of the political regime that is responsible for rural energy intervention programs*.” CO12 (2008) related efficiency in project implementation with increasing energy efficiency as a major objective of the rural energy intervention programs, “*One of the major problems of the traditional ways of energy use is the low energy efficiency. By upgrading the rural energy systems, a major change is the significant increase of energy efficiency among rural residents. Likewise, governance and administration also need to emphasize efficiency by which the limited personnel and funding resources can be well spent with lots of environmental benefits. Consequently, concepts including efficient management, efficient administration, and efficient mobilization are at present, the keynote of bureaucratic discussions in China*.”

Table 4.20: Perceptions on the Necessity of Efficiency in Rural Energy Planning (2)

Criterion: *Implementing energy intervention programs based on local conditions & seeks for time/cost effectiveness*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	0	14	86
Technicians	0	0	0	33	67
Planners/Scholars	0	0	0	29	71
Village cadres	0	0	13	13	75
Overall	0	0	3	19	78

The high levels of agreement with the criterion ‘adaptation and time/cost effectiveness’ among the administrative stakeholder interviewees was confirmed by available rural energy plans and implementation guidelines which stipulate that the construction or installation of new energy systems should optimize the use of existing human, physical, and financial resources to increase project implementation efficiency and reduce unnecessary time and cost input. When the administrative stakeholder interviewees were asked whether the rural energy intervention programs were implemented based on local conditions and whether efforts were made to seek time/cost effectiveness, roughly three quarters of the respondents confirmed the use of the efficiency criterion, while a much smaller proportion (25 percent) thought efficiency had not been incorporated yet in the current practices of program implementation or were not certain the application of the criterion. PO9 (2008) emphasized that, "*As program implementation efficiency was widely required and advocated in rural Hainan, the provincial government requires local administrative stakeholders to ensure public service provision, bureaucratic quality, civil servants' competence, and the credibility of local government's commitment to the overall rural energy policies and plans.* But he also identified that the requirements for local administrative stakeholders of the rural energy intervention programs were challenging as the requirements covers a wide range of difficult tasks and missions, such as increasing bureaucrats' expertise, maintaining policy consistency, ensuring the delivery of basic infrastructure and financial support, improving the quality of public administration, and guaranteeing the administrative and technical skills of civil servants.

Despite the high levels of agreement with and the repetitive emphases on the efficiency criterion, the administrative stakeholders of Hainan's rural energy intervention programs generally assumed that no formal definition was established for administrative efficiency or program implementation efficiency as the meaning of 'efficiency' was firmly established on a common-sense basis among the stakeholders. As in the Hainan's case, time/cost effectiveness in the specific context of the rural energy intervention programs is targeted to be a key criterion before the outset of the program implementation process. No specific efficiency indicators were defined or quantified to measure the program implementation efficiency.

The critical questions regarding the efficiency and effectiveness concerns raised in this situation are: can program efficiency be traded off for effectiveness in the implementation of the rural energy intervention programs? If the trade-offs are inevitable, have efforts been made to remedy the ineffective energy programs or dysfunctional energy systems? Hainan's case did not answer these questions. It was implied that without defining the indicators of efficiency in program implementation, the principle might have only been used as a justification for local actions geared to fulfilling upper policies and requirements. Indeed, Hainan's rural energy intervention programs were conducted without specifying the benchmark or indicators of program effectiveness. Government publications and reports only addressed the quantities of new energy technologies and systems constructed and adopted. Few studies or reports followed up in terms of the quantities of new energy technologies and systems that are still working; for how long, and how often. Almost all administrative interviewees emphasized the necessity and importance of '*ensuring program effectiveness while pursuing program efficiency*'. However, the implementation of Hainan's rural energy intervention programs did not clearly prioritize program effectiveness from the outset, and the practice demonstrated the inclination to concentrate on program efficiencies without enough scrutiny on program effectiveness. As such, information provided from newly accomplished energy programs was not sufficient for policy or plan adjustments or improvements, particularly with regard to issues such as conducting short-sighted construction or investment, wasting human, physical and financial resources, and selecting alternatives to solve the rural energy problems. The lack of concentration on ensuring and reporting program effectiveness also seriously influenced the quality of usable information provided by the energy programs to other CEV construction projects. In addition, given that most local rural energy plans were carried out after the plans had been legally approved by the upper officers and there was a general lack of flexibility of adjusting and implementing rural energy plans, the procedures of assessing and approving the rural energy plans may be seriously questioned. Throughout the whole process of Hainan's rural energy intervention programs—right from the conceptualization of rural energy plans, to the approval phase, and to implementation stage—there was no policy breakpoint of balancing program efficiency with program effectiveness. Rather, program effectiveness should be emphasized and ensured with priority over the pursuit of program efficiency.

(c) <u>Learning by doing</u>

'Learning by doing' has strong positive association with the increase of program implementation efficiency. It embraces a philosophy of continuous improvement through learning and advocates the management of knowledge. It emphasizes the importance of developing a culture that enhances and encourages organization to learning and to increase efficiency. The underlying mechanism may be via the decision-makers or administrators of a certain policy or plan being informed through feedback from past experiences of similar program implementation. Early experiences of program implementation are expected to generate both positive and negative lessons to decision-makers and planning practitioners that are considering or preparing similar practices in different locations. Through the process of 'learning by doing', the general costs of new practices decline as a result of accumulated experiences. In rural energy intervention programs, 'learning by doing' has the potential to reduce project time and to lower the engineering costs of siting, installing, debugging, and operating of the new energy technologies and systems, all of which can increase the program implementation efficiency. Since late programs have the advantage of learning from the experiences of earlier entrants for the purpose of lowering time and costs required for the programs, increasing program efficiency through 'learning by doing' is an internal program attribution that should be exerted through active learning for both the administrative and the public stakeholders[100].

In Hainan's rural energy planning case, the criterion of 'Emphasizing learning by doing – acquiring insights from both successful and unsuccessful experiences' also received high levels of agreement from the administrative stakeholder interviewees. Overall, 18 percent of the interviewees were not sure about the utility of 'learning by doing', 29 percent of the interviewees agreed, and 53 percent strongly agreed with the necessity and importance of the criterion in rural energy intervention programs (Table 4.21). Among the four groups of interviewees, planner/scholar interviewees had the highest level of agreement, followed by government officials, technical specialists, and village cadres. SC5 (2008) commented that the concept of the 'learning organization' was gaining currency amongst the provincial government and a few local government institutions in Hainan because of an increasing recognition that learning is a key to competitiveness. In these institutions, officials thought a major way to maintain competitiveness was to keep learning especially in a rapidly changing and unpredictable environment. The rise of the concept encompassed the need to understand both the domestic and international dynamics of political contexts and to develop effective policy countermeasures for the changing patterns and influences. Many institutions emphasized continuous learning through personal mastery, shared vision, team learning, and critical thinking.

The increasing recognition of the importance of active learning within the administrative organizations did lead to a high rate of using the criterion in practice among government interviewees. Specifically, 76 percent of the government interviewees claimed the execution of 'learning by doing' in the rural energy intervention programs, while 10 percent responded with "no" and 14 percent were not sure about the usage of the principle. The high rate of usage among government officials alone, however, could not ensure the effectiveness of learning from the experiences of success and failure in

[100] The potential of a program to be efficiently implemented can generally be traced to characteristics internal to the driving force of the administrative stakeholders as well as the cooperation of the public stakeholders (Otero & Pagan, 2003). In other words, the capacity to attain the optimum level of program implementation efficiency is primarily embodied in the administrative stakeholders. At the same time, active and cooperative public learning and feedback can provide useful information for increasing program implementation efficiency.

the rural energy intervention programs, not to mention the increase of program implementation efficiency. In fact, large proportions of technical specialists and village cadre stakeholders were not sure about or did not execute ‘learning by doing’ in practice, which was confirmed by the interviews as well as the comments from SC6.

Table 4.21: Perceptions on the Necessity of Efficiency in Rural Energy Planning (3)

Criterion: *Emphasizing ‘learning by doing’ – acquiring insights from both successful and unsuccessful experiences*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	7	38	55
Technicians	0	0	33	11	56
Planners/Scholars	0	0	7	7	86
Village cadres	0	0	38	44	19
Overall	0	0	18	29	53

There were three major reasons to deal with the failure that the increasing recognition on the importance of active learning within the administrative organizations turned out to be merely nominal in Hainan’s rural energy intervention programs. First, the ‘learning by doing’ principle requires high levels of mutual agreement among all stakeholders to best inform the areas of improvement for future efficiency. The lack of active learning in a chain of program implementation can be strong enough to prevent the principle from being effective. In the Hainan case, the interviews disclosed that the recognition of the importance of active learning among the administrative institutions had not reached all other stakeholders. Specifically, nearly 60 percent of the technical specialist and village cadre interviewees were not sure about the use of ‘learning by doing’ in practice, 22 percent responded ‘no use’ and only 18 percent of them claimed the use of the principle in practice. In SC6’s (2008) view, most technical specialists only provided technical assistance in villages “*as they were used to doing*” and most village leaders only acted as communicators or assistants of local government in the rural energy intervention programs. Effective ‘learning by doing’ was rarely identified among technical specialists or village cadres. Second, the unwarranted effectiveness of ‘learning by doing’ in Hainan’s rural energy intervention programs could also be attributed to the inadequate statutory power and vagueness of legislation on learning. In order to ensure the knowledge of both successful and unsuccessful program implementation experiences is captured, shared, supported, facilitated and rewarded, it is not enough to only recognize the importance of learning. More importantly, 'learning by doing' should be built into work structures, politics, and practices among all stakeholders through the means of statutory power and legislation. However, due to the finiteness and freshness of a learning atmosphere, there was a lack of legitimate legislation imposing the execution of 'learning by doing' in Hainan's rural development programs. Third, the rooted administrative context in which error were unfavourable also seriously influenced the quality of learning when stakeholders tried to avoid reporting program failures. The lack of summary or critique could also result in negligence of active learning in practice among technical specialists and village cadres. Without proper guidance, the public adopters of new energy technologies and systems could be numb towards program failures and effective learning among rural residents would be restricted. In this regard, the existing political system and the main value judgement towards error in Hainan were major obstacles that had impeded the execution of 'learning by doing' in the rural energy intervention programs. Hence, the principle's potential of increasing program efficiency was much discounted.

(d) Preparing initial incentives

Community development projects require that both the administrative and public stakeholders within the community are willing to dedicate their resources to the program implementation. The dedicated resources from the administration are regarded as incentives, i.e. reasons to finance interventions or to promote community development projects. If incentives are lacking, the local participation objective might be difficult to achieve and the effectiveness of the programs would be affected (Johansson, Eriksson, Sadigh, Rehnberg, & Tillgren, 2009). Bandura (1988) argues that human behaviour cannot be fully understood without considering the regulatory influence of response consequences. Rather, individual work performance and involving enthusiasm in community development projects are at least partially determined by organizational reward systems (Rynes & Gerhart, 1999). In rural energy intervention programs, incentive-based schemes, such as subsidies and allowances, can not only offset the costs of adopting the new energy technologies and systems, but also stimulate the enthusiasm of participation as well as program implementation efficiency. Numerous studies have shown that when properly implemented, incentive mechanism can be effective in enhancing working performance and efficiency (e.g., Kluger & Denisi, 1996; Komaki, Coombs, & Schepman, 1996; Stajkovic & Luthans, 2003). Hence, incentives are stimulus factors that can contribute to program implementation efficiency. Moreover, incentive mechanisms must include efficient and cost-effective institutional arrangements for delivering assessment requirements in which incentives for the participants are properly aligned.

The criterion of 'Preparing initial incentives to responding and affected people for participating in the programs' was acknowledged by most administrative stakeholder interviewees. Overall, 56 percent of the interviewees strongly agreed and 32 percent of the interviewees agreed with the criterion. 12 percent of the interviewees were not sure about or reserved on the criterion (Table 4.22). From a group perspective, government and planner/scholar interviewees had higher levels of agreement with the criterion over technician and village cadre interviewees. Most interviewees confirmed that incentives, particularly fiscal or financial incentives, could contribute to increasing program implementation efficiency. PO8 (2008) saw fiscal incentives had three roles in rural energy intervention programs. First, the subsidies to the rural end-users of new energy technologies and systems embodied the concerns and care of the provincial government on rural livelihoods. The subsidies could be effective in maintaining healthy government-public relationships which can contribute to political advocacy and stability. Secondly, the costs – either full (for retrofit) or incremental (for energy system replacement or new construction) – for adopting new rural energy technologies and systems, were recognized as a major obstacle of implementing the rural energy intervention programs. Offering financial incentives could alleviate the economic burdens of the rural adopters. Third, the provision of financial incentives can stimulate individual efficiency in adopting new energy technologies and systems, which increase the overall project implementation efficiency in the community as a whole.

Table 4.22: Perceptions on the Necessity of Efficiency in Rural Energy Planning (4)

Criterion: *Preparing initial incentives to responding and affected people for participating in the programs*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	0	24	76
Technicians	0	0	33	56	11
Planners/Scholars	0	0	0	29	71
Village cadres	0	0	31	38	31
Overall	0	0	12	32	56

PL2 (2008) highlighted persuasion as a core component of the rural energy intervention programs. In some cases, local government and technical specialists may seek to persuade rural households to participate in the rural energy intervention programs and to adopt new energy technologies and systems, addressing the benefits to the environment/resources and to future generations. In addition to demonstrating the benefits based on empirical data, the provision of financial incentives often had positive effects on the promotion. In this regard, the provision of financial incentives was regarded as enhancement of technology introduction and diffusion programs. PO9 (2008) confirmed that initial incentives were prepared for almost all rural households that were or would be involved in adopting new rural energy technologies and systems. The subsidies usually accounted for up to one third of the financial costs of the adoption, depending on the economic conditions and the real needs of the rural adopters. Most of the subsidies were released after the construction was accomplished. TE3 (2008) commented based on his experiences that, in most cases the information about financial incentives had been shown to attract and motivate rural people to the rural energy intervention programs as well as to serve as a reinforce of individual efficiency in adopting the new energy technologies and systems.

In addition to the incentives for the adopters, bonuses or rewards were also prepared for local government officials and technical specialists who contributed to promote new rural energy technologies and systems in DRAs. The bonuses for local officials and technical specialists included both financial bonuses and non-financial incentives, such as recognition, acknowledgement, and performance feedback. PO9 (2008) stated that non-financial rewards were the major incentives for local officials and technical specialists in Hainan’s rural energy intervention programs. SC4 (2008) confirmed that the government subsidies had been useful in promoting new rural energy technologies and systems in DRAs, but still only a fraction of the potential had been tapped. She saw developing and operating the incentive mechanisms as an institutional development issue, in which inadequate organizational and institutional systems for developing projects and accessing funds were the main problems. She suggested a more effective incentive-based policy instrument was needed to balance the attractiveness and effectiveness of the instrument, and the benefit and cost to rural people who participated in the rural energy intervention programs. SC5 (2008) argued that whether financial incentives had a positive impact on increasing program implementation efficiency depended in large part on how they were treated by the government or the supervisors. He suggested that in order to make financial incentives more effective in Hainan’s rural energy intervention programs the administration of funding resources as well as the funding application-approval processes needed to be given more attention. The more closely the financial incentives were tied to performance, the greater program effectiveness and efficiency would be achieved in the energy intervention programs. He suggested more assessments on the project effectiveness were needed in the existing incentive mechanisms of Hainan's rural development projects.

4.5.2 Participation: Emphasized but Challenging

Stakeholders' participation is a perpetual process in the phase of program implementation. Being participative does not only mean the fulfilment of individual duties or responsibilities, it also emphasizes proactive communication, collaboration and partnership among stakeholders. Whereas a policy or plan still can be made without the participation of certain groups of stakeholders, program implementation would become stagnant because of stakeholders' default of their duties or responsibilities. This principle respects stakeholders' opinions and interests which are of potential contributions to enhance implementation efficiency and program effectiveness. It also suggests decision-makers to provide necessary support and incentives to stimulate public participation. The participation principle also considers four tests in the implementation phase of Hainan's rural energy planning practice. The four tests emphasize a proactive and positive atmosphere of stakeholders' participation and suggest the need of social learning and conflict resolution in the implementation phase of energy planning.

(a) <u>Defining responsibilities and exchanging information</u>

Recognizing obligations and constantly striving to fulfill them are fundamental requirements of stakeholders' participation. If stakeholders' participation in program implementation is to be effective, stakeholders must first be clear about and then fulfill their moral and legal obligations, by which they can act collectively to undertake intervention programs. Of particular importance, the decision-makers should make other stakeholders aware of individual duties and responsibilities. If a program is implemented without clarifying the duties or responsibilities of stakeholders, it risks failure not only from making uninformed decisions but also from creating obstacles for stakeholders' collaboration. Also, decision-makers should administer and maintain the orderliness of stakeholders' participation, which requires the administrative stakeholders to exchange relative information and to collaborate with each other.

As a fundamental requirement of effective participation, the yardstick of 'defining responsibilities and exchanging information for program implementation' was highly accepted by the stakeholder interviewees, especially government officials and planners/scholars (Table 4.23). Specifically, 18 percent of the interviewees agreed with the criterion and 74 percent of the interviewees showed strong agreement with the criterion. Technician and village cadre interviewees had relatively lower levels of agreement with the criterion. PO5 (2008) affirmed that the criterion was exactly what the provincial government required the local officials to perform in rural development projects. Local officials, who specified rural energy plans, were required to define the duties and responsibilities for stakeholders of institutions in the rural energy intervention programs. The local decision-makers were also expected to facilitate and ensure information exchange and collaboration among the institutions.

Table 4.23: Perceptions on the Necessity of Participation in Rural Energy Planning (1)

Criterion: *Defining the duties and responsibilities of leading and participating organizations and ensures exchange of information and collaboration among agencies*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	0	10	90
Technicians	0	0	11	56	33
Planners/Scholars	0	0	0	7	93
Village cadres	0	0	31	19	50
Overall	0	0	9	18	74

When the local officials, including those at city, county and township levels, were asked about their practices of ‘defining responsibilities and exchanging information’ within their jurisdiction, all 17 local officials affirmed the execution of the tasks. According to them, the head officials of local Civilized and Ecological Offices administered, defined, and assigned duties and responsibilities for the underling officials within the jurisdiction. The tasks were performed before the commencement of program implementation in institutional meetings in which some technical specialists, planners/scholars, and village leaders were also at present. Through these meetings, small implementation units were formed as the functionaries of communities where new energy technologies and systems were to be introduced. A unit usually comprised an official from the local Civilized and Ecological Office, a technical specialist, and a planner or a scholar. With the assistance of village cadres, officials of a unit were responsible for the implementation of the rural energy intervention programs in no more than three villages. Village leaders were the major forces that delivered energy policies and plans to the rural public. They helped introduce the objective of the energy plans and the rationale of new energy technologies and systems. They also specified what the rural public were expected to do or contribute in the rural energy intervention programs. Upon the accomplishment of the projects, the units were to be reorganized and reassigned with new duties and responsibilities in different villages.

SC5 (2008) commented that the unit-based administration of program implementation in Hainan's rural energy intervention programs had both advantages and shortcomings. The division of responsibilities and the formation of administrative units allowed program implementation to take place at different destinations simultaneously, which was a positive response to the recognition of the urgency to upgrade the energy systems in rural households. In this regard, the unit based program implementation addressed program efficiency. Also, the small unit highlighted the necessity and importance of collaboration and information-sharing. Because of the different responsibilities and expertise, unit members had to rely on other members' cooperation to ensure the smoothness of program implementation within their jurisdictions. Collaboration and information exchange automatically became indivisible tasks of each implementation unit. However, the unit-based responsibility division and program implementation might have restricted the exertion of other officials' expertise or specialties that were needed in certain villages. Although the head officials of local Civilized and Ecological Offices might have considered the differences of the affiliated officials and assigned responsibilities based on their expertise and proficiency, the unit-based administrative structure may risk the disadvantage of lacking flexibility that was needed to best exert the affiliated officials' expertise in communities where the expertise was most needed. Next, collaboration and information-sharing might have been effective within each implementation unit but not among different units, especially considering the heavy and complicated tasks of each unit. Except for the report to the head officials, collaboration and information exchange among the implementation units was very limited.

Outside the administrative unit, information-sharing with the public is another area that needs improvement in Hainan's rural energy intervention programs. The allocation of administrative responsibilities of program implementation was performed with the presence of barely any rural residents. Through the communication with or the instruction of village leaders, the public might have been clear about their own responsibilities but not about the division of administrative responsibilities before program implementation started. The lack of acquaintance with the administrative stakeholders and their roles among the rural residents could reduce the likelihood of active public participation. It is not wise to ignore the presence of public in defining and allocating administrative responsibilities in the energy intervention programs.

(b) Collaborative participation

The criterion of ‘Requiring all stakeholders to exert their functions in energy intervention programs collaboratively’ was commonly agreed by the stakeholder interviewees of rural energy planning in Hainan. Overall, 50 percent of the interviewees strongly agreed with the criterion, 37 percent generally agreed and 13 percent were neutral on the criterion (Table 4.24). Government and planner/scholar interviewees had higher levels of agreement with the criterion than other groups of interviewees. Most interviewees who agreed with the criterion confirmed the advantages that collaborative participation can offer. They also identified that “*It is not sufficient to only consider the advantages or benefits that the approach can offer; it is also needed to consider how to attain successful collaborative participation in Hainan’s rural community development projects*.” They regarded clear communication throughout the rural energy planning practice as a fundamental and necessary element to achieve successful and effective collaboration among stakeholders.

Although the administrative stakeholders had high levels of agreement with collaborative participation in rural energy planning practice, their general understanding and expectations of collaborative participation in community development projects remained at a low level. Except for a couple of scholars, most interviewees considered collaborative participation as stakeholders’ cooperative efforts of fulfilling their own responsibilities. Impacts or reflections of public opinions on policy and decision-making seemed to be unfamiliar terms to most of the interviewees. Because of the ideological restrictions among the administrative stakeholders, the potential of strengthening policy effectiveness from public input was circumscribed from the outset of rural energy planning practice, not to mention the reflections of public inputs to policy flexibility and improvement in the process of program implementation. SC1 (2008) confirmed the judgement by identifying the fact that the emphases on collaborative participation in Hainan’s rural energy planning practice were the governmental decrees of requiring the public to obey governmental decisions on the rural energy intervention programs. From this perspective, rural residents’ quick response to the governmental decisions by adopting new energy technologies and systems under technical guidance without complaints or objections appeared to be the 'ideal' cooperation from the public for most local decision-makers.

Table 4.24: Perceptions on the Necessity of Participation in Rural Energy Planning (2)

Criterion: *Requiring all stakeholders to exert their functions in energy intervention programs collaboratively*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	3	17	79
Technicians	0	0	33	56	11
Planners/Scholars	0	0	0	36	64
Village cadres	0	0	31	63	6
Overall	0	0	13	37	50

Table 4.25 uses Arnstein's 'Ladder of Public Participation' to demonstrate the roles of the public in Hainan's rural energy planning practice. It shows a majority of rural residents participated in the energy intervention program as mere policy observers with little input in the decision-making process. 70 percent of the survey respondents depict their involvement as performing the assigned tasks with incentives while government decide agenda and direct the program implementation process. 22 percent of the respondents felt they had no real input or impact on the policy and decision-making process despite village leaders who were chosen as their representatives. Nine respondents affirmed that their opinions were asked and analyzed but local government officials made decisions on the rural energy intervention programs. Four respondents claimed working with local officials to determine priorities but with little influence on directing the program implementation process.

Instead of planning 'with' or 'by' the local people, Hainan's rural energy planning was performed mainly by local officials 'on' or 'for' the local people. Particularly, SC2 (2008) criticized the program implementation of Hainan's rural energy planning as a process of "*forcing the diffusion of rural energy technologies through regulatory instruments*". In addition to the low regard for public participation in decision-making by the local officials, the general public's own expectations for their involvement and influence on environmental issues were also very weak. This phenomenon was not exclusive to the rural residents in Hainan. Rather, it represents an endemic problem of contemporary

China, which has been documented in the literature. In his work on public environmental consciousness in China, Lee (2005, p. 56) identifies that, "*Instead of policies being informed or influenced by public opinion, it is the public's own environmental perceptions of the environment that are being shaped by state policies propagated by the media. … As a result, members of the public are not able to push for any viable alternative, and are not particularly interested in doing so*." Based on several recent studies on the impact of Chinese public opinions on environmental quality, Lee (2005, p.57) further sees that, "*When it comes to evaluating the actual impact of pro-environmental opinion, instead of public concern, it is actually the concern of local governmental officials entrusted with the responsibility for environmental management that matters*."

Table 4.25: Public Participation in Hainan's Rural Energy Planning

Mode of participation	Involvement of local people	Community residents (N =156)	
		# of responses	% of responses
Co-option	Token; representatives are chosen, but no real input or power	34	22
Compliance	Tasks are assigned, with incentives; outsiders decide agenda and direct the process	109	70
Consultation	Local opinions asked; outsiders analyze and decide on a course of action	9	6
Cooperation	Local people work together with outsiders to determine priorities, responsibility remains with outsiders for directing the process	4	3
Co-learning	Local people & outsiders share knowledge, to create new understanding & work together to form action plans, with outsider facilitation	0	0
Collective action	Local people set their own agenda and mobilize to carry it out, in the absence of outside initiators and facilitators	0	0

Apparently, Hainan's rural energy planning was no exception to this conclusion. First, the decision-making process failed to involve all the genuine public stakeholders who might be affected by the rural energy intervention programs. As a matter of fact, the local government officials had a relatively higher regard for the opinions of technical specialists, planners and scholars than for the main characters of the programs, rural residents. Although the decision-making process involved village cadres, there was no obvious evidence of input from the village leadership on behalf of the public in the available rural energy plans. Secondly, a majority of rural participants involved in the energy intervention programs as only token or compliant executers. In a political environment where rural sustainable development initiatives were not imperative appeals generated from the bottom, the public opinion was neither translated and considered when making decisions, nor reflected in the program implementation process. Unfortunately, China's political system and planning practice are not ready to facilitate broad involvement of all stakeholders, and the public has not yet been convinced to fully commit to addressing their concerns of rural sustainable development initiatives. Given these noticeable gaps, the 'collaborative participation' in Hainan's rural energy planning practice was far away from the theoretical norms. Although emphasized by the administrative stakeholders, the 'collaborative participation' was practiced only as stakeholders' cooperative efforts of fulfilling their responsibilities which had been determined even before the program implementation started. The limitations had restricted the advantages of meaningful collaborative participation as well as a more efficient and participative program implementation in Hainan's rural energy planning practice. Under the existing historical, political, social, and cultural climate, it is challenging to realize meaningful collaborative participation in Hainan's rural energy planning practice and other rural sustainable development contexts.

(c) Ensuring technical support

In order to facilitate the implementation of a development aid project, ensuring technical support is necessary for communities steadily to increase the well-being of its citizens through the project. Specifically for development projects that involve the introduction and diffusion of new technologies, rapid and adequate technical support represents a key means of supporting equitable access and use of technologies to ensure meaningful learning for community members and to ensure the effectiveness and efficiency of program implementation. Readily available technical support is also important in keeping the newly adopted technologies in good working conditions after the construction is finished.

The yardstick of 'Providing technical support to the local people – fully explains existing problems of energy use with a focus on the rationale and potential impacts of energy intervention programs' remained as another criterion that was generally agreed but unfulfilled in Hainan's rural energy intervention programs. Overall, 85 percent of the interviewees strongly agreed and 15 percent generally agreed with the criterion (Table 4.26). No interviewee reserved or objected the criterion.

Table 4.26: Perceptions on the Necessity of Participation in Rural Energy Planning (3)

Criterion: *Providing technical support to the local people – fully explains existing problems of energy use with a focus on the rationale and potential impacts of energy intervention programs*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	0	7	93
Technicians	0	0	0	11	89
Planners/Scholars	0	0	0	14	86
Village cadres	0	0	0	31	69
Overall	0	0	0	15	85

By groups, government, technician, and planner/scholar interviewees had slightly higher levers of agreement than village cadre interviewees. PO1 (2008) claimed that, "*Technical support, in rural community development projects, is of prime importance in duplicating new technical applications*." The provincial government required the assurance of at least one technical specialist to provide technical guidance in communities where the energy intervention programs were being implemented. The government also required the specialists to provide rapid and effective technical assistance with solutions to people's technical problems.

At interviews, the technical specialists introduced that technical assistance to rural people who were involved in the energy intervention programs was provided through four main channels, including on-site technical workshops, manuals/instructions, technical hotlines, and library collections.

1) Technical workshops: Based on mutually agreed program implementation schedules, technical specialists pay visits to communities that are involved in the energy intervention programs to provide on-site technical assistance and guidance. The themes of the workshop include the problems of traditional energy use, rationale and potential impacts of new energy technologies and systems, government environmental decisions and policies, case studies of achievements in other CEVs, and new agricultural practice. By visiting the rural households and examining the newly adopted energy systems, technical

specialists often work hand in hand with rural residents to work out tailored solutions to the problems of the energy systems.

2) Manuals/instructions: Printed hardcopies of technical guidance, instruction and troubleshooting tips are an important source of technical information, especially when on-site technical support is not available. In addition to the device manuals from the manufacturers, Hainan's local technical centres also provide rural residents with extra printed materials on the installation, construction and use of the new energy technologies and systems. In a succinct manner, the printed materials cover principles and suggestions for installation, construction and troubleshooting.
3) Technical hotlines: Hainan's local technical centres have established technical hotlines to provide timely technical guidance and suggestion to rural people during business hours. The telephone numbers of the technical hotlines are delivered to rural residents through technical workshops, TV and radio broadcasting programs. Rural residents who adopt new energy technologies or systems are also suggested to contact the technical support hotlines offered by accessory manufacturers when they have technical problems in installing or using the devices.
4) Library collections: Hainan's local technical centres have established libraries with plentiful collections on rural energy technologies and systems, agricultural practice, on rural economic development. Rural residents can borrow and study the materials in the libraries. They can also take a couple of books home overnight after check-out.

Although local technical centres have established multiple channels to provide technical support to rural people, it is still challenging to assure that meaningful technical support is readily available for the rural energy intervention programs. Through interviewees, three factors were identified as the main reasons that led to the gaps. First, there was a shortage of qualified technical specialists who could offer technical guidance and assistance to rural people. Because of the wide and quick responses to the provincial rural energy policies, there were increasing numbers of villages and households that were or would be involved in the rural energy intervention programs. The availability of rural technical specialists could not match the increasing needs of on-site technical assistance in the rural energy intervention programs. Due to the increasing pressures of working load and efficiency requirements, technical specialists had to work in different villages from time to time. It was difficult for technical specialists to dedicate to the new energy technologies or systems in a few households or those in a sole village because of the multiple assignments. For rural residents who missed the scheduled technical workshops, it was difficult to recover the on-site professional technical support. Second, the low education level of the rural people was a major barrier of making the technical support sensible to them. All technical specialists confirmed the difficulty of explaining to the rural people about the existing problems of energy use as well as the rationale and potential impacts of energy intervention programs. At times, they only required rural residents to understand how to make use of the new energy technologies or systems without full knowledge about the working rationale. As TE3 (2008) identified that, owing to the rare opportunities of gaining access to the modern technology and science, rural people, especially the minority people, had in-depth faith of their traditional and existing living styles and it was challenging to alter their beliefs. Last but not least, a passive learning atmosphere was pervasive among the residents of rural Hainan. Most rural people were not interested in studying the energy intervention programs unless they were required to do so. Technical workshops, although limited at times, could still provide meaningful technical support to rural people. However, other possible channels of providing technical assistance were considered as tokenism for the low utilization rates.

Given these barriers, meaningful technical support was not readily available for rural residents who were involved in Hainan's rural energy intervention programs. Many rural residents, although they had adopted or were using the new energy technologies and systems, were not fully convinced about the necessity or importance of them, nor were they clear about their working rationale. When they encountered technical problems, they lacked fundamental problem-solving skills and usually hesitated in seeking technical assistance through the available manuals/instructions, technical hotlines, or library collections.

(d) Facilitating social learning and mediating conflicts

The social learning perspective calls for an embedded collective reasoning and learning process towards public ends. It requires a multi-scale, polycentric governance approaches that recognize the contribution of a large number of stakeholders, functioning in different institutional settings. It emphasizes collective studying stakeholders' views intersect and diverge, through which socially reliable solutions can be generated to contemporary planning and policy dilemmas. When the interviewees were asked about their attitudes towards 'social learning and mediating conflicts', diverse responses were received. The interviewees had different levels of agreement with the criterion. Overall, 4 percent of the interviewees strongly disagreed; 15 percent disagreed; 57 remained neutral; 12 percent agreed; and the rest 12 percent strongly agreed with the criterion (Table

4.27). The interviewees were found to lack general understanding of the terms of 'social learning' and 'mediating conflicts'. Although many interviewees, especially government officials, agreed upon the necessity and importance of learning, most of the interviewees lacked appropriate understanding on 'social learning'. In fact, many interviewees were not sure about the existence of 'conflicts' and questioned the rationality of 'mediating conflicts' in the rural energy intervention programs. The main reason that caused the diverse responses towards the criterion was the interviewees' general unfamiliarity of planning theory and the new terms in planning literature.

Table 4.27: Perceptions on the Necessity of Participation in Rural Energy Planning (4)

Criterion: *Facilitating social learning among all stakeholders on the energy issues in question to mediate potential conflicts which may discontinue the energy intervention programs*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	10	17	48	17	7
Technicians	0	11	89	0	0
Planners/Scholars	0	0	43	21	36
Village cadres	0	25	69	0	6
Overall	4	15	57	12	12

Because of the knowledge vacuum on 'social learning' and 'conflict resolution', government stakeholders neither attempted to facilitate meaningful social learning among all stakeholders, nor to mediate potential conflicts in the energy intervention programs. Instead, most government officials had deep beliefs in the roles of dominant governance on policy execution and program implementation. They believed that potential program-related conflicts among stakeholders or groups could be eliminated if the stakeholders could acknowledge policy priorities and make necessary compromises. Hence, many government officials strongly advocated and adhered to the existing top-down regime, which in their thoughts determined the smoothness of program implementation and minimized the potentials of possible conflicts. They expected and required other stakeholders to obey the rural energy policies and decisions rather than to induce more troubles or conflicts in the process of program implementation. Without the leadership from the government officials, meaningful social learning and conflict resolution in Hainan's rural energy intervention programs were hard to vitalize. The shortcoming also partly explained why 'learning by doing' was hard to realize in Hainan's rural development projects.

Although meaningful social learning did not occur at a satisfactory level in Hainan's rural energy intervention programs, technology introduction and diffusion through leadership and neighbourhood aid were emerging in some villages. In these villages, village leaders were pioneers of adopting new rural energy technologies and systems. By demonstrating the uses of new energy technologies and systems, village leadership had helped rural people make decisions on participating in the rural energy intervention programs. At the same time, communication among new energy adopters and the activity of 'learning from neighbours' also emerged in a few villages. The emergence of the new learning trend among rural residents not only helped the diffusion of new energy technologies and systems in DRAs, but also marked the emergence of 'learning from and helping with each other collectively towards the public ends.' TE3 (2008) positively commented on the new trend of learning among rural residents in adopting new energy technologies and systems. He regarded learning from leadership and neighbours as an extension of the technical workshops. Being the pioneers of utilizing new energy technologies and systems, the village leaders can act as demonstrators and promoters of the energy intervention programs in their villages. At the same time, if rural people can learn from their neighbours about the new energy technologies and systems, a community-based multiplier effect can be achieved in energy technology introduction and diffusion. The technical specialist emphasized the importance of professional technical assistance in the energy intervention programs, "*Although learning from village leaders and neighbours can partly remedy the challenge of limited available on-site technical workshops and can facilitate the implementation of the energy intervention programs, village leaders and community residents cannot provide as much professional technical assistance or advice as technical specialists can*." He claimed that it would be better for rural residents to look for professional technical support should they encounter technical problems with the new energy technologies and systems. When on-site technical workshops were not available, rural residents were encouraged to use the technical hotlines to get professional assistance and advice.

Given the evidence of limited on-site technical workshops, rural residents' rare uses of technical support media, and a general lack of planning theory and expertise, it was challenging for meaningful community-based social learning to take place actively and widely across rural Hainan. Particularly with the embedded ideology of governmental dominance on citizens, it was understandable that government officials were also challenged to create a mutual learning atmosphere and effective conflict mediation measures. However, it should and could be improved to encourage people to learn more actively from the specialists, village leaders and neighbours.

4.5.3 Synthesis of Section

The responses to the criteria questions designed for assessing the efficiency and participation principles in the Hainan case shed light on the practical emphases and dilemmas in the process of local program implementation. In testing the individual criterion of the principles, it was found that both the understanding and the practices of the two principles in the Hainan case did not match the theoretical standards, which could have been one of the major reasons for the province-wide program ineffectiveness. Specifically, the efficiency principles were generally acknowledged and emphasized by administrative interviewees. However, the effectiveness of the new energy technologies and systems did not receive enough attention as necessary ‘pilot testing’ procedures and scrutiny on program effectiveness were certainly missing in most local program implementation cases. The participation principle was emphasized by local government officials. But the stakeholder participation in Hainan’s rural energy planning practice had seriously deviated from the theoretical insights. Local officials strongly advocated their dominance over the citizens and they expected the public to obey the governmental decisions and policies. Public participation in the rural energy intervention programs remained at low levels of fulfilling the assigned tasks with rare opportunities to contribute to policy improvements. Due to the shortage of qualified technical specialists and the limited use of technical support media, technical support was considered not readily available for most rural people. Community based collective learning and conflict resolution was not achieved in rural Hainan. Given the existing ideological settings and practical constraints, it was challenging to integrate theoretic insights of public participation in Hainan’s rural energy intervention programs.

4.6 Monitoring

As an integral procedure of a program cycle, monitoring is an important phase to ensure that the project is implemented as per the planned schedule. The process helps the decision-makers to measure how well they are achieving their targets. This is based on the understanding that the process through which a project is implemented has a lot of effect on its use, operation, and maintenance. As such, the monitoring activities should appear on the work plan and should involve all stakeholders. The monitoring process of Hainan’s rural energy planning was against two aggregate sets of criteria, i.e., continuity and reflectivity, through a number of research instruments, including interviews, surveys, documents, and reports. Like the previous two stages, the study also explored various stakeholders’ perspectives on each underlying criterion for continuity and reflectivity and submitted findings on whether each criterion has been recognized and executed in practice. It was found that the administrative stakeholders of Hainan's rural energy intervention programs were aware of the necessity and importance of the continuity principle, but the principle was not strictly executed and often stopped after government subsidy was released to the adopters. Meanwhile, the reflectivity principle was overlooked by the administrative stakeholders and remained vague in practice due to the absence of updated monitoring results.

4.6.1 Continuity: Aware of but not Compulsorily Executed

The exploration and assessment of the monitoring phase in Hainan's rural energy planning practice began with the principle of continuity. Monitoring should be conducted not only during the program implementation process but also after the projects are in place and operating. The acknowledgement and execution of the continuity principle in practice are the requirements and characteristics of responsible planning and implementation. The principle respects and values the projects' performance and effectiveness after the construction is finished. It affirms that continuous monitoring can identify project flaws that may lead to the suspension or abandonment of the program. By fixing the small problems in time, program failures or dysfunction can be avoided. Even for projects without flaws, continuous monitoring can provide updated information on the programs, which can be referenced in future work. The continuity principle considers four tests in Hainan's rural energy planning. The four tests highlight the necessity of continuity for both administrative stakeholders and the local adopters of new energy systems. The administrative stakeholders should continue monitoring, evaluating and publicizing the conditions of the energy projects. The public should not only continue using the new energy technologies and systems but also keep learning and sharing the experiences of using the energy technologies and systems.

(a) <u>Periodic evaluation</u>

Monitoring implies an ongoing evaluation or assessment of activities in policies, programs, processes, or plans. This involves the collection and interpretation of data on a regular basis. The main role of this stage is to systematically document the aspects of performance that indicate whether or not activities are functioning as intended or according to some appropriate standards (Rossi, Freeman, & Lipsey, 1999). Weiss (1998) extends the role by emphasizing evaluation as "*the systematic assessment of the operation and/or outcomes of a program or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the activity*" (p. 4). Wildavsky (2008) even suggests that if the consequences of contemplated actions cannot accurately be appraised, specified objectives will be achieved only by accident. While being interviewed about the necessity and importance of periodic evaluation after program implementation, a majority of respondents expressed awareness and support of evaluation processes. As for the responses to the criterion of 'Conducting regular assessment of the energy program to influence the decision-making & planning process', 21 percent of the respondents were neutral; 41 percent agreed; and 38 percent strongly agreed with the criterion (Table 4.28). Government officials, technical specialists, and planners/scholars had relatively higher levels of agreement with the criterion than village cadres. Respondents who agreed with the criterion could relate program evaluation with future policy adjustments. Government officials had high expectancy of hearing updated information about the rural energy implementation programs and they heavily relied on progress reports and updates from technical centres for such information. The officials regarded technical specialists as the right persons to conduct program evaluation and to submit assessment results because of their expertise in energy technologies and systems, on-site technical support experiences, and direct connecting with the local residents. However, none of the government officials specified whether it was mandatory to conduct regular assessment on the new energy technologies and systems after construction, how often the assessment should be conducted, what evaluation measures should be used, what standards or indicators should be used as the benchmark of evaluation. When it comes to the technical specialists, most technical interviewees mentioned the experiences of grappling with the pressures created by time constraints and the increasing needs of technical guidance and assistance. Since periodic evaluation was not stipulated by the government supervisors, few such evaluations were conducted in villages where the new energy technologies or systems were put into use. Many technical specialists claimed of having reported to the government supervisors about the program

Table 4.28: Perceptions on the Necessity of Continuity in Rural Energy Planning (1)

Criterion: *Conducting regular assessment of the energy program to influence the decision-making & planning process*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	10	66	24
Technicians	0	0	11	33	56
Planners/Scholars	0	0	7	14	79
Village cadres	0	0	56	25	19
Overall	0	0	21	41	38

progresses soon (usually one month) after the program implementation was finished. The progress report usually addressed the number of new energy technologies or systems built or installed, the number of new energy systems put into use, and a general description of their workloads in the implementation process. The post-implementation evaluation appeared to be a forgotten process in Hainan's rural energy planning.

There was a significant gap between the normative ideal of program evaluation that is espoused in the planning and evaluation literature and the reality for planning practitioners in Hainan's energy intervention programs. Although many administrative stakeholders of the Hainan case were aware of the relationship, they were either not capable of or did not plan to monitor or evaluate the performance of the newly built energy technologies and systems. The expectation for conducting program evaluation by technical specialists was hampered by the constraints on their time, money, and availability[101]. The technical staff resources were concentrated on the coverage of technical assistance in DRAs; this, rather than tracking the performance of accomplished projects, was considered a planning priority in local realities. In addition to the constraints of time, money, and expertise needed to conduct periodic evaluation after program implementation, two technical specialists (TE7 and TE9, 2008) mentioned that the monitoring and evaluation processes were perceived to be too lengthy and complicated and often did not contribute much to the decision-making process. TO1 (2008) considered the redeployment of technical staff as another important constraint on conducting periodic post-implementation evaluation processes. He mentioned that many technical specialists were seeking alternative positions while they were employed in local technical centres. The mobility of the local technical staff and the unfamiliarity of new staff with existing settings also added considerable challenges to conduct periodic evaluation on the performance of new energy technologies and systems. Being extremely underused, program evaluation's potential of contributing to policy adjustments and improvements was rarely attained in Hainan's rural energy intervention programs.

In general, Hainan's rural energy plans were not readily conducive to program evaluation because neither governmental doctrines nor local rural energy plans stipulated the necessity or importance of program evaluation. This was especially the case with identified shortage of time, money, and

[101] This is true for governments that experience a downward shifting of responsibilities from senior governments, reductions in revenue generation capacity, and the distractions associated with reorganization and amalgamations (Graham, Phillips, & Maslove, 1998).

resources. The awareness of program evaluation without mandatory fulfillment allowed selective program objectives, which might suit the coverage of new energy technologies and systems in rural Hainan but has endangered the overall program quality or effectiveness by overlooking the performance or conditions of the new energy technologies and systems. Hence, the evaluation of the effectiveness of Hainan's rural energy program should be enforced by articulation and stipulation in each local rural energy plan before program implementation takes place.

(b) Transparent assessment information

Although the post-implementation evaluation was rarely conducted in the Hainan case, the criterion of 'Updating and making relative data accessible to all, and communicates with stakeholders' was generally accepted by the stakeholder interviewees. Overall, 10 percent of the respondents were not sure about the criterion, 38 percent generally accepted; and 51 percent strongly accepted the criterion (Table 4.29). No interviewee disagreed with the criterion. Among the groups, planners/scholars had the highest levels of agreement with the criterion. They suggested that, when the intentions in plans were not realized, it was difficult to know whether the failure was due to poor performance or unreasonable expectations. They believed that information transparency could offer a combination of greater equity between legitimate interests and the input of more balanced information to decision-making through public reflection. With the recognition of the weakness, they strongly suggested the need for information transparency and the need for decision-makers to proactively seek the perspectives of all those who were involved in the energy programs.

Table 4.29: Perceptions on the Necessity of Continuity in Rural Energy Planning (2)

Criterion: *Updating and making relative data and information accessible to all, and communicates with stakeholders*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	3	55	41
Technicians	0	0	11	33	56
Planners/Scholars	0	0	0	7	93
Village cadres	0	0	31	38	31
Overall	0	0	10	38	51

A conflict existed between the acceptance of information transparency and the norm in practice because the post-implementation evaluation processes were largely lacked in local practices. Consequences of each action in planning become the basis for the succeeding steps (Wildavsky, 2008). Due to the lack of program evaluation, information about the performance of the new energy technologies and systems was not available even though there was a strong request of information transparency from planners/scholars, not to mention updating and making assessment data accessible to all stakeholders. The performance or problems of most newly adopted energy technologies and systems were not periodically assessed or updated. Further, it was often difficult to link the limited investigations on the performance of the accomplished projects to adequate information to make informed comment either on whether the existing rural energy policies should be adjusted or how to adjust the policies. In fact, anticipated program failure or ineffectiveness was not clearly articulated in most progress reports. This represented a challenge and a key obstacle for transparent information of assessment in rural energy planning.

Even when investigation was conducted on the newly adopted rural energy technologies and systems, most scholars questioned whether the information about program failures or ineffectiveness would be articulated or reported without reservation[102]. Again, SC1 (2008) mentioned the systematic resistance to errors in the existing political systems. He suggested that errors were not welcomed in the rural energy intervention programs. As the administrators of the rural energy intervention programs, local officials did not expect or respect program failure or ineffectiveness. In fact, local officials could not take the risks of articulating program failure or ineffectiveness. They might have suggested technical specialists to provide further technical support, but experiences of failure or ineffectiveness in Hainan's rural energy intervention programs appeared easily concealed, neglected, and forgotten by the local officials. As for the technical specialists, they were also reluctant to articulate program failure or ineffectiveness, if there was any, to local officials because of the high risks of political sensitivity. Being the principals who delivered technical guidance and assistance to rural residents as well as the functionaries of reporting program progresses, technical specialists were well aware of local government officials' expectations. While reporting the performance of the newly adopted energy technologies and systems, they often tried to shrink the magnitude of negative information to avoid challenges from their supervisors. But in fact, it was challenging to fix the dysfunctional energy technologies and systems. In a political system where program errors were unwelcome, it was

[102] In generic program evaluation, the articulation of outcomes and impacts is a fundamental requirement of the monitoring and evaluation process.

perplexing and unrealistic to obtain transparent assessment information. In this regard, most scholar interviewees emphasized that third parties must be appointed to monitor and evaluate the performance of the newly built energy technologies and systems so as to make informed comment on fixing the dysfunctional projects as well as on possible policy adjustments and improvements.

(c) Continuous learning

In Hainan's rural energy intervention programs, the criterion of 'Encouraging local people to keep learning the technologies/devices from their colleagues & other sources' was highly responded by the administrative stakeholder interviewees. Overall, only 9 percent of the interviewees were not sure about the utility of 'continuous learning', 32 percent of the interviewees generally agreed, and 59 percent strongly agreed with the necessity and importance of the criterion in rural energy intervention programs (Table 4.30). Among the four groups of interviewees, planner/scholar interviewees had the highest level of agreement, followed by government officials, technical specialists, and village cadres. PO11 (2008) commented that, no matter what position you are in or what you education levels are, people need to have a life-long learning habit to keep updated with the information and changes in the society. PO12 (2008) extended that, "*The rural energy intervention programs address the communication among the administrators, technical specialists and the public in terms of teaching and studying. The accomplishment of project construction or installation does not mean the communication should be stopped. Instead, the adopters and users of the new energy technologies should keep learning as many technical specifics cannot be completely covered in the program implementation process through technical workshops, and many factors that can prevent the new*

Table 4.30: Perceptions on the Necessity of Continuity in Rural Energy Planning (3)

Criterion: *Encouraging local people to keep learning the technologies/devices from their colleagues & other sources*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	3	28	69
Technicians	0	0	22	33	44
Planners/Scholars	0	0	0	21	79
Village cadres	0	0	19	50	31
Overall	0	0	9	32	59

energy technologies and systems to fully exert their functions are yet to be discovered in practice. ”

At interviews, 86 percent of the government respondents claimed that it had been repeatedly emphasized to encourage local people to keep learning about the energy technologies and systems from their neighbours and other sources after the construction of the projects was finished. They expected technical specialists and village cadres to deliver the ideas to the public adopters. As the messengers between government administrators and the public, technical specialists and village cadres were the key persons to illustrating the importance of continuous learning and information-sharing on the uses of new energy technologies and systems. However, they did not connect governmental expectations with the rural public properly. They could not or did not compulsorily execute the government requirements to a satisfactory degree. All technical specialists and 81 percent of the village cadre interviewees claimed that they were aware of the governmental emphases on encouraging continuous learning and information-sharing among the local people.

Despite the awareness, most technical specialists could not ensure the continuity of learning and information-sharing in certain villages because of the mobility needs as per the assignments of new technical guidance and assistance duties. They might have mentioned the necessity and importance of continuous learning and information-sharing among the public in technical workshops, but they could not guarantee the acceptance and execution from the public. As for village leaders, their efforts alone could not create a collective continuous learning and information-sharing atmosphere in their communities because of the low education levels and the tradition of being conservative. In fact, there was a misunderstanding about continuous learning and information-sharing among many village leaders. At the interview, VC3 (2008) suggested that, “*When the energy technologies and systems stopped working, the owner have to seek help to fix the problems. For most village members, the most convenient source of information is the help from their neighbours. So, in case the new energy technologies or systems were not working, the owner would seek help from their neighbours without having been told to do so.*” This view might have acknowledged the importance of learning to fix technical problems, but it turned out to be an excuse of not having enhanced continuous learning and information-sharing among the public. The misunderstanding or misinterpretation of governmental requirements did not help creating a positive continuous learning and information-sharing in most Hainan’s rural communities. In fact, the perspective ignored the complexity of the technical problems as well as the frustration people might have in seeking proper technical assistance. As SC5 (2008) suggested that, “*Village leaders and neighbours are not technical specialists anyway.*

The technical assistance from village leaders and neighbours is limited. When professional technical assistance is needed to fix the energy technologies and systems but is not available, rural people can easily be frustrated."

A serious gap was found between governmental expectations and public responses in practice regarding continuous learning and information-sharing in Hainan's rural energy programs. Although the administrative stakeholders were aware of the necessity and importance of enhancing continuous learning and information-sharing among rural people, the requirements were not performed by technical specialists or village cadres. As a result, learning and information-sharing remained weak among rural people who were involved in the energy programs. More efforts were required to enhance leaning and information-sharing among rural people.

(d) Further incentives

The role of financial incentives in enhancing program implementation efficiency was confirmed. As in the Hainan case, financial incentives helped rural people make decisions about adopting new energy technologies or systems, stimulated their participation enthusiasm, and enhanced the overall program implementation efficiency in rural communities. Moreover, incentives have potentials of helping rural people maintain the viability of the sustainable initiatives. This is especially true for projects that are prone to suspension due to technical problems or inappropriate uses. The new energy technologies and systems being promoted in rural Hainan, including anaerobic digesters, energy-saving cook stoves, solar water heaters, liquefied petro-gas tanks, and solar photovoltaic systems, are highly subject to the constraints of technical problems and inappropriate uses for rural people. It is not surprising that new energy technologies or systems are because of technical problems or inappropriate uses in DRAs. In such situations, continuous incentives will not only help rural people cover part of the costs to fix the energy systems but also consolidate their enthusiasm of participation and continuous using the rural energy technologies and systems.

Most interviewees agreed that financial incentives would help rural people cover part of the repairing and maintenance costs of the new energy technologies and systems. However, different responses were received towards the criterion 'Providing incentives to local people for continuous using new technologies or devices'. Overall, 1 percent of the interviewees strongly disagreed with the criterion; 7 percent disagreed; 25 percent remained neutral; 44 percent generally agreed; and 22 percent strongly agreed (Table 4.31). The divergence came from the argument whether financial incentives should be provided to rural people who adopted new energy technologies and systems. Respondents who disagreed with the criterion considered the availability of funding as well as the responsibilities of the adopters. Two government officials (2008), PO8 and PO9, mentioned the limited funding resources. They indicated that the constraints of funding did not allow further financial incentives for maintaining the installed projects. Rather, they implied funding should be allocated to new energy intervention programs to get more rural people involved and benefiting from the programs. TE3 (2008) implied that rural participants of the energy intervention programs were the adopters as well as the beneficiaries of the new energy technologies and systems. He suggested that rural people had the responsibility of maintaining the energy technologies and systems no matter whether further financial incentives were provided or not.

Table 4.31: Perceptions on the Necessity of Continuity in Rural Energy Planning (4)

Criterion: *Providing incentives to local people for continuous using new technologies or devices*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	10	14	69	7
Technicians	11	22	22	44	0
Planners/Scholars	0	0	0	21	79
Village cadres	0	0	69	19	13
Overall	1	7	25	44	22

The advocators of the criterion affirmed the difficulties in extracting additional funds to support rural people for continuous uses of the new energy technologies and systems. Rather, they mentioned that nonfinancial incentives are important and necessary for rural peoples' continuous use of the new energy technologies and systems. PO3 (2008) mentioned that nonfinancial incentives in the energy rural intervention programs are most associated with recognition and performance feedback. SC1 (2008) suggested that, "*Although nonfinancial incentives of recognition does not have extensive foundation as that of money, the conceptual effects of recognition in maintaining participation enthusiasm and sustained use of new energy technologies and systems cannot be ignored.*" He suggested that if nonfinancial incentives were provided on a regular basis in monitoring the performance of the energy technologies and systems, they could be powerful incentive motivators for performance maintenance and improvement in Hainan’s rural energy intervention programs. He suggested that nonfinancial incentives could be provided in terms of acknowledgement, attention, praise, approval, or genuine appreciation for work well done from one individual household or group to another. The delivery of nonfinancial incentives could allow the targeted adopters of new energy technologies and systems to realize that they were noticed, and the feedback condition could enable the target adopters to know how they were doing.

In practice, 22 out of the 29 government official interviewees (76 percent) claimed providing nonfinancial incentives to rural people for continuous using of the new energy technologies and systems. However, the provision of nonfinancial incentives was tied to the performance evaluation process. Due to the fact that the post-implementation evaluation was not carried out in most rural communities where the energy intervention program was implemented, there is a serious lack of information on the performance of the installed projects. Hence, the provision of nonfinancial incentives lost the foundation in Hainan’s rural energy intervention programs. As the post-implementation evaluation was rarely conducted, the missing performance results prevented the provision of nonfinancial incentives and the potential of the incentives in help maintaining the use of new energy technologies and systems in the Hainan case. The lack of post-implementation evaluation not only harmed the integrity of Hainan’s rural energy planning practice but also hampered the execution of necessary steps that were conducive to project viability in rural communities. It affirms that developing plans, program implementation, and monitoring are highly dependent on each other. The lack of any procedure can inhibit the effectiveness of other planning procedures and even the effectiveness of the whole program. As for the Hainan case, it was not enough to only emphasize the necessity or importance of post-implementation evaluation processes. Rather, the key was to ensure professional evaluation of the finished energy intervention programs was conducted on a regular basis. Considering the lack of qualified technical specialists and quality of evaluation information, it is necessary to establish a third party who can conduct performance evaluations on new rural energy technologies and systems, provide timely and useful professional technical assistance to rural people, and generate equitable, objective and meaningful information for better decision-making.

4.6.2 Reflectivity: Vague and Overlooked

Monitoring of the new programs should be conducted continuously after the construction or adoption is finished. In addition to reporting the updated conditions of the projects, the continuous monitoring should be able to provide insights about the successes or failures of the programs which can be used to improve the decision-making and implementation of policies and plans. Being reflective, program administrators can not only reduce the likelihood of future program failures, but also enlarge the possibilities of creating more successes and fully fulfilling the functions of the programs to benefit more people. The reflectivity principle suggests that policy-making and project implementation should be adaptive, flexible and evolutionary. Based on the track of the accomplished program, administrative stakeholders are responsible for adjusting policies and plans to avoid failures and wastes but to maximize the possibilities of being successful and effective. The exploration and assessment of the reflectivity principle in Hainan's rural energy planning practice also consider four tests. The four tests require the administrative stakeholders to be responsible for learning from the accomplished projects, adjusting policies and plans, and maximizing the possibilities of effectiveness.

(a) Options and alternatives

Preparing and considering policy alternatives or back-up programs is not only an important process of building policy flexibility, but also an important step of strengthening program reflectivity. With perceptions of high program failure risks, considering policy alternatives or back-up programs is an important step of planning practice by which the decision-making process can benefit from learning, adjusting, and new understanding of the accomplished programs. Even in cases where program implementation has experienced success, comparing a deliberative summary on the program against other development options and alternative proposals can help maintaining the success of the programs and generate empirical knowledge of policy-making and implementation.

The criterion of 'Considering development options and alternative proposals after program implementation' appeared to be insignificant or meaningless to most interviewees (Table 4.32). Overall, more than half of the respondents remained neutral on the necessity and importance of considering development options and alternative proposals after program implementation. 7 percent of the respondents strongly disagreed; 18 percent of disagreed; 21 percent generally agreed; and only 3 percent of the respondents agreed with the criterion. Among the stakeholder groups, planners/scholars had the highest level of agreement (71 percent of the interviewees in the groups generally agreed and 14 percent strongly agreed with the criterion; 7 percent remained neutral; and 7 percent disagreed with the criterion), followed by technical specialists, government and village cadres. The high percentage of respondents who remained neutral on the criterion demonstrated that the necessity and importance of comparisons and summary based on the performance of the accomplished projects remained unclear among a large proportion of administrative stakeholders in

Hainan's rural energy intervention programs, and perhaps so in other rural community development projects or sustainable development initiatives. For respondents who disagreed with the criterion, they had obviously overlooked the reflectivity principle and thus lost opportunities of policy adjustment or improvement. Many opponents of the criterion denied the flexibility and reflectivity principles without realizing it for they had regarded considering development options and alternative proposals as redundant procedure to planning. In practice, few reports or analyses of retrospective comparison or studies were found in Hainan's rural energy intervention programs. Even for local official interviewees who agreed with the criterion, they acknowledged the absence of analyses or studies comparing the accomplished programs with developing options, not to mention preparing alternative proposals.

Table 4.32: Perceptions on the Necessity of Reflectivity in Rural Energy Planning (1)

Criterion: *Considering development options and alternative proposals*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	14	17	59	10	0
Technicians	0	22	67	11	0
Planners/Scholars	0	7	7	71	14
Village cadres	6	25	69	0	0
Overall	7	18	51	21	3

Generally in the Hainan case, existing rural energy plans were not readily conducive to program flexibility or reflectivity because preparing and comparing alternatives remained overlooked or vague among the decision-makers. Hence, preparing and comparing alternatives had either been cursorily performed or bypassed. The lack of development options or alternative programs can hurt the effectiveness of the energy intervention programs because the lack of flexibility and reflectivity symbolize the blindness of irresponsible planning and project implementation, which leads to increased risks of program failures and post-failure dilemmas. More than the threat of increasing the risks of failures for existing projects, the lack of reflectivity in planning practice does not help clarify the factors that lead to program success or failure and thus cannot prevent further program failures and resource losses. As few studies of comparing development options or policy alternatives were conducted, the rural energy intervention programs had yet another deficiency related to planning integrity. The indication is not only the urgency of improving the planning expertise of local decision-makers, but also the necessity of reforming the existing planning practice. The perceptions towards the roles of error, failures, alternatives, and policy adjustment and improvement need serious re-examination and consideration in rural energy planning practice based on the recognition and acceptance of the flexibility and reflectivity principles.

(b) Policy adjustments & improvements

As an objective in a plan may be desirable but not always attainable, objectives and the means for achieving them should not be always fixed in the plan (Wildavsky, 2008). Accordingly, an indispensable step in planning is continuous adjustment and improvement based on evaluation and reflection. Through reflection, policy makers can and should criticize the tacit understanding that have grown up around the repetitive experiences of a specialized practice, and thus make new sense of the situations of uncertainty or uniqueness which he may allow himself to experience. In case of program failure or ineffectiveness, lessons should be learned about fulfilling intentions by noting what happens when early optimism is replaced by later rationalization. In this regard, program failures and errors should be magnified rather than minimized because of their impact on future decision and program effectiveness. If the planning practice is to maintain the integrity of rationality and integrity, decision-makers must be mindful of the insight that policy adjustments and improvements based on program evaluation and reflection are essential. For these reasons, the study of the attitudes towards and preparation for policy adjustments and improvements are critically important. No matter whether the necessary post-implementation evaluation is conducted or not, it is not redundant to test whether the administrative stakeholders bear in mind, uphold, or perform policy adjustments and improvements based on existing projects.

At interviews, the criterion of ‘Having adaptive capacity to learn from and adjust policies and plans based on results from project assessment’ appeared to unintelligible to most government, technical specialist and village cadre interviewees. Most interviewees were perplexed about the terms of “*adaptive capacity*” and “*policy adjustments*”. The researcher tried to explain the terms in lay language, but most interviewees were still not sure about the criterion and the interim logic between the criterion and other criteria or interview questions. Overall, 71 percent of the respondents remained neutral on the criterion; 4 percent of the interviewees disagreed; 21 percent generally agreed; and 4 percent strongly agreed with the criterion (Table 4.33). Among the interviewee groups, planners/scholars had the highest level of agreement. 57 percent of the planner and scholar interviewees generally agreed and 21 percent strongly agreed with the criterion. The rest 21 percent were not sure about the criterion. Confusions were found among most government, technical specialist and village cadre interviewees.

Table 4.33: Perceptions on the Necessity of Reflectivity in Rural Energy Planning (2)

Criterion: *Having adaptive capacity to learn from and adjust policies and plans based on results from project assessment*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	7	79	14	0
Technicians	0	11	89	0	0
Planners/Scholars	0	0	21	57	21
Village cadres	0	0	88	13	0
Overall	0	4	71	21	4

The ambiguity of the administrative stakeholders on policy adjustments and improvements was not surprising or accidental with the findings of their attitudes and practices from previous tests of planning theoretical insights. As contents and procedures in a planning cycle are inter-related with and dependent on each other, the causality of the vagueness on policy adjustments and improvements among the administrative stakeholders had deep systematic and institutional roots. First, the principle of policy flexibility was not accepted by all administrative stakeholders. In fact, a large proportion of Hainan's decision-makers did not agree with the principle in practice. From the beginning of the rural energy planning practice, there was strong reluctance on the necessity of policy or plan adjustments among many local decision-makers. Second, the decision-makers of the rural energy plans in Hainan did not pay enough respect to the opinions of other stakeholders, especially the public. Essentially, the opinions which might contribute to policy flexibility or reflectivity were not welcomed by the local decision-makers. Most of Hainan's rural residents might not have strong political will, but the existing planning system has excluded their opinions without having asking for or acquiring their opinions. Third, Hainan's local rural energy plans were developed in fragmentary procedures with a lot of key steps missing. Most planning practice missed the preparation, comparison, and evaluation alternative or back-up programs. The missing steps not only revealed the rigidity of the existing rural energy planning system, but also demonstrated the decision-makers' lack of attention to expertise in dealing with uncertainties and challenges. Fourth, the improper attitudes towards program errors and failures in the planning system had restricted the proper conduct of policy adjustments and improvements. Due to the intolerance of the planning system towards program errors and failures, most administrative stakeholders were neither prepared to learn from nor ready to report errors and failures without reservation. The ambiguity of the administrative stakeholders on ‘adaptive capacity’ and ‘policy adjustments and improvements’ was predictable.

When the governmental officials were asked whether policy adjustments and improvements were conducted after the implementation of certain rural energy intervention programs, roughly four fifths admitted the absence of the procedures. Reluctant to admit their flaws in planning, most of them claimed the lack of information and data to perform necessary reflection, amendment, or improvement. Given the analyses presented above about the reciprocity of planning procedures, it was still inevitable to be in question whether policy adjustments or improvements would be conducted had so-called information and data been available for the local decision-makers. For the endemic malfunctioning problems of new rural energy technologies and systems in rural Hainan, one might argue rural people’s lack of enthusiasm for fixing the systems or efforts in seeking technical support because of the fact that rural people were not obligated to use the energy systems although they had participated in the energy intervention programs and adopted the new energy systems. It was the decision-makers’ disregard of policy adjustments and improvements that led to the exaggeration of the problems and dilemmas. No doubt, the rural energy intervention programs were needed to alleviate the tensions between energy use and environmental/resources conservation. The introduction and promotion of new energy technologies and systems in rural Hainan was reasonable. The problem was the fact that the decision-makers could be able to and should be responsible in avoiding the ‘snowballing’ of malfunctioning rural energy systems across rural Hainan by being prepared to adjust policies and plans upon the discovery of the very first malfunctioning energy systems, but they did not prevent that from happening because most of them neglected policy adjustments and improvements based on the finished projects among many of the unfulfilled procedures of the much fragmented practice.

(c) Legislative measures

In order to maintain the pre-eminence of future objectives and the control of program implementation, planning assumes and requires power. Hence, planning is tied with politics and legislation. The essential concern in this context is whether the planners or decision-makers have sought to make use of statutory power or legislative measures to build a legal platform that ensures the implementation of the plans and helps to maintain the viability of the programs. Applying the consideration to the energy intervention programs in DRAs, legal measures that forbid environment devastating activities and resource over-exploitation (e.g. meeting energy needs from deforestation) are much needed in communities where energy intervention programs are implemented. From a combined perspective of energy resources and needs, such a legitimate platform should and can contain adequate statutory power to shift rural people's dependence on traditional biomass resources in meeting their daily energy needs to the newly adopted energy technologies and systems. Although rural people are not obligated to use the new energy technologies and systems, the enforcement of legal measures indirectly prescribes the adopters to keep the new energy systems in good working conditions and to maintain the use of the energy systems. Accordingly, the establishment of legal measures will bring about a favourable environment for the rural energy intervention programs against the uncertain and often resistant social contexts.

In the Hainan case, the key informant interviewees were also asked about their attitudes towards legislative measures on regulating and preventing rural environment and resource devastating activities in communities where the rural energy intervention programs had been implemented. Although the interviewees affirmed the role of legal measures in maintaining governance, the integration of legal measures into the rural energy intervention programs remained indefinite in many administrative stakeholders. As for the criterion of 'Seeking legislative opportunities to regulate environment & resource devastating activities', 68 percent of the respondents remained neutral; 29 percent generally agreed; and only 3 percent strongly agreed with the criterion (Table 4.34). As the decision-makers and the administrators of the rural energy intervention programs, the government respondents were not sure about the criterion. Specifically, 79 percent of them were neutral on the criterion and 21 percent generally agreed with the criterion.

The administrative stakeholders' uncertainties on the criterion stemmed from two branches of considerations, including the nature of the rural energy intervention programs and the efficacy of statutory power in changing people's energy use. PO3, 4, 8, 9, and 12 (2008) saw the nature of the rural energy intervention programs as the process of gaining public advocacy of the new energy technologies and systems. PO8 (2008) emphasized that public advocacy would outperform pure coercion or imposition in the energy intervention programs. PO9 (2008) thought the enforcement of legal measures in the programs as coercion or imposition which would work just the opposite to what people had expected. TE2 and 5 (2008) questioned the roles of legislative measures in shifting rural people's reliance from traditional biomass resources to the new energy technologies and systems. In their views, traditional energy sources had an embedded influence on rural people's livelihoods. There would be little effect for immediate legislative measures to change rural people's beliefs and customs.

Table 4.34: Perceptions on the Necessity of Reflectivity in Rural Energy Planning (3)

Criterion: *Seeking legislative opportunities to regulate environment & resource devastating activities*

	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	79	21	0
Technicians	0	0	67	33	0
Planners/Scholars	0	0	21	64	14
Village cadres	0	0	88	13	0
Overall	0	0	68	29	3

Despite the uncertain perspectives, China's rural environmental and resource protection has been notorious for its inadequate legislative specification and enforcement (Su & Ma, 2006; Tang, Li, & Zhang, 2007). Similar with other Chinese environmental laws, the shortcomings that confront China's legal system on rural environmental and resource protection include problems of not only ambiguous provisions, but also slow and ineffective enforcement. The case of the active "*Forest Protection Law of China*[103]" is a good example of the shortcomings. As the constitutional document for protecting forest resources, the constitution consists of 49 statutes of but it does not include explicit provisions on restricting or forbidding deforestation activities related to rural energy demand. A particular problem is the omission of provision for the role of rural environmental authorities to ensure implementation. Additionally, the legal enforcement regime requires more stringent measures or underpinnings to ensure effective action against non-compliance. The unclear and inadequate punishment measures compounds the dilemma and greatly weakens the statutory power of the constitution. The ambiguity of provisions and the fragmentation of institutional functions determine

[103] The current "*Forest Protection Law of China*" was passed on September 20, 1984 at the Sixth National Congress of China. It was later amended and passed on April 29, 1998 at the second meeting of the Ninth National Congress of China.

that the prohibition of energy-related deforestation activities in rural China falls into idle speculation. Without specification of the nature, reward/punishment, and responsibilities, protecting rural environment and resources and forbidding rural energy-related deforestation in China lacks a binding legal mechanism and can only be viewed as administrative orders at most. Ambiguity of regulations at the central levels is a key reason for slow and ineffective enforcement. In fact, the enforcement of most Chinese environmental laws has lagged far behind the enactment (Tang et al., 2007). For example, the province-wide enforcement of the "*Forest Protection Law*" in Hainan did not start until the "*Hainan Environmental Protection Law*" was enacted on March 5, 1990 after the ninth provincial People's Congress – more than five years after the enactment of the national law. The ambiguity of the legal framework implies the necessity of greater autonomy on the part of local governments and more reliance on their ability to cope with rural energy-related deforestation activities. However, the statutory power and legislative measures in the Hainan case were overlooked by the local officials.

When the government interviewees were asked about the enforcement of legislative measures of forbidding energy-related deforestation activities in the communities where the energy intervention programs were implemented, most respondents equivocated on the conduct of legal opportunities or measures. Provincial government officials considered that relative legal measures had already been adopted along with the enactment of the provincial environmental protection law, but they did not comment on the fact that energy-related deforestation activities could not be eradicated, even within communities that involved in the energy intervention programs. Local government officials admitted of no further legal measures in the rural energy planning practice. SC3 (2008) saw that most government officials in Hainan only undertook educational drives to require rural residents not to devastate rural environment and resources, and no stringent measures or rules were put in place to ensure the implementation. Technical specialists and village cadres were not sure about the legislative enforcement on preventing energy-related deforestation activities. There appeared to be confusion among technical specialists and village cadres regarding the legal measures as most respondents in the two groups seemed to be waiting for the directions or orders from the local officials. As for the rural residents, most of them heard about provincial legal documents of environmental protection, but they were not sure about the specifics of rewards or punishments that were connected with energy-related deforestation activities.

In summary, legislative measures remained ambiguous and were largely overlooked by the local decision-makers in Hainan's rural energy intervention programs. The ambiguity not only existed in the lack of specifications of the reward/punishment mechanism on protecting/devastating rural environment and resources, but also in the vagueness of responsibilities and enforcement measures. The negligence of legislative measures demonstrated that Hainan's rural energy intervention programs lacked reflectivity in the planning practice as well as in the legislative mechanism.

(d) Strategies for sustained & wider applications

Addressing sustainability in the context of DRAs, the perspectives of energy sustainability, planning, and community development in the literature have a mutual intersection – exerting the benefits of sustainable initiatives or projects not only in communities where the intervention program has accomplished but also in neighbourhood communities or regions at a broader scale. In this regard, positive rural community development projects should not stand alone. Rather, they should be extended at wider regional national and international community. This requires the decision-makers of the community development projects to be reflective so as to assist in expanding and integrating the sound technologies and practices in their peer communities. In other words, the accomplishment of a rural community development project is not the end of the program cycle. Rather, the accomplishment and performance of the project offers the policy platform where rigorous efforts are needed to maintain the viability of the accomplished projects as well as to widen the applications at a broader scale. The decision-makers are responsible for undertaking the meaningful task.

When the key informant interviewees were asked about their attitudes towards the necessity and importance of preparing strategies for sustained and wider applications, the criterion of 'Preparing strategies to keep the use of new energy technologies/devices active & widen their applications at a broader scale' was agreed to more than three quarters of the respondents. Although uncertainties about the criterion still existed among some respondents, the criterion was the most accepted criterion of all reflectivity criteria in the evaluation. Overall, 22 percent of the interviewees remained neutral on the criterion; 54 percent of the respondents generally agreed; and 24 percent strongly agreed with the criterion (Table 4.35). Among the 29 government official interviewees, 5 officials (17 percent) remained neutral on the criterion; 18 officials (62 percent) generally agreed; and 6 officials (21 percent) strongly agreed with the criterion.

In spite of the interviewees' agreement, preparing strategies for sustained and wider application remained yet another overlooked criterion in practice. The government interviewees accepted the importance of maintaining the viability of accomplished projects and extending the programs in other communities, but they rarely performed strategy speculation or adjustment to better and extend the application of energy technologies and systems based on established projects. TO3 (2008) acknowledged that it was an important concern to maintain the viability of energy technologies and systems after the construction was finished but he also suggested that it was difficult to generalize the factors that had led to the suspended uses of the new energy technologies and systems because of the diverse and uncertain reasons. SC1 (2008) argued that it might be too late to prepare strategies to maintain the viability of the rural energy projects after the construction was finished. He suggested that such strategies should have been developed even before the program implementation started. As for strategies for extending the energy technologies and systems at a broader scale, the technology diffusion of the Hainan case did occur but with rare reflection based on finished projects. As SC1 (2008) described, "*The decisions or plans of introducing and promoting rural energy technologies in certain villages are developed at the same time by small working groups. The program implementation in different villages may occur at different times because of the limited numbers of available technical specialists. The projects in different villages were not connected or reflected with each other.* "

Table 4.35: Perceptions on the Necessity of Reflectivity in Rural Energy Planning (4)

Criterion: *Preparing strategies to keep the use of new energy technologies/devices active & widen their applications at a broader scale*					
	Strongly disagree %	Disagree %	Neutral %	Agree %	Strongly agree%
Government	0	0	17	62	21
Technicians	0	0	56	33	11
Planners/Scholars	0	0	0	43	57
Village cadres	0	0	31	63	6
Overall	0	0	22	54	24

The findings from testing the reflectivity of preparing strategies for extending application at a broader scale were in compliance with the findings from testing 'trial and error' criterion. With the previously identified shortcomings of Hainan's rural energy planning practice, the findings of preparing strategies for extending the applications at a broader scale being overlooked were not surprising or accidental. As the post-implementation was not stringently performed, the decision-makers lost the judging platform to perform policy and strategy reflection. Even with data about the performance of the newly built energy technologies and systems, the decision-makers still had the tendency of bypassing the reflection procedure as they were influenced by the flawed conventional planning practice and administrative system.

4.6.3 Synthesis of Section

The findings from the criteria questions designed for exploring and testing the continuity and reflectivity principles in Hainan's rural energy intervention programs have revealed key informants' attitudes on and the fulfillment of the principles in practice. Serious gaps were identified between theoretical insights and the practice in Hainan. By examining these criteria, the study revealed some of the causalities that led to the post-implementation dilemmas in Hainan's rural energy planning. The findings also shed light on the dilemmas of other similar intervention programs in DRAs. In order to maintain the integrity of rural energy planning, post-implementation monitoring is an indispensable procedure. Yet, it remains largely overlooked and unused, which not only sacrifices the viability of the finished projects but also restricted the execution of policy reflection. As in the Hainan case, the local understanding and practices of the continuity and reflectivity principles fell away from the theoretical standards, demonstrating that serious flaws existed in Hainan's rural energy planning practice and the administrative system. Specifically, local decision-makers were aware of the continuity principle, but the principle was not strictly executed. Due to the defect or scarcity of periodic assessment, transparent information, continuous learning, and further incentives, the viability of the accomplished rural energy projects was hard to maintain. Moreover, the lack of post-implementation monitoring reduced the possibility of performing policy reflection. At the same time, most decision-makers remained vague on the reflectivity principle. They often overlooked the reflectivity principle in practice, as evidenced by the scarcity of preparing alternatives, policy adjustments, legislative measures, and strategy reflection. As contents and procedures in a planning cycle are inter-related with and dependent on each other, the cursorily executed monitoring procedure in Hainan's rural energy planning practice was identified as a significant shortcoming which needed immediate attention and correction.

4.7 Summary

This chapter presents the research findings from the field research in China's Hainan province. The chapter introduces Hainan's EPS as the Local Agenda 21 with a focus on the CEV Program under

China's national energy policies. The up-to-date national energy policies and Hainan's rural energy policies are presented. The efforts of Hainan's government in promoting new energy technologies and systems in DRAs are highlighted with the analyses and presentation of government motivations and expectations, emerging energy systems in rural areas, and existing problems. Next, the chapter explores and presents the stakeholders and their roles in Hainan's rural energy planning practice and the overview of the planning process. Based on the evaluative framework developed in Chapter Two, the study explores and examines stakeholders' attitudes towards theoretical insights and their practices in the operationalization, implementation and monitoring stages of Hainan's rural energy planning practice. Serious gaps between theoretical insights and local practices as the equity principle was recognized but not totally fulfilled; the flexibility principle remained contentious and singularly executed; the efficiency principle was accepted but performed without enough scrutiny; the participation principle was emphasized but challenging; the continuity principle was aware of but not compulsorily executed; and the reflectivity principle appeared to be vague and overlooked in Hainan's rural energy planning practice.

CHAPTER FIVE: DISCUSSION

Based on the research findings from the field study, this chapter discusses the findings of the case study in reference to three broader aspects of enhancing the effectiveness of rural development projects in DRAs. This chapter makes comments on the existing perspectives in the literature, highlighting the viewpoints substantiated and weakened by the empirical study of the Hainan case. While acknowledging the known external challenges that impede the implementation of development projects in DRAs, the chapter advances the urgency of improving the planning process. The author argues that proper reforms in the planning practice can have positive impacts on the effectiveness of sustainable development initiatives in terms of program implementation and continuous utilization. This chapter begins with an argument on the applicability of the evaluative framework in assessing the planning practice of development projects in DRAs and discusses the possible barriers that may impede the integration of planning theory into practice (Section 5.1). The next section acknowledges the external challenges that impede effective planning and calls for decision-makers and planning practitioners' attention to the internal problems of the planning mechanism (Section 5.2). Based on the discussions, section 5.3 offers policy reflections and implications of the study. The chapter is concluded with a summary (Section 5.4).

5.1 Integrating Theory into Practice

Integrating theory into practice is not only about the use of theory to examine the traditional practice, but also is about the provision of directions to future practices and research[104] (Pyfer, 1976). The assessment of Hainan's rural energy intervention program substantiates the argument of Eggenberger and Partidario (2000) that integrating theory into practice is a complex process and has different dimensions to deal with because the integration process brings a new entity to the long-established planning process, one by means of which new relationships are to be established. Integrating theory into practice is a fundamental requirement of Marxism and China's *Scientific Development Perspective*, both of which suggest that theory is generalized based on practice; the validity of theory should be tested by practice; and useful theory should be applied in practice. For researchers and planning practitioners, it is not enough to merely focus on how much theory and knowledge is

[104] Theory serves as the foundation of examining the traditional approaches to promote growth and assertion of program efficacy. Based on evaluation, it also lends directions to future program design, and generates topics for future development and research (Pyfer, 1976).

mastered. Rather, it is more important to apply theory and knowledge to practice, solving problems that impede program effectiveness and community development (CNDRC, 2006a).

Reviewing what planning is about, the author advocates the viewpoints of planning as intention and adaptation (Wildavsky, 2008) and regards the integration of planning theory into practice as a necessity of planning itself. Planning is not only about the process of putting a proposal into effect but also about the 'continuous adjustments' based on 'the lessons learned while fulfilling the intentions by noting what happens' especially 'when early optimism is replaced by later rationalization'. The assessment of Hainan's rural energy programs revealed that the program effectiveness was desirable but often unobtainable and gaps existed between planning theory and local practices. The recognition supports the claim of intensifying the controlling role of planning (Wildavsky, 2008), for 'the more consequences we control, the more we succeed in planning'. The author advocates Eggenberger and Partidario's (2000) suggestions on the forms of integration: *substantive integration* considers not only physical issues but also social and economic problems; *methodological integration* deals with coordinating different approaches to planning; *procedural integration* adopts coordination, cooperation and subsidiarity as guiding principles among agencies; *institutional integration* involves the provision of capacities, the definition of integration organization, effective communication and the interventions among agencies; and *political integration* ensures sustainability as overall guiding principles in planning and assessment and integration of sector regulations and strategies.

The integration of planning theory and practice in DRAs has potential benefits of improving the information base for decision-making and plan formulating, streamlining rational allocation and use of resources, enhancing greater transparency and more meaningful stakeholder participation and perhaps most importantly, offering an accountable framework against which relative procedural and institutional shortcomings in rural development planning can be overcome for the good of enhancing the effectiveness of the community development projects. Planning theory should not play only an advisory role or else be used as an evaluation method to criticize rural energy planning practice. Rather, planning theory should be used to contribute to meaningful improvements of decision-making and program effectiveness, which requires the integration of planning theory and energy planning practice. The integration of planning theory into rural energy planning practice requires the recognition and efforts from both researchers and practitioners.

5.1.1 Strengths & Weaknesses of the Evaluative Framework

There are at least three components to deal with while integrating theory into practice: to examine the traditional approaches, to provide directions and suggestions in future practice, and to generate future research needs. Of the three components, the latter two depend on the accomplishment of the first component. This study centres around integrating planning theory with rural energy planning practice in DRAs. Theoretical insights were consolidated into an evaluative framework and tested in the Hainan case. Since the integration of theory into practice in the study all comes down to the evaluative framework, it is essential to discuss the strengths and weaknesses of the framework before any policy and research suggestion can be made as theory is often misused, either by acceptance without analysis, by rejection without analysis, or most commonly, by inappropriate application in practice. A critical review of the evaluative framework adopted in the study can help avoid misuses of theory. With the identification of the perceived strengths and weaknesses of the evaluative framework, policy implications and future research directions arising from the study will have more meaningful significance not only for Hainan's rural energy intervention programs but also other community development projects in DRAs.

In retrospect, the evaluative framework has been an effective vehicle that offers an opportunity to integrate theoretical insights with empirical planning practice – on one hand theoretical insights can be questioned and examined in practice; on the other hand lessons arising from the test in practice can reflect the legitimacy of theoretical insights. Due to the lack of available framework in the literature, it appeared essential to develop an evaluative framework for assessing rural energy planning practice in DRAs. Even after the field study, to the use of the evaluative framework for testing program effectiveness purposes in practice is still advocated as a proper and feasible method for the study. The research findings show that the establishment of the evaluative framework was appropriate. Overall, the aggregated principles had theoretical support from the literature that strived for better planning practice. The principles served as reasonable gauges of rural energy planning practice in DRAs rather than unrealistic standards that would have never been obtainable in practice. As for the individual criteria of the framework, although they could not represent the wholeness of each principle, each specified some major considerations and tasks to be undertaken in practice. This allowed the researcher to better exert the 'explorative' nature of the study and to conduct meaningful interviews that were prone to disclose the gaps between theory and practice.

While the evaluative framework of the study is being viewed as a major contribution, it is also important to reflect on its strengths and more importantly the necessary steps of building the strengths. For effectiveness-driven program tests, the evaluative framework has strengths of being generalizable, communicable, and complementary. First, the evaluative framework focuses on three major processes of planning – operationalization, implementation, and monitoring in which principles of equity, flexibility, efficiency, participation, continuity, and reflectivity are vital to program effectiveness. With the generalizability of the principles, researchers and planning practitioners can draw diagnostic conclusions based on which further research and policy suggestions can be specified and put into use. Second, the evaluative framework is communicable in both academic and professional settings because each aggregated principle involves some 4 criteria that specify and highlight some literature-supported key considerations and tasks for effective planning. The strength allows researchers to conduct more specific and meaningful inquiries to disclose more details regarding the "black boxes" in rural energy planning. Third, the evaluative framework has strength in unifying the principles and criteria as a referential model because of the mixed-scanning of the approaches. The evaluative framework was established based on the assimilation of the theoretical insights of the fundamental RCP and other complementary planning approaches. The criteria were not contradictory to each other. Rather, the criteria focus on different aspects of rural energy planning. Complementary as they are, they build up strengths for the evaluative framework as whole for academic and professional purposes. Based on the study, it is submitted that four steps are necessary to establish workable evaluative framework for planning practice, including an extensive review of literature, a critical comparison of different perspectives through 'mixed scanning', a pre-testing of the evaluative framework through consultation with multiple sources, and the assurance of the validity and reliability of the framework in designing and conducting the field research.

Although the application of the evaluative framework has reached a satisfactory level in the study, it is acknowledged that the evaluative framework is not without shortcomings. First, due to the time and budget constraints the evaluative framework has not been able to cover all the considerations and tasks that are needed to guarantee the effectiveness of rural energy planning in DRAs. Second, the search for more effective planning is still being conducted by various scholars and practitioners. Accordingly, the evaluative framework was developed not to be static. Perhaps constant critiques and modification on the framework will be more conducive to more effective rural energy planning. Third, much like other social inquiries, the evaluative framework is not supposed to be omnipotent to reveal all gaps between theory and practice. Similar as the Hainan case, it is expected that the tests of the evaluative framework in other studies will not be able to disclose all shortcomings of the planning process up against the literature. Thus, the limitations of the policy implications and research recommendations arising from the studies may have been determined due to the shortcomings of the evaluative framework. Also, fixing the identified theory-practice gaps in the planning practice cannot guarantee absolute effectiveness of the rural energy intervention programs. Being explorative, the evaluative framework was designed to disclose some major shortcomings of the current rural energy planning practice and to advance the understanding of how to enhance the effectiveness of the energy intervention programs. It is acknowledged that the consummation of theory is done by multiple studies from various angles. More academic attention to and interests in the effectiveness of rural energy planning and other community development programs are called for. Only upon the accumulation of empirical findings can theory be gradually improved to strengthen the effectiveness of practice and thus benefit people.

5.1.2 Applying Western Theory in an Oriental Setting

The study of Hainan's rural energy intervention programs weakens doubt on the appropriateness of applying Western theory in Oriental settings. Rather, it advocates the necessity of testing the insights of the Western planning theory in Oriental settings to explore the existing shortcomings of the planning practice and calls for proactive actions of integrating planning theory with rural energy planning practice in DRAs. While dealing with the integration of theory and practice, one would ask unavoidable questions regarding the feasibility of applying Western theory in an Oriental setting. In fact, there has been a long tradition in the literature that scholars question the appropriateness of applying Western theory in Oriental settings. For example, Heady (1995) sees that, "*Some models seem to be applicable only to parliamentary or presidential democracies, and not to the much larger number of contemporary political entities which have regimes dominated by single parities or by professional bureaucrats*" (p. 54). Welch and Wong (1998) conclude that when theory that was designed for the West or for Europe is applied to non-Western nations, it rarely fits well, exaggerating the tension between theory and practice. Although these arguments may disclose the parochial nature of the western theory in some academic areas, the study shows these judgements are untenable in applying planning theory in Oriental settings. Rather, the fear of testing Western theory in Oriental settings can only prevent discovering the shortcomings of rural energy planning in DRAs and thus the opportunities of improving the practices. The statement is justified by four main reasons, including the trend of academic research, the nature of planning theory evolution, the scarcity of Chinese planning theory, and the rationality of critical thinking.

First, the study agrees with Healey's (1992; 2003) statement that current academic studies operate increasingly in a global environment that requires greater communication and cooperation among nations. Theoretical boundaries on examining, adapting, or applying Western theory in Oriental settings are more and more unclear, especially with the development of information technology. To draw on a mix of international literature is not only a theoretical requirement but a practical necessity in current research. It is impossible to exclude cross-referencing international literature in an academic work. As Hood (1989) identifies, "*Today, scholars live in what is much more of a global village conceptually, in that it would be hard to write an acceptable research degree thesis in the subject which did not draw on an international literature for its conceptual framework. It is hard to see this trend going into reverse*" (p. 348). Indeed, in today's global village failure to incorporate ideas from other contexts can be detrimental to the long-term development of the Western theory and for the applicability of Western theory elsewhere (Welch & Wong, 1998). Theory, in itself, is the consolidation of previous experiences and studies and is to be tested and applied in practice to improve practice and benefit people. The study argues that differences of the political, economic, and social context of a particular nation should not be regarded as excuses of prevent an academic study.

Second, the study recognizes that modern planning is an improvement process through which the ever-increasing problems in urban and regional development are better solved. Ever since the emergence of planning theory, however, it has not been prescribed that planning theory cannot be tested, adapted, or applied in Oriental settings. In terms of applicability, planning theory differs from political and economic theories. The study supports that applying Western political and economic theory in Oriental settings is subject to the differences in the political and economic systems (Heady, 1995; Welch & Wong, 1998). Specifically, theory of the Western parliamentary or presidential democracies may not be feasible in China where the contemporary political regime is dominated by the single Chinese Communist Party. Likewise, the Western capitalist economic theory is not completely workable in China which holds a market-based socialist economic system. Unlike the two, the evolution and flourish of planning theory is dedicated to improving planning practice that are needed in solving problems in urban and regional development (Wheeler, 2004). However, the study acknowledges that the applicability of planning theory is subject to the political and economic settings. As a subset of environmental planning, energy planning (especially in DRAs) is also facing intractable problems of program effectiveness. Accordingly, energy planners and researchers are obligated to test and apply planning theory in practice to improve the planning practice. In case when planning theory has to confront the political or economic system, discretionary flexibility can assist

Oriental practitioners to realize the gaps between theory and practice and to adapt Western planning theory with appropriate approaches to improve the rural energy planning practice.

Third, the study identifies that there is a paucity of Chinese planning theory in the literature. Compared with Western societies, China has a very short history of modern planning and formal planning education. In fact, formal planning emerged in China in the 1980s with rapid urbanization, and the Chinese Chartered Urban Planner certificating system[105] was not established until 1999. There are few Chinese planning models, approaches or theoretical perspectives that originated in its own settings. Under the circumstance of limited original Chinese planning theory, the only possible measure to deal with the planning problems in the general Chinese planning practice is to borrow and adapt the Western planning theory to the Chinese context. In fact, Chinese scholars have long been informed by Western theories and have acted as 'importers' to borrow ideas and theories from various schools in the West to apply to the Chinese context, particularly since the late 1970s (Zhang, 1993). In applying Western theory in an Oriental setting, scholars must bear in mind that in addition to political, economic and social settings a set of international variables exist and are relevant factors. Thus, discretionary flexibility is suggested and as Heady (1995) views that, "*Cross-national explorations of the relative importance of such factors should be encouraged, and for an understanding of any single nation-state bureaucracy all of the pertinent factors should be investigated*" (p. 97).

Last but not least, the study was developed based on a consistent academic discipline – critical thinking, which enables one to analyze, evaluate, explain, and restructure our knowledge, decreasing the risk of adopting, acting on, or thinking with, a false belief. Critical thinking is the purposeful and reflective judgement about what to believe or what to do in response to observations, experience, verbal or written expressions, or arguments (Fisher & Scriven, 1997). Critical thinking gives due consideration to the evidence, the context of judgement, the relevant criteria for making the judgement, the applicable methods or techniques for forming the judgement, and the applicable theoretical constructs for understanding the problem and the question at hand (Moore & Parker, 2008). Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends

[105] The system was designed to grant professional planner designation which focuses on the urban design expertise with little emphasis on planning theory.

(Fisher & Scriven, 1997; Moore & Parker, 2008). It also requires ability to recognize problems[106], to find workable means for meeting those problems, to gather and marshal pertinent information, to recognize unstated assumptions and values, to comprehend and use language with accuracy, clarity and existence or non-existence of logical relationships between propositions, to draw warranted conclusions and generalizations, to put to test the conclusions and generalizations at which one arrives, to reconstruct one's patterns of beliefs on the basis of wider experience, and to render accurate judgements about specific things and qualities in daily life (Fisher & Scriven, 1997; Moore & Parker, 2008). In this regard, it is not an illegitimate imposition to test, adapt or integrate Western planning theory in Oriental rural energy planning practice. Rather, the conduct and lucubration of the study is supported by the rationality of critical thinking.

5.1.3 Applicability in Broader Contexts

Again, the evaluative framework of the study was established under the big picture of sustainable rural development based upon an extensive review of literature on planning and rural community development. Although the author only examined the framework in a subset of rural sustainability intervention planning – rural energy planning in China's Hainan province – the evaluative framework was expected to be workable in other sustainability intervention program in DRAs as well. First, the evaluative framework of the study focuses on three indispensable processes of planning, i.e., operationalization, implementation and monitoring. According to the rational comprehensive planning model, the three processes are necessary to planning integrity. Not only rural energy planning but all rural sustainability intervention planning should contain the three major stages. To ensure meaningful conduct of rural sustainability intervention programs, the three stages are inevitable. To examine possible causes of program ineffectiveness, the three stages are also the main targets. Second, the 24 criteria drawn from theory consolidated and represented the current perspectives of more effective approaches to planning. In the lifespan of rural sustainability intervention planning, it is important to check whether these principles are upheld and performed – equity and flexibility in conceptualizing and making plans, efficiency and participation in implementing the plans, as well as continuity and reflectivity in monitoring the accomplished projects. In order to increase the explicitness of the study some criteria in the evaluative framework directly addressed 'energy', such as Equitable 3, Flexible 1, 2, 4, Efficient 2, Participative 2, 3, 4, Continuous 1, and Reflective 4. In testing or applying the evaluative framework in other rural

[106] In contemporary usage 'critical' has the connotation of expressing disapproval which is not always true of critical thinking. A critical evaluation of an argument, for example, might conclude that it is valid.

sustainability intervention programs or broader contexts, these criteria can be fit into the specific programs without losing the theoretical insights included in the case study of Hainan's rural energy intervention programs. Again, discretionary flexibility will help examiners to adapt the evaluative framework in the programs to be assessed. Third, there are numerous rural sustainability intervention programs and international aid projects being undertaken in rural areas. However, the literature has a paucity of discussions on principles and specific measures that are needed in the planning processes to be conducive to program effectiveness. The author welcomes comments and experiences in applying the evaluative framework in practice. However, the author argues that applying the evaluative framework does not mean replicating it in other contexts without critical thinking. The framework can be borrowed and should be applied in other programs with examiners' discretion.

5.1.4 Normative Status of the Evaluative Framework

Norms have influence on people's behaviours as they can drive people's attitudes, perceptions, and actions. In DRAs, it is hugely important and necessary to establish norms to direct planning practice for context-dependent community development projects like rural energy intervention programs. Efficacy-driven norms for planning can provide not only guidelines on what planners and rural people can follow to achieve higher levels of program effectiveness, but also insights into what measures can be adopted to improve the existing norms. For, without a generally consentient set of norms, planning efforts to community development projects are likely to be conducted in chaos and are prone to ignore the importance of program effectiveness. And without continuous reflections on the planning norms, most of the community development projects of sustainable development initiatives may likely continue to falter. To a certain degree, this study helped in establishing the norms for rural energy planning and offered insights into generalizing planning guidelines for community development projects in DRAs.

Prior to this study, no mainstream approach to rural energy planning had been uncovered to involve a normative framework that details a set of standards for energy intervention programs to achieve. The problem of ineffectiveness harassing the rural energy intervention programs in DRAs could partly be attributed to the lack of a normative framework that specifies standards to meet, procedures to follow, and measures to adopt. Although the evaluative framework of the study was mainly used to critically assess the rural energy intervention programs in Hainan, the framework provides suggestions and indications on establishing norms for rural energy planning and other community development planning practices. In fact, the study shows some obvious gaps between rural energy planning practice and the criteria of the evaluative framework. Efforts in meeting the principles of the framework will be conducive to increasing program effectiveness. More specifically, in the operationalization stage of the program cycle, planners should address equity issues and be flexible in decision-making; when plans are being implemented, planners should adopt the principles of efficiency and participation; and after the programs are completed, planners should perform continuous monitoring and meaningful policy reflection actions. By elaborating the basic elements of the principles, the framework demonstrates some more specific measures in terms of evaluation criteria. The gaps identified in the empirical study in Hainan indicate if the principles are to be met the measures specified in the criteria need to be incorporated in planning norms. As expressed by some interviewees of the field study, they were interested in the study results based on which possible measures would be adopted to standardize planning norms and to increase the effectiveness of community development projects.

However, it is important to note that the evaluative framework established and used in the study represents a forefront attempt of testing insights drawn from theory in practice. In spite of the gaps identified, lessons arisen from the study may not be enough to establish a prevailingly workable set of norms for rural energy planning or other community development planning practices. For, the four criteria of each principle only represent some aspects of insights drawn from planning theory and they cannot be treated as the entirety of each principle; although the study revealed some obvious gaps between theoretical insights and local planning practice, there has been no empirical evidence to justify the efficacy or impacts of fixing the gaps. In fact, some criteria and principles still remained contentious in the study location. Accordingly, it is important and necessary to look squarely at the strengths and weaknesses of the evaluative framework when establishing planning norms. While identifying that the evaluative framework may be conducive to standardizing planning practice, the limitation and constraints of the framework also need to be reconsidered. As a result, precautionary and discretionary judgements are necessary in establishing planning norms based on the evaluative framework and the results of the study.

5.1.5 Foreseeable Barriers of Integration

The author agrees with Eggenberger and Partidario's (2000) suggestions on the five forms of integration and their recognition that no form of the integration is easy. For the researchers and decision-makers in Hainan and elsewhere with similar problems, integrating planning theory into rural energy planning practice will continue to be a key challenge, which is exacerbated by local authorities' planning orientation of meeting the energy needs of the rural public and alleviating the tensions between energy use and environmental/resource degradation through effective rural energy intervention programs. Now that it is necessary to integrate planning theory into the rural energy planning practice to increase the effectiveness of the rural energy intervention programs in DRAs, it is inevitable to estimate and analyze possible barriers of integration. The author agrees with the summary by Ostrom (1999) that integrating planning theory in environmental planning practice is facing challenges from three different levels, including *micro*, *meso*, and *macro* levels. The *micro* level concerns the resources (time, money, staff) available with a focus on the human resource capacities; the *meso* level deals with institutional procedures and management structures, systems of knowledge transfers, norms, and incentive structures; and the *macro* level addresses the network of stakeholders and the administrative/legal context of the integration (Nykvist & Nilsson, 2009). Based on the analysis of the Hainan case, the author points out that a number of foreseeable barriers at the *micro*, *meso*, and *macro* levels exist and impede the integration of planning theory into the energy planning practice in DRAs (Table 5.1).

Table 5.1: Foreseeable Barriers of Theory-Practice Integration

Level	**Barriers**
Micro – practical & human resources	• Limited financial and personnel resources • Lack of training and knowledge on planning theory • Lack of rational planning expertise • Low levels of education • Unawareness of theory-practice integration
Meso – institutional norms & procedures	• Lack of interested financial & technical institutions • The duality of government • Inadequate agency mandate • Entrenched narrow views on planning procedures • Inadequate attention to program effectiveness • Unwarranted fulfilment on monitoring & reflection • A general lack of learning atmosphere
Macro – stakeholder network & legal or administrative context	• Disciplinary chauvinism • Political or bureaucratic unwillingness • A governing atmosphere of obedience other than cooperation • Lack of partnership among stakeholders • Public unawareness or resistance of participation at higher levels • Inadequate statutory power or legislation

First, the study confirms that financial, resource, and personnel constraints at the *micro* level not only impede the implementation of rural energy intervention programs in DRAs (Painuly, 2001; Li & Hu, 2003; Weisser, 2004; Gallaghe et al., 2006), but also limit attempts, if any in these areas, to rationalize and formalize existing energy planning practice by incorporating and fulfilling the insights from planning theory, particularly by addressing and bridging the theory-practice gaps identified in the case study. The study further highlights an often neglected factor that most decision-makers and planning practitioners in DRAs are unacquainted with planning theory – leading to the fact of being insufficient in directing or guiding the integration of planning theory into practice. Because of the lack of knowledge and expertise of rational planning, decision-makers and planning practitioners have to struggle with the conflicts between the necessity of implementing rural energy intervention programs and the dilemma of program ineffectiveness. Yet, they remain unaware of borrowing and adapting Western planning theory which might have been able to contribute to the planning rationality and program effectiveness. Even when they realize the problems of the existing rural energy planning practice, there is no formal framework or guideline that could fully inform the stakeholders of how to make use of planning theory to enhance the effectiveness of the existing rural energy planning practice.

Second, the study sees that at the *meso* level the institutional settings in DRAs are unfavourable for promoting stakeholder participation, partnership, or rational planning procedures that are needed to increase the effectiveness of rural energy intervention programs (Reddy & Shrestra, 1998; Roos et al., 1999; Limmeechokchai & Chawana, 2007). Beyond the identification, the study foresees that the institutional constraints will be magnified when an attempt is made to integrate planning theory into the rural energy planning practice, leading to certain levels of resistance to integration, given that greater participation and coordination is required than in the traditional procedures. Due to the 'non-profit' nature of the rural aid programs, there is a lack of participation from financial and technical institutions which are expected to contribute to facilitating the rural energy planning practice. As shown in the Hainan case, the rural energy intervention programs turned out to be a direct dialogue between the government and the rural residents. As the government dominated the rural energy intervention programs, there is a serious lack of outsiders' participation and contribution. Throughout the programs, the government acted as not only the decision-makers but also the planners of the projects. The dual roles of the government in the projects are not conducive to self-evaluation on program effectiveness or to bringing in more measures to alter the existing institutional settings and planning practice. In the meantime, the narrow views of the traditional planning practice were entrenched in the existing procedures, leading to the ignorance of post-implementation evaluation and reflection as well as program effectiveness. Because of the lack of a learning atmosphere in the existing institutional settings, previous failures could not be learned or used to prevent future losses. Within the existing institutional settings and default planning procedures, the integration of planning theory into rural energy planning practice in DRAs will be challenging and laborious.

Third, the study argues that the existing *macro*-environment in DRAs (at least that of China) is not conformable to integrating planning theory into rural energy planning practice, which is similar to the identification that the *macro*-barriers impede the implementation of rural energy plans (Lutzenhiser, 1993; Sathaye & Ravindranath, 1998; Rosch & Kaltschmitt, 1999; Kulczycka & Lipinska, 2003; Leiserowitz et al., 2006). In rural development projects that are directed and administered by the government, disciplinary chauvinism on the traditional administrative and planning approaches is embedded and immovable in the political system because of the ingrained dominance. The integration of planning theory and rural energy planning practice will inevitably confront the existing political settings and planning practice. In a governing atmosphere of obeisance, the introduction of cooperation and partnership is up against the compromises of the parties that were in control in the traditional settings. Even when the parties are willing to compromise to foster more cooperation and partnership, there are difficulties in communication and in resolving conflicts among stakeholders, and more particularly, the divergence in perceptions and practices of manipulating upper decisions and effective program implementation among the executors of government decisions. In the meantime, the rural residents are unaware that their participation would contribute to program effectiveness. Given the generally low levels of education and the long-term impact of the obedience atmosphere, rural people lack willingness and interests in participating in the decision-making process. The interim between ‘imply obedience’ and ‘proactive participation’ is anticipated to be indefinitely long. Moreover, the integrity of rational planning does not have support from statutory stipulation or enforcement in DRAs. It will take an enormous amount of resources and a long time to establish a legal framework to assure the integrity of rational planning in rural energy intervention programs. It is barely possible to integrate the insights from planning theory into rural energy planning practice in DRAs even when some theory-practice gaps are identified to reduce the effectiveness of rural energy intervention programs.

5.2 Planning for Rural Development Projects

Given the poverty-related vicious circles in DRAs (Posa et al., 2008), rural energy intervention programs may be one of the most fundamental and important initiatives of all community development projects. Hainan's rural energy intervention programs conform to the concerns of energy sustainability in the literature (Kuhn, 1992; Dearden & Mitchell, 1998; Voorspools, 2004; WEC, 2005; Gibson, 2006a; Jefferson, 2006; Lund, 2006; Mulugetta, 2008;). The replacement of traditional energy use by affordable, reliable and environmentally responsible energy systems is fundamental and conducive to other development initiatives, such as developing economic crops and community-based industries as well as fostering public education. The energy intervention program itself may be the goal of the development projects, with the aim of ultimately delivering any number of the many benefits linked with a reliable and affordable energy supply, benefits as discussed in Chapter One and expected by decision-makers, such as increased quality of life, the creation of new economic activities, and the stimulation of existing economic activities. In order to turn the rhetoric of the development initiatives into realities, the author strongly calls for the efforts of ensuring the effectiveness of planning practice. In the case study of Hainan's rural energy intervention programs, a number of challenges were identified through interviews with the administrative stakeholders. These challenges conform to the relative discussions in the literature in that the planning and implementation of rural development plans and projects is subject to a number of challenges, including financial, technical, social, cultural, and institutional constraints (Muntasser et al., 2000; Glicksman et al., 2001; Painuly, 2001; Kulczycka & Lipinska, 2003; Li& Hu, 2003; Weisser, 2004; Gallaghe et al., 2006; Leiserowitz et al., 2006; Limmeechokchai & Chawana, 2007).

In addition to these identified challenges, this study further reveals that the planning practice for development projects in DRAs has a number of shortcomings that may have led to the ineffectiveness of the projects. When administrative stakeholders were interviewed about their attitudes and practices as per the criteria drawn from the literature, the shortcomings of the planning practice become apparent. The integration of planning theory into the existing planning practice will not be easy even when the theory-practice gaps are identified. The integration of planning theory into the planning practice for development projects in DRAs will be encumbered by a range of factors of different levels, ranging from the available sources, to existing institutional settings and political environment. The constraints of integration are widely existed, but it does not mean the planning practice for development projects in DRAs does not need to be altered or improved. It will be a constant topic for researchers and planning practitioners to consider how to improve the planning practice with the identified challenges and political settings. On the other hand, to improve planning practice does not mean to overthrow the existing political system and regime which are unfavourable to the integration of planning theory into practices. Instead, the key point is to highlight the problems in the existing planning practice, to call for decision-makers and planning practitioners' attention to the problems, and to adapt planning theory into planning practice by gradually filling the gaps identified in the case study and elsewhere. Based on the case study, the author has summarized a number of internal and external problems that are pertinent to the existing planning practice of Hainan's rural energy intervention programs. They can be compared or referenced by other community development projects when the effectiveness of the projects is arising as an important concern among scholars and decision-makers.

5.2.1 External Problems

When poverty alleviation and improved well-being become top goals of the decision-makers in DRAs, numerous rural community projects are proposed and implemented across the poor areas. However, most rural development projects are subject to a series of external problems mainly due to the nature of being 'less developed'. Because of the resource shortage factor, decision-makers in DRAs often have to struggle with the conflicts between limited resources and too ambitious objectives. When local governments introduce new environmental technologies and practices, it is even more difficult to make them acceptable in DRAs due to the generally low educational levels and poor environmental awareness. In spite of the increasing call for public participation in the decision-making process for more effective planning practice, people in DRAs generally are short of political will and often retain their obeisance to the decision-makers. Most village leadership does not contribute much to public participation at higher levels or to program effectiveness enhancement. These external problems commonly exist in DRAs and often harass the decision-making and implementation of rural development projects.

(a) <u>Limited resources vs. ambitious objectives</u>

The study reinforces that there are constant conflicts between limited resources and often ambitious objectives in planning for development projects in DRAs (Painuly, 2001; Li & Hu, 2003; Weisser, 2004; Gallaghe et al., 2006). Due to the relatively low economic levels of the developing world, decision-makers have to mind the availability of resources that are needed to implement and realize the community development projects throughout the whole process of the projects – from conceptualization, implementation to the monitoring stages of the projects (Dracker & De Laquil, 1996; Lookman & Rubin, 1998; Wyman, 1999; Painuly, 2001; Weisser, 2004). As shown in Hainan's rural energy intervention programs, lack of financial and technical resources were recognized as the top two barriers of rural energy planning. The lack of financial resources aggravated the public's perceptions of the high costs in building and maintaining the new rural energy technologies and systems, which had downgraded the affordability and acceptability of the new energy systems in the first place. Although the new energy technologies have numerous proven benefits, the affordability of the energy systems can be detrimental for rural people to adopt or fix. On the other hand, there are not enough technical specialists that dedicate to energy technology introduction and diffusion (Martinot, Sinton, & Haddad, 1997; Li & Hu, 2003; Gallaghe, et al., 2006). The lack of technical specialists unavoidably limited the provision of technical training, support, and monitoring activities throughout Hainan. As a result, the quality and operation of the new energy technologies and systems cannot be guaranteed and the effectiveness of the overall rural energy intervention programs was degraded. Given the challenges of limited resources, it was worthy considering the numbers and survival rates of the rural energy intervention programs, for limited resources could only be well spent or exerted their functions in limited projects. Perhaps it would have made more sense for program effectiveness to focus the limited resources on a limited number of villages or take a gradual manner to implement the rural energy programs.

The conflicts between limited resources and ambitious objectives are common in numerous development projects of the less developed world. In reviewing the rural energy intervention programs that suffer from program ineffectiveness in the developing world, it is not hard to find out that many of these projects share a same character of being mega-projects. These include not only Hainan's rural energy intervention programs, but also those in other provinces of China. Internationally, the cook stove improvement projects in India (Neudoerffer et al., 2001) and Zimbabwe from the early 1980s to the mid-1990s (Mapako, 2004), India's biogas movement in early 1980s (Neudoerffer et al., 2001), and South Africa's photovoltaic projects in late 1990s (Bikam & Mulaudzi, 2006) also indicate that it may be easy to set up targets of installing hundreds or thousands of energy systems across rural areas on paper but the projects are difficult to implement at one time and the program effectiveness is barely ensured in reality. Too ambitious targets of the rural energy projects imply that the reality of limited resource availability is ignored, which leads to compromises of the effectiveness of the programs. Moreover, the huge investments on the rural energy technologies and systems which are not used or do not make any difference in people's energy use, are not close to the intentions or expectations to improve rural livelihoods or to protect rural environment and resources. Rather, they can be attributed to irrational spending, wastes, or squandering. If the rural energy technologies and systems were to be installed for suspension, the rural energy intervention programs would have lost the significance in the first place and the implementation should have not been preceded to avoid losses. Instead, the limited resources should have been allocated to other projects that are more likely to succeed and to benefit rural people.

(b) Low education levels & poor environmental awareness

The study supports the viewpoints of Lutzenhiser (1993), Rosch & Kaltschmitt (1999), and Kulczycka & Lipinska (2003) that the low education levels and poor environmental awareness are major hurdles of planning for rural development projects. Because of the generally poor delivery of information services, people in DRAs suffer from low education levels that are connected with poor education standards, high illiteracy levels; inadequate reading materials; lack of awareness and interests in reading habits and scarce libraries that should act as information centres. Although the Chinese government enforced the 'Nine-year Compulsory Education' policy in 1986, there are still a large number of rural people who remain illiterate or cannot complete the nine-year education[107]. Because of the generally low educational level, the introduction and the diffusion of rural energy technologies and systems in DRAs are extremely difficult. In terms of the educational level, people in the areas are not ready to fully understand and grasp the rationale of the advanced energy technologies, especially for an anaerobic digestion and photovoltaic systems. Under the circumstance, extra technical training and support is needed to assure rural people's full understanding of the energy technologies and to create a transparent environment for sustainable and efficient use of the new energy systems. If the technical training and support cannot be guaranteed for the new energy technologies and systems, the effectiveness of the energy intervention programs will be in jeopardy when rural people's technical problems cannot be solved quickly.

At the same time, the decision-makers in DRAs must bear in mind that the overall environmental awareness of the rural people is often very poor. As indicated in the Hainan case, rural people had very long history of using traditional energy sources which had been embedded in the rural

[107] As demonstrated in a survey conducted by HPBS (2004, p.216) on a random sample of 3,687 mature people in rural Hainan, a high percentage of the rural people did not finish the minimum education requirements of the Chinese government by 2003. Specifically, 159 people remained illiterate; 578 people only had primary school education; 1,228 people had junior secondary school education; and 313 people had senior secondary school education. Only 44 and 14 people had secondary technical training and junior college education respectively.

livelihoods and would be difficult to replace. Contrary to the poor environment and resource awareness, rural people are more interested in pursuing economic growth which implied that rural people were cautious in making decisions on adopting the new rural energy technologies and systems. At the same time, there was a lack of innovative atmosphere across rural Hainan, leading to a certain level of disregard for energy system upgrading or a lack of support of the new energy technologies and systems. The traditional styles of energy use and other rural practices, although they do harm to the environment and local resources, are often not realized as inappropriate by most of the rural people. Without any sustainability intervention programs, rural people are very likely to continue the ingrained practices and will pass the traditions to their younger generations. Even when sustainability intervention programs are being implemented in DRAs, planning practitioners or technical specialists need to spend extra efforts in providing environment and sustainability education to the rural people beforehand to ensure the smoothness of the program implementation. For after all, it takes time and money to alter rural people's belief on their traditional styles of energy use and other rural practices. Perhaps strengthening the overall public education and environmental awareness in DRAs is an indispensable task to improve the effectiveness of rural energy intervention programs and other rural development projects. Particularly in DRAs where rural development projects are not scheduled because of some challenges, strengthening rural education and environmental awareness is the only way to alleviate the tensions between rural livelihoods and environmental/resource conservation.

(c) Low levels of public participation & political will

Through the case study of Hainan's rural energy intervention programs, it is confirmed that the lack of political will among people in DRAs is connected with the poor educational levels (Reddy & Shrestra, 1998; Roos et al., 1999; Limmeechokchai & Chawana, 2007). However, the author does not agree with some scholars' argument that empowering the grassroots in decision-making process may bring only marginal advantages (Rist et al., 2007). Compared with the maturity of the democratic system in developed countries, the democracy in the Third World is infantile and meaningless in planning for rural development projects. Rural people often participated in the rural development projects as mere observers with little, if any, input in the decision-making process. In most cases, rural people only obey government decisions and perform the assigned tasks with incentives while the government decides agenda and directs the program implementation process. Most people have few opportunities to voice their development goals or priorities. For a certain rural development project that is planned for the people by local government with little public consultation, the planned projects may not be appropriate in addressing people's needs and the real development priorities.

The study supports that public advocacy is important for rural development projects in terms of planning and utilization (Davidoff, 1965; Wheeler, 2004). If the smoothness of program implementation and the effectiveness of the overall development projects are top concerns, empowering rural people will be necessary especially in the areas where people have low levels of political will. If rural people have the opportunity to voice their concerns over the planned development of projects and their opinions about their needs and development priorities, decision-makers and planning practitioners will have opportunities to examine the appropriateness and feasibility of the planned development projects. The projects will benefit from increased public advocacy if the decision-makers can adopt measures to address the public concerns. Even when the development projects are found to be inappropriate, decision-makers or planners can be flexible to adapt to people's needs and development priorities. By doing that, not only is more public advocacy obtained on new projects through policy adaptation and adjustment but the possible program ineffectiveness of the originally planned projects can be avoided even before the program is implemented. Without public advocacy, the planned rural development projects, even with a certain amount of government financial support, can only be attributed to enforced projects. Accordingly, not only will the program implementation suffer from tardiness but the public acceptance of the new projects cannot be ensured.

The study reveals that the lack of political will amongst people in the areas is rooted in multiple complex factors and it is challenging to empower people in decision-making process. However, it is not appropriate for government officials to make decisions without any input from the public. Government officials should not exclude public opinions in making plans for community development projects. Rather, empowering rural people in decision-making should be encouraged in the planning practice through more frequent public consultation activities. The recognition conforms to the arguments of communicative planners (Forester, 1989; Healey, 1992, 2003, 2006; Innes & Booher, 1999). Rural people need to participate at higher levels in planning for rural development projects to generate more public advocacy and program effectiveness.

(d) Fragmented village leadership

The study highlights an important but often neglected problem – the fragmented village leadership in DRAs, which is little discussed in the literature. The important role of village leadership in strengthening the effectiveness of rural development projects is either unfulfilled by village cadres themselves or has been ignored by local government officials. Although village leaders are usually selected by local residents and are acknowledged by local government officials because of their generally higher education levels and administrative abilities, their contribution to the overall effectiveness of rural development projects is quite limited. As identified in the Hainan case, the village leadership in many rural communities is fragmented throughout the rural energy planning practice, intensifying the risks of program failures in their communities. Although many village leaders were involved in the process of conceptualizing rural energy plans, they either did not have the real power to voice rural people's needs and development priorities or passively accepted the decisions of the local government officials. Rural people might have had very high expectations on the village leadership to strive for their own goods and development opportunities, but most village leadership could not fully represent their interests in the connections between local government officials and the public. When rural energy plans were implemented in local villages, village leaders acted as the pioneers in adopting the new rural energy technologies and systems and contributed to the demonstration and introduction of the new practices to the rural people. However, most village leaders did not contribute much to the monitoring of the new energy systems' performance after the implementation in their jurisdictions. When dysfunctional energy systems appeared in the villages, most village leaders neither reported to local government officials and technical centres nor sought measures with rural people to fix the technical problems.

The fragmented village leadership in rural development projects could be attributed to two main reasons. On one hand, most of village leaders did not take the responsibility of monitoring the performance of the new energy technologies and systems within their jurisdictions. When necessary assessment and monitoring could not be performed by technical specialists due to the limitations of available resources, village leaders should have taken the responsibility in monitoring and reporting the performance of the new energy technologies and systems within their jurisdictions. However, most new rural energy technologies and systems were not monitored or reported on the inertia of the village leadership. Local government officials and the technical specialists thus lost track of the accomplished rural energy projects, which put the overall effectiveness of the rural energy intervention programs in jeopardy. When dysfunctional energy systems did not receive timely repair services or technical adjustments, most of them were doomed to be deserted. On the other hand, most local government officials ignored the role that village leadership could have contributed to the overall effectiveness of the rural energy intervention programs. The officials did not make full use of rural village leadership by assigning village leaders appropriate duties of monitoring and reporting the performance of the new energy technologies and systems. As the village leaders are not obligated to examine the new energy technologies and systems, most rural household energy systems are hardly inspected by anybody after the program implementation. In this regard, village leaders could at most be viewed as the connectors or the communicators between local government officials and rural people. Their administrative abilities and roles were not fully used towards the effectiveness of the rural energy intervention programs.

5.2.2 Internal Problems

While acknowledging the known external challenges that impede the implementation of development projects in DRAs, the study further advances the urgent need of examining and improving the internal factors of the planning process. In fact, there exist many problems within the administrative or planning system, which have been less studied. If the external problems are to be viewed as challenges for planning practitioners to conduct more rational planning practice or to produce more program effectiveness, the administrative or planning system also deserves critical examinations and reflections on its own problems that prevent the planning for rural development projects to achieve further success. Based on the critical assessment of Hainan's rural energy intervention programs, the study argues that there are at least five main internal problems in the existing planning practice for rural development projects in poor areas, including deficient planning professionalism among the planning practitioners, inappropriate institutional settings and mandates, entrenched and intense bureaucratic arrogance, inadequate punishing measures and actions, and insufficient legislative support and control. Planning practitioners may often reference external problems as the factors that lead to program ineffectiveness or failure. However, they often bypass or avoid the internal problems that are no less significant than the external problems in relation to program effectiveness. The highlight of the internal problems here is not pure alarmism or dispensable. If planning or program effectiveness is to be strengthened, critical reviews and proper corrections of the internal problems within the administrative or planning system will make more sense than solely discussing external problems or challenges.

(a) <u>Deficient planning professionalism</u>

Since planning began to be established as a profession in Western societies in early 1910s, planning theory has flourished and evolved tremendously as evidenced by the bilateral advancement between theory and practice. While planning practice in developed countries has been improved with the increased democracy and continuous critiques, progresses of planning in less-developed world seem to be isolated from the evolution of Western planning theory. Western planning experiences and insights from planning theory are barely studied in relation to or incorporated in the planning practice of the poor areas in the Third World. There is hardly any planning professional standard or framework to stipulate the proper conduct of planning practice in the DRAs. Most practitioners lack adequate planning professionalism and expertise, which often puts the integrity of planning in jeopardy and results in unexpected ineffectiveness or failures.

As indicated in the case of Hainan’s rural energy intervention programs, decision-makers and planning practitioners are not familiar with Western planning theory or practices. Although some of the insights drawn from planning theory were recognized or accepted by some of administrative stakeholders, the respective planning standards were not fully executed or fulfilled in the rural energy planning practice, such as the equity, efficiency, participation and continuity principles. In fact, some important insights and procedures in relation to more effective planning practice were ignored by a majority of administrative stakeholders, for instance, the reflectivity principle. Some planning insights still remained contentious among the administrative stakeholders, for example, the flexibility principle. The lack of planning professionalism and expertise among administrative stakeholders and planning practitioners indicated that agreements on planning principles were hard to reach and enforcement of rational planning procedures were difficult to establish or implement in poor areas. Consequently, the lack of planning professionalism and expertise was a main reason that had led to the identified gaps between planning theory and local practice. If the identified gaps between planning theory and local practice are to be fixed, a formal planning framework that stipulates necessary planning procedures in rural development projects is necessary. In order to establish such a planning framework, it requires the administrative stakeholders to reach a consensus on the integrity of rational planning, which calls for more critical assessments and reflections on the current planning practice for rural development projects. The stakeholders not only need to study the Western planning theory and practices but also need to incorporate and adapt Western planning theory into their own practices.

(b) Inappropriate institutional settings and mandates

The existing institutional settings in relation to planning for rural development projects in poor areas are not conducive to the provision of appropriate supervision actions. Planning for rural development projects not only requires coordination and participation from all stakeholders, but also needs supervision from the public, administrative colleagues, and even outsiders. Proper supervision can help restraining the abuse of administrative rights and resources, especially in the areas with limited resources. Appropriate monitoring actions facilitate the delivery of administrative execution and planning conduct to rural people and strengthen time and cost effectiveness in planning practice. Under appropriate supervision actions, stakeholders are bonded to the fulfillment of their responsibilities throughout the planning process and the program effectiveness can be increased.

The critical assessment of Hainan's rural energy intervention programs indicated that the dual functions of government officials had reduced the opportunities of being monitored or criticized. As the administrators and the planners of the rural energy intervention programs, the local government officials initiated, planned, directed, and administered the rural energy planning process. Most of Hainan's rural energy intervention programs were conducted without outsiders' supervision or competition. Even, there were few actions assigned and performed to monitor the performance of new rural energy technologies and systems. Although the lack of monitoring could be attributed to the shortage of available human resources, most government officials that involved in Hainan's rural energy intervention programs did not even try to seek other measures to monitor the performance of the rural energy systems. For example, the rural village leadership could have been a good source of performing monitoring tasks on the new rural energy systems in their villages. Although village leaders might not be able to provide timely and accurate technical support of assistance on the dysfunctional rural energy systems, they could make periodic reports on the condition of the energy systems in their villages to the government officials and they could contact the technical centers to seek technical assistance with the probable causes of the problems. Unfortunately, there were hardly any supervision actions taken through the planning process or after the programs were accomplished.

Unlike the Western settings for planning, there is no clear segmentation among planning, administration, and monitoring in the institutional settings for rural development projects in DRAs. Most planning practice and rural development projects is undertaken without proper supervision actions or an alternative competition mechanism. The inappropriate institutional settings or the lack of proper mandates are not conducive to the delivery of administrative execution and planning conduct to rural people or the enhancement of time and cost effectiveness in planning practice. Rather, it creates an environment in which the administrative stakeholders can sing their own praises. Instead of bringing transparent information on program effectiveness, the inappropriate institutional settings are more likely to incur confusion and abuse of administrative rights and resources. If meaningful monitoring is to be performed in the planning for rural development projects, segmentation between administration and planning responsibilities is necessary. The government officials can take the responsibilities of being either the planners or the monitors. The important thing here is the infusion of adequate and meaningful monitoring actions into the existing planning practice. This will require an adjustment of the existing institutional settings but involving appropriate parties all organizations, such as other independent government organizations, non-governmental organizations, and interested businesses or companies. The adjustment of the existing institutional settings with proper segmentation and execution of planning and monitoring responsibilities can lead to an increased overall sense of responsibility, contributing to the proper delivery of administrative execution and planning conduct as well as the increase of program effectiveness.

(c) <u>Entrenched and intense bureaucratic arrogance</u>

A generally entrenched and intense bureaucratic arrogance among government officials is one of the major shortcomings to planning for rural development projects in DRAs. The traditional political attributes of defending administrative authority and the hierarchical social structure have a significant impact on local planning practice. Because of the entrenched political structure and administrative atmosphere, planning for rural development projects suffers from a series of problems, including but not limited to a lack of transparency of data, a lack of meaningful stakeholder collaboration, limited public input, and a repulsion for error and critiques. Despite the problems, there is a lack of awareness among decision-makers in the planning practitioners regarding the entrenched and intense bureaucratic arrogance, which not only restricts more sound local planning practice but also affects the integration of the insights from planning theory into local planning practice.

As demonstrated in the Hainan case, the top down administrative structure dominated the decision-making process and most of local planning practice. Public involvement in the planning and decision-making process was rare in rural China. Most rural people were discouraged from voicing their opinions on their real needs and development priorities. Under the administrative structure, democracy was not encouraged. Government bureaucrats often make the decisions and rural people were informed as to what to do and what would occur. As for the rural energy planning practice, the local government played a fundamental role in planning processes and public voices will hardly be taken into consideration. In the interviews, although some administrative stakeholders were aware of the importance of public input and stakeholder collaboration, a commonly accepted consensus on the terms were not reached, not to mention the fulfillment of the procedures in local planning practice. In conjunction with previously presented internal problems, the entrenched and intense bureaucratic arrogance also reflected on the conduct of planning professionalism on rural people. The rural energy plans were developed with little meaningful public input; the existing problems, the rationale and prospective benefits of the rural energy systems were not fully elaborated or communicated to the rural people; there was a lack of data transparency; exclusion of error and program failures widely existed; and there was a lack of learning atmosphere through continuous monitoring and reflection activities. The solipsism in China's administrative structure has a long tradition and deep roots, which is difficult to alter.

It is acknowledged that government officials and other administrative members have generally higher education levels and administration abilities than the public in DRAs. However, it is inappropriate to exclude any meaningful public participation in decision-making processes. The entrenched and intense bureaucratic arrogance assumes that government officials and village leaders can well represent the interests and benefits of the public and the involvement of public participation in decision-making processes may not be necessary. In fact, government officials and village leaders can never fully represent the interests and benefits of the public until extensive public consultation has occurred. Under the arrogance, local planning practice do not benefit much from program efficiency. Rather, the lack of data transparency, public input, meaningful stakeholder collaboration, critical assessments, and reflections become serious flaws of the planning practice under such a narrow bureaucracy. When these problems are identified, the negativities of the entrenched and intense bureaucratic arrogance will be magnified as the integration of planning theory insights with practices and other efforts to bridge the gaps will again confront the political resistance stemming from the embedded bureaucratic arrogance.

(d) Inadequate punishing measures and actions

In addition to the identified external challenges and the connatural shortcomings in planning practice, the lack of punishing measures and actions in rural development projects is also identified as a common problem in DRAs. Given the nature of rural development projects as revolutionary projects of their traditions and practices, decision-makers and planning practitioners should foresee the difficulties in incorporating the new practices into the existing livelihoods of the rural people. Particularly with the recognition of numerous external challenges, the administrators should have been able to identify the high risks of program ineffectiveness for the rural development projects. Along with the assessment and approval of the rural energy plans, decision-makers should have established affiliated punishing measures and actions to avoid the abuse of administrative rights and resources as well as to reduce the likelihood of endless losses. For most rural development projects, the original intentions are to help the rural people improve their livelihoods with improved practices and uses of local resources. It may be too farfetched to require rural people to repay government incentives for the suspension and the abandonment of the new practices. However, it is feasible to emphasize the viability and sustainability of the new practices among rural people. And it is not immoderate to ask for rural people's promises of continuing the new practices and fixing problems when necessary. In the meantime, punishing measures and actions can be established for administrative stakeholders who are responsible for the implementation of the rural development projects. Any program ineffectiveness and failures can be subject to fines or repayment from the principles. With an adequate system of punishing measures and actions, the principal administrative stakeholders who have to increase their attention to program effectiveness by conducting more frequent monitoring and assessments. However, most rural development projects in poor areas are implemented without such a punishing system. The lack of appropriate measures and actions to rebuke the abuse of administrative rights and resources or irresponsible shirking program failures is an important root of blindfold program implementation and uncontrolled program failures and losses.

As shown in the Hainan case, the usual energy intervention programs became a project with high priority in Hainan's rural development agendas. Although the new energy technologies and systems had numerous proven benefits and potential in improving rural livelihoods and protecting the environment and resources, the actual performance of the programs was not satisfactory because many problems existed in program implementation and the daily use. Since the government officials intended to further the programs by introducing and diffusing new energy technologies and systems in more and more rural villages, ensuring program effectiveness had to be considered with proper measures and actions in the program agendas to control and avoid more and more future losses. While emphasizing program efficiency, decision-makers also needed to highlight the necessity of program effectiveness. When providing stakeholders with incentives, punishing measures and actions should also be clarified even before the implementation of the projects. A well-defined system of reward and punishment in relation to the planning for rural development projects could help strengthen program effectiveness.

(e) Insufficient legislative support and control

Another important internal problem of the planning for rural development projects in DRAs is the lack of legislative support and control. Although planning should be strongly tied with politics and legislation, the planning for rural development projects in poor areas is often isolated from the legislative systems. From conceptualization to implementation of rural development plans, there is hardly any legitimate platform that focuses on the effectiveness of rural development projects with explicit statements and stipulations on stakeholders' jurisdiction and responsibilities, necessary planning procedures, relevant statutory power and support, and objective reward and punishment mechanisms. In other words, decision-makers and planners seldom sought to make use of statutory power or legislative measures to build a legal platform that ensures the implementation of the plans and helps to maintain the viability of the development projects. Even if some legislative measures are considered, the enforcement of the measures is facing a lot of challenges and hard to fulfill in DRAs. The lack of legislative support and control has left procedural breaches and excuses for possible program ineffectiveness and failures.

As exemplified by Hainan's rural energy intervention programs, planning for the development projects in DRAs suffers from the lack of legislative support and control and accordingly the informal conduct of planning professionalism. On one hand, there were few legal measures adopted to regulate the environment and resource devastating activities from the public. Even after the rural energy intervention programs were accomplished, traditional energy use by deforestation still could not be completely eradicated in many villages. And these activities were not punished due to the lack of legal measures and enforcement. In case the new rural energy technologies and systems stopped working because of technical problems, many owners of these energy systems simply went back to the traditional practices instead of seeking assistance to fix the energy systems. Had any legal measures been enforced to either regulate the environment and resource devastating activities or require the public to seek technical assistance to maintain the operation of the energy technologies and systems, the rates of abandoning the energy systems would reduce dramatically. On the other hand, there were few legislative measures adopted to maintain the integrity of rural energy planning practice. The critical assessment of planning for Hainan's rural energy intervention programs indicated that serious gaps between planning theory and local planning practice commonly existed. Many planning principles, although recognized by some administrative stakeholders, were not completely fulfilled in practice. The informal conduct of planning professionalism in rural Hainan had a lot of reasons, one of which was the lack of legislative measures to enforce the necessary procedures in planning. Coupled with challenges of limited resources and planning expertise, many local government officials saw planning as a "one time" activity rather than a dynamic and a continuous process. For many local government officials, the focus of rural energy planning was to develop planning documents to get approval and more financial assistance from higher levels of the government. Once a plan was approved and funding was allocated, program implementation started in rural villages without addressing on program effectiveness. Necessary steps, such as monitoring and reflection, were often ignored or bypassed by local government officials. Had any legal measures been adopted to enforce those necessary planning procedures, the program effectiveness would benefit from these activities for an increased planning integrity.

5.2.3 Ensuring Effectiveness

Based on the critical assessment of Hainan's rural energy intervention programs, this study has identified several gaps between planning theory and local planning practice in DRAs. In addition to exploring the reasons of the gaps, the study has also generalized some major challenges that impede the integration of the insights drawn from planning theory with the planning for rural development projects in DRAs. In the extended discussions beyond the planning practice, the study also outlines some major internal and external problems facing planning for rural development projects in DRAs. Being a critical study, this research was not intended to frustrate or be contradictory to the efforts of improving rural livelihoods and protecting the rural environment and resources in DRAs through rural development projects. Rather, this research was conducted for the purpose of improving the program effectiveness by a critical assessment of the rural development projects in Hainan. The integration of planning theory into local practices was based on the intention of improving program effectiveness. By highlighting the existing gaps between planning theory and local practices as well as the existing internal and external problems, the author was trying to explore the possible shortcomings in planning processes which were seldom studied or hardly known in both academic and practical understanding. With the evaluative framework and research findings, the study offers clues and directions for examining the planning process. In addition to the gaps and the problems identified in this study, there may be more to be explored and identified.

With so many gaps and problems identified, it is clear that the integration of planning theory into local practices will be a long and difficult process. The increase of program effectiveness through capacity building in practice will be an ongoing process which requires more critical assessments and reflections. As a matter of fact, the author admires and respects the determination and efforts of the government in DRAs in pursuing sustainable rural development through rural development projects, especially under the condition of numerous challenges and limitations. The author advocates these rural development projects. However, the study emphasizes the importance and necessity of ensuring the effectiveness of these projects. Government officials and planning practitioners in DRAs must pay more attention to program effectiveness than they used to. For after all, the potentials of the rural development projects can only be fulfilled by ensuring program effectiveness. Western planning theory may not be easily integrated into local planning practice, but government officials and planning practitioners can adapt the insights drawn from planning theory or seek other appropriate workable measures when they bear in mind program effectiveness as a top concern of planning for rural development projects. In this regard, ensuring program effectiveness has become a precondition of conceptualizing and implementing the plans for rural development projects for most decision-makers and planning practitioners in DRAs. Only when ensuring program effectiveness is all agreed upon can meaningful measures and mechanisms be established to strengthen the community development planning practice in DRAs.

5.3 Reflections and Implications

After the critical assessment of Hainan's rural energy intervention programs and some extended discussions, it is time to provide policy reflections and implications for rural energy planning and other rural development planning practice in DRAs. The critical assessment was not intended to frustrate rural development projects or to overthrow the political system of DRAs. The point is to highlight the existing theory-practice gaps as well as the problems associated with integrating planning theory into local practices in planning for rural development projects in DRAs. Based on these gaps and problems, policy reflections and implications can be generated. Whether these policy suggestions work in different contexts of DRAs will require decision-makers' discretionary flexibility and will need to be tested in practices. Perhaps it requires decision-makers and planning practitioners to explore their own measures to close the theory-practice gaps and existing problems. Based on the case study of Hainan, the author suggests that decision-makers and planning practitioners can consider exploring solutions in at least the following five directions, including striving for resource opportunities, strengthening learning and training, adjusting institutional arrangements, improving planning practice, and adopting and enforcing legislative measures.

5.3.1 Striving for Resource Opportunities

Since the lack of available resources has become a barrier for planning and implementing rural development projects in DRAs, the decision-makers should explore and strive for additional resource opportunities to meet the increasing needs of rural development. In order to help rural people get out of the vicious circles related to poverty, decision-makers in developing rural address have to struggle with the conflicts between limited resources and the increasing development needs. The lack of financial resources and technical specialists not only impedes the introduction and diffusion of new rural technologies and practices, but also threatens the potential and viability of rural development projects in practice. With more financial resources and technical specialists, decision-makers will be able to provide rural people with more assistance that helps the adoption of new technologies and practices and to maintain their viabilities and benefits to rural people. In this regard, decision-makers not only need to adopt measures to ensure program effectiveness within reasonable jurisdictions by emphasizing financial efficiency, but also need to seek both domestic and international opportunities.

Domestically, decision-makers can look for financial opportunities from endowment funds, charity organizations, and profitable enterprises to increase the availability of financial resources that can be devoted to rural development projects. With more financial resources, decision-makers will be able to provide rural people with more financial incentives to help the adoption and maintenance of new technologies and practices. They will also be able to invest in training more technical specialists that are needed to provide necessary technical assistance, support and other program related services. In addition to the technical specialists that are trained by the government, decision-makers can consider training and recruiting technical specialists from institutions of higher learning and other research centres. Decision-makers also need to bear in mind the resource opportunities from the upper administrative levels. For example, the provincial government of Hainan can strive for financial opportunities from the national stimulus package [108] which gives priority to rural sustainable initiatives. The provincial government can also work with the central bank to strive for financial opportunities from the national debt projects. With the support from the national administrative level, local development projects should be continued and the program effectiveness should be increased.

In the meantime, decision-makers also need to strengthen international cooperation through Emission Trade, Joint Implementation and Clean Development Mechanisms, which are supported by the Kyoto Protocol. With the ratification by 141 countries, the Kyoto Protocol entered into force on February 16, 2005. Not only has progress led to quantitative obligations for industrialized countries to limit their emissions, but also respected the development needs of developing countries and hence established a

[108] Triggered by the American subprime crisis in 2007, the global economy experienced certain levels of recession. In response to the economic down turn, the Chinese government came up with a national stimulus package totalling 4 trillion Yuan RMB to maintain the prosperity and stability of the national economy.

market for carbon credits. Emission Trade, Joint Implementation and Clean Development Mechanisms allow developed countries to claim emissions reductions as a result of supporting development projects in developing countries. In the Copenhagen Climate Summit in December 2009[109], leaders from developed countries also promised to provide financial resources to support the sustainable initiatives in developing countries with the condition of allowing strict monitoring and international inspections. With the external opportunities, decision-makers in DRAs can work with international aid organizations to seek cooperation opportunities with developed countries. Through the international treaties, not only can developed countries contribute to the global efforts of saving energy input and reducing emissions by buying the energy and emissions saved from the initiatives in developing countries, but the DRAs can receive some financial resources to facilitate the planning and implementation of development projects, and to strengthen the overall program effectiveness.

5.3.2 Learning and Training

Continuous learning and training should be strengthened among the stakeholders of rural development projects. It is apparent that a positive learning atmosphere is often absent among the stakeholders of rural development projects in DRAs. On one hand, the top-down administrative structure has nurtured entrenched and intense bureaucratic arrogance among administrative stakeholders. Under the structure, administrators expect obedience from their affiliated officials and the public. They do not welcome challenges, error, and program failures. Without a learning atmosphere, decision-makers in DRAs often ignore outsiders' opinions and input. Consequently, there is often a lack of collaboration among stakeholders and the level of public participation is often very low. On the other hand, rural development projects, like rural energy intervention programs, focus on the introduction and the diffusion of new technologies and practices, which requires strong abilities of learning and digesting among the public. However, people in DRAs have long traditions of being less educated because of the limited access to education resources and services. As a result, the implementation and operation of rural development projects in DRAs is even more difficult. Given these shortcomings and challenges, it is necessary to strengthen learning and training among the stakeholders of rural development projects in DRAs.

[109] Although with high expectations, the Summit did not reach a satisfactory agreement on reducing energy and emissions even after days of extensive debates because of the acute conflicts between developed and developing countries, which are manifested by the contradictions between the development needs of developing countries and the quantitative quotas of reducing energy and emissions suggested by developed countries.

From administrative stakeholders, the key point is to gradually reduce the bureaucratic arrogance and to nurture a learning atmosphere, in which administrative stakeholders to strengthen self-learning activities, respect the opinions and input from outsiders and the public, facilitate stakeholder collaboration, encourage the public to voice their needs and development priorities or to comment on the decisions and policies, to provide more training opportunities and the services to the underlings and the public, respect critiques and program failures, and strengthening monitoring, assessment, and reflections on accomplished projects. The administrative stakeholders should strengthen the studying on planning theory and successful practices. With their discretionary flexibility, they can learn, borrow, and adopt the insights from Western planning theory and experiences into the local planning practice. In order to nurture a learning atmosphere, there is a need to reach consensus in the administrative structure and upper officials should take the lead to strengthen theoretical studies and communications among the administrators.

In the meantime, public education should be strengthened. While the formal nine-year compulsory education policy should be continued and enforced, necessary training in terms of technical support and assistance is of particular importance for rural people to command and utilize new technologies and practices. Even after the implementation of rural development projects is accomplished, continuous training should be provided to help rural people maintain the use of new technologies and practices. Again, the provision of continuous technical training and support may be subject to limited resources and personnel. Administrative stakeholders may also consider nurturing a community-based learning atmosphere in which rural people can learn from their colleagues and village leaders. With such a learning atmosphere, rural people would be more likely to seek technical assistance to fix problems than to abandon the use of new technologies or practices. In a positive learning atmosphere, not only will planning for rural development projects benefit from being more equitable, flexible, efficient, participative and reflective, but the effectiveness of rural development projects can be increased.

5.3.3 Institutional Arrangements

The existing institutional settings of DRAs have shortcomings which limit the delivery of administrative execution and planning conduct to the public. The conjunction of multiple roles of initiating, planning, directing, and administering rural development projects is not conducive to increasing program effectiveness because of the lack of appropriate supervision. Rather, it may leave administrative breaches for abusing administrative rights and resources. In order to remedy the shortcomings, relative adjustments are needed in the existing institutional settings of DRAs. The key point of such adjustments is to decentralize administrative rights that are relevant to planning for rural development projects. The subdivision of the individual administrative roles related to planning may be hard to proceed due to the limitations of the political structure. However, the separation of monitoring from decision-making and implementation can be accomplished by the introduction of proper competition or mandate mechanism. As such, stakeholders are bonded to the fulfillment of their responsibilities throughout the planning process with the mutual supervision and stimulation. Government officials in DRAs can consider establishing the competition or mandate mechanism by involving non-government organizations, enterprises, and international aid agencies at the cost of some fiscal budget. Based on the involvement, government officials can choose either to be monitored or to monitor the performance of the third party.

If government officials choose to be monitored by the third party, government officials need to provide efficient services to decision-making and program implementation responsibilities. Throughout the planning process, the governmental undertakings should be transparent to allow timely assessments and comments through the partnership with the third-party. If shortcomings emerge in the planning processes, timely comments from the monitoring party can help the practitioners get back on the right track. Upon the accomplishment of rural development projects, government officials also can appoint a third-party organization to monitor the performance of the new technologies and systems. When necessary, the third-party organization should provide timely technical assistance to rural people to help maintaining the use of the new practices. While the planning processes and rural development projects are monitored properly and corrected quickly, the overall program effectiveness can be greatly increased. If government officials choose to monitor, it means the transfer of implementation responsibility to a third-party organization. At the cost of some fiscal budget, the government can bring into competition and mandate the planning practice with program effectiveness obligation provisions. In this setting, the third-party takes the responsibility to implement government policies and decisions and to ensure the performance of new rural technologies and systems. At the same time, government officials monitor and evaluate the performance of the third-party. Since the third-party is contractually obligated to program effectiveness, the executives will come up with proper measures to deliver program implementation and management professionalism with time and budget efficiencies. Within this mechanism, rural development projects will maintain the viability and benefits to the rural people because of timely and proper monitoring and corrections.

Introducing the competition or mandate mechanism is not to scramble the political structure or the administrative rights. Rather, the institutional adjustment aims at increasing program effectiveness by increasing meaningful monitoring and correction actions. The conjunction of multiple planning roles and responsibilities within a sole party or administrative body does not create senses of urgency and responsibility that are needed to ensure program effectiveness. Institutional adjustments with the involvement of a third-party may impropriate a portion of the limited fiscal budget of the poor areas, but the planning for rural development projects can benefit from increased program effectiveness because of the bilateral monitoring and stimulation relationships between the third-party and the government. Consequently, the suggestions on institutional adjustment at the costs of establishing a competition or mandate mechanism in planning practice for rural development projects are worth adopting.

Another suggestion concerning institutional settings and mandates is the embrace of village leadership. As village leaders' contribution to the overall effectiveness of rural development projects is quite limited because of the fragmented village leadership, the intensification of village cadres' administrative roles as part of the institutional adjustment can have positive roles in facilitating the implementation of rural development projects and maintaining the uses of the new practices. Decision-makers should respect and encourage village leaders to voice the real needs of rural people and the development priorities of the villages. Village leaders' role of being pioneers in adopting the new practices should be maintained and consolidated. In addition, village leaders should be assigned responsibilities of monitoring the performances of the new projects. As the village administrators who live with their village colleagues, village leaders have the advantages of being close to rural people and it is easy for them to obtain information on the performance of the new rural development projects on a household basis. The assignment and mobilization of rural village leadership in strengthening the monitoring on rural development projects not only can offset some pressure of the lack of technical specialists and services, but also can contribute to program effectiveness through increased local administration and monitoring.

5.3.4 Planning Practice

The critical assessment on Hainan's rural energy intervention programs indicated that the planning for rural development projects in DRAs had shortcomings that were not up to the standards of planning theoretical insights. Not only did the administrative stakeholders on the planning practitioners not reach a consensus on all insights drawn from planning theory, but the practice in relation to each criterion was inappropriately executed or not totally fulfilled. The planning practice in DRAs has much potential to improve in all major stages, including operationalization, implementation, and monitoring. Although there may be more shortcomings of the planning practice to explore and more suggestions to make, the author focuses the suggestions for the improvement of the planning for development projects on the criteria in the framework. Based on the research findings from the Hainan case, the author suggests that the improvement of planning practice should be connected with other suggestions and adjustments. Although many questions may still remain about the essential requirements for effective planning in DRAs, it is proposed that any effort geared towards effective planning in the context of DRAs ought to focus on the principles of equity, flexibility, efficiency, participation, continuity, and reflectivity. For better planning practice, decision-makers and planning practitioners in Hainan and other similar context can consider policy adjustments in a number of directions as summarized in Table 5.2.

As repeatedly emphasized, discretionary flexibility is needed to specify and execute the planning principles and implications. Specific measures to improve the planning practice in DRAs should recognize the particular social, political contexts within which they are adopted and applied. To improve the planning practice in DRAs, the author calls for most appropriate sets of measures that are driven by intentions of overcoming explicit problems and are practically feasible in specific contexts. Decision-makers should judge and distinguish the commonness as well as the uniqueness of different contexts. For example, the contexts of Hainan's rural energy intervention programs share the commonness of DRAs in terms of being less-developed and lack enough resources for fulfilling the objectives of development plans. However, the critical assessment of Hainan also suggested that the integration of planning theory with local practices is subject to the political and structural environment. As China is undergoing a period of dramatic transformation, it has both the old imprint of a planned command economy and the new features of a transitional economy. Structural constraints such as the institutional settings and the traditions of executing decisions are compounded by the emerging issues of decentralization at the local level. Consequently, the measures to improve planning practice in rural China should be in compliance with the endeavours to establish a unique model of socialist democracy. Although the integration of planning theory into the local development planning practice is difficult, continuous and gradual efforts of merging the insights drawn from planning theory with context-specific local planning practice are feasible. And the planning practice for rural development projects may be improved in the near future for effectiveness-driven measures that manifest the delivery of equity, flexibility, efficiency, participation, continuity, and reflectivity principles in local practices.

Table 5.2: Implications for Improving Planning Practice

Principles	Implications
Operationalization	
Equity	1. Promote the understanding of harmonious society among officials. 2. Adjust the weight between urban and rural development concerns. 3. Clarifying problems and objectives among all stakeholders. 4. Enhance data accessibility and transparency.
Flexibility	1. Strengthen impact assessment at the destinations of rural projects. 2. Consider program feasibility against existing and possible barriers. 3. Encourage, respect, and value stakeholders' opinions. 4. Prepare and compare alternative programs before decision-making.
Implementation	
Efficiency	1. Test at limited sites before wide implementation and promotion. 2. Seek time/cost effectiveness and emphasize program effectiveness. 3. Acquire and make use of both successful and failure experiences. 4. Prepare incentives and require program effectiveness promises.
Participation	1. Define responsibilities and promote collaboration among actors. 2. Encourage the public to participate at higher levels. 3. Fully explain projects to the public for increased public advocacy. 4. Facilitate and nurture a learning atmosphere among stakeholders.
Monitoring	
Continuity	1. Conducts regular & frequent assessment on accomplished projects. 2. Make data on projects transparent and accessible. 3. Encourage continuous learning and use of new practices. 4. Provide further incentives for effective programs.
Reflectivity	1. Review and compare projects against objectives & expectations. 2. Make proper policy adjustments based on project monitoring. 3. Seek legislative opportunities and regulation measures. 4. Generalize and prepare strategies for more effective programs.

5.3.5 Legislation and Regulation

Another implication for the bureaucracies of DRAs is the need to combine statutory power with planning for rural development projects. As the planning for rural development projects in DRAs is often isolated from the legislative systems, there is hardly any legal platform that focuses on the effectiveness of rural development projects with explicit statements and stipulations on stakeholders' jurisdiction and responsibilities, necessary planning procedures, relevant statutory power and support, and objective reward and punishment mechanisms. In order to maintain and strengthen the authoritarian legitimation of effective planning practice, legal support and control is needed to ensure the professional conduct of planning and to regulate the practices that confront rural sustainability. Decision-makers and administrators in DRAs can consider the enhancement of the legal system for the integrity of planning in practices through specifying the legislative requirements, clarifying stakeholders' jurisdiction and responsibilities, necessary planning procedures, specific statutory power and support, and objective reward and punishment mechanisms towards planning for rural development projects. In the meantime, the legal system should be enhanced and enforced to cope with public activities that confront rural sustainability by clarifying duties and responsibilities and setting up stringent legal measures for non-compliance. In particular, it is suggested here that a stronger, more explicit and independent law on rural development law may contribute to more solid conduct of planning practice and more powerful support for maintaining the uses and practices of new rural development projects in DRAs.

5.4 Summary

Based on the research findings from Hainan's rural energy intervention programs, this chapter extends the analyses of the Hainan case to broader issues and discussions. In order to remedy the gaps between planning theory and local practices in Hainan's rural energy intervention programs, the integration of the insights drawn from planning theory into local practices is of particular importance. The chapter begins with a review of the validity and reliability of the evaluative framework adopted in the case study and discusses the applicability of the evaluative framework in an Oriental setting and in broader contexts of rural development projects. The discussions highlighted the foreseeable barriers of integrating planning theory into the development planning practice in DRAs. Coupled with the discussions of Hainan's rural energy planning practice, the chapter then analyzes the external and internal problems that are related to planning for rural development projects in DRAs and emphasizes that it is of vital significance for decision-makers and planning practitioners to pay attention to program effectiveness. With the identified gaps and problems, the chapter offers some policy implications for better development planning practice in DRAs, including striving for resource opportunities, strengthening learning and training, making institutional arrangements, mainstreaming formal rational planning practice, and enhancing legislation and regulation. The next chapter presents the conclusion of the study.

CHAPTER SIX: CONCLUSIONS

As the final section of the thesis, the chapter summarizes the study and presents conclusions based on relevant literature, the case study findings and the extended discussions. Being concluding and reflective, the chapter also covers the contributions of the study, the research limitations, and suggestions for future research directions. More specifically, the chapter begins with a review of the study objectives and the procedures of fulfilling these research needs and answering the research questions (6.1). Then, the chapter synthesizes the research findings from the critical assessment on Hainan's rural energy intervention programs and the relevant extensions and discussions (6.2). Following the synopsis of the research, the chapter presents the study contributions together with the reflections on both theory and practice (6.3). Also, the chapter provides some limitations of the study (6.4) and outlines the suggestions for related future research directions (6.5). Finally, the chapter ends the thesis with a brief summary (6.6).

6.1 Study Flow

This study focuses on an obstinate and inconvenient problem in DRAs where government officials' efforts of promoting small-scale usual energy technologies and systems with demonstrated benefits only achieved limited progresses of diffusing the energy technologies and maintaining viable and effective uses of the technologies among rural people. Rural energy technologies and systems, such as anaerobic digestion, energy-saving stoves, solar water heaters, and photovoltaic systems, either experienced difficulties in introduction and diffusion processes or had high rates of abandonment after the projects were accomplished. As sustainable rural development is increasingly being called for in both academia and practice with a focus on energy sustainability, the effectiveness of rural energy policies and other development planning practice is of particular importance. Although there are multiple complex factors that may have restricted the effectiveness of the energy intervention programs in DRAs, this study seeks to explore opportunities and conditions from planning theory to provide theoretical insights required to strengthen the effectiveness of energy planning and other development-related planning practice in DRAs. In order to provide policy suggestions to the rural energy planning and other development planning practice, it is necessary to explore the existing gaps between planning theory and local practices as well as the problems that either prevent the professional conduct of rational planning in local practices or will hamper the efforts of integrating planning theory into local practices. In this regard, the gaps and problems are to be revealed through a critical assessment of local planning practice in terms of administrative stakeholders' attitudes and practices. In order to avoid being passively informed in the field research, an evaluative framework that contains a set of aggregate criteria needs to be established based on literature review. Only with the evaluative framework can the later inquiry process be proactive, constructive and objective.

As a proactively exploratory research, this study involves the processes of establishing an evaluative framework, conducting a case study, and analyzing research findings from the case study. The literature review is the fundamental part of the research work's methodological strategy. The role of the literature review is not only to explore empirical generalizations of planning shortcomings, if any, that may have led to program failures or ineffectiveness of rural energy planning in DRAs, but also to develop an evaluative framework which could guide the field study of assessing local planning practice. A first round of extensive literature scanning indicated that few studies delved into the examination of the planning processes and there was no evaluative framework available to be adopted for the intended assessment. Accordingly, a second round of literature review was conducted to establish the evaluative framework. As presented in Chapter 2, the literature review started with an overview of the current perspectives on sustainable development with a focus on DRAs. Under the big picture of sustainable rural development, the study examined major perspectives and arguments on energy, planning and community development in relation to sustainability. The theoretical insights for effective rural energy planning were consolidated into 24 criteria which were aggregated to six groups of evaluative yardsticks, i.e., equity, flexibility, efficiency, participation, continuity and reflectivity. If the rhetoric of increasing the effectiveness of rural energy planning is ever to be translated into more of a reality, it is necessary to examine whether the aggregated criteria are upheld and performed in practice.

Since it was not realistic to examine the rural energy planning practice in all DRAs where the rural energy intervention programs suffered from serious program ineffectiveness, a case study approach was adopted to offer a relatively holistic understanding of a representative case through conducting detailed contextual analysis of a limited number of events or conditions and their relationship (Yin, 2003). The case study approach has typically been used in an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident (Yin, 2003). Differing from studies that involve multiple cases, this study is a single-case study which emphasizes in-depth and detailed coverage to ensure the representativeness of the case under investigation. For a single-case study, careful investigation of the potential case is needed to minimize the chances of misrepresentation and to maximize the access needed to collect the case study evidence (Yin, 2003).

As for the research conducted in the thesis, the rural energy planning practice of Southern China's Hainan province was selected as the case to be investigated. A description of the study area was provided in Chapter 3, including the typical environmental and energy problems in rural China, the evolution and characteristics of China's rural energy planning from literature, and Hainan's geography, history, demography, and government administrative structure. Like many DRAs, rural Hainan also experienced rigorous rural energy intervention programs. However, the energy intervention programs in rural Hainan also suffered problems of difficult technology diffusion and high rates of abandonment after the accomplishments. The planning practice involved in Hainan's rural energy intervention programs represents a typical planning approach in the DRAs of China and other similar less-developed countries. Lessons learned from the Hainan case can reflect the problems of planning practice in DRAs that experience failures or ineffectiveness in rural energy intervention programs. Hence, the critical assessment of Hainan's rural energy planning process proved to be an excellent observation point for unfolding the potential gaps that may have partly contributed to the program ineffectiveness. Details about the range of research methodology were provided in Chapter 4, including the foundation and the rationale for a single-case study, the design of the study, the procedures of conducting the field research, the methods involved in data collection and analysis, as well as the problems encountered and data limitations.

6.2 Synopsis of Results

Hainan's rural energy intervention programs were implemented by Hainan government under an increasing national recognition of sustainable development in China. Along with the boosted economic growth since the late 1970s, the Chinese government has realized the necessity of developing quality economic growth that emphasizes fewer negative impacts on environment and resources than the traditional mode. More and more policies and legal documents on environmental and resource protection were established and put into effect. Entering the 21st century, the Chinese leadership has adopted the concepts of "*Harmonious Society*" and "*Scientific Development Perspective*" in the new socialist economic development mode that reinforces the pursuits of economic development include not only quantity and speed, but also quality and efficiency. Coupled with international agreements and trends, the increased awareness of sustainable development in China has led to the issue of "*Saving Energy and Reducing Emissions*" as a national top energy policy. Under the national context of conducting and promoting sustainable development initiatives, the provincial government of Hainan established and reinforced its Agenda 21 – to build Hainan as an "*Eco-province*" of China. Since Hainan is dominantly rural, sustainable rural development, namely the "*CEV*" program, has become a significant component of the "*Eco-province*" strategy. Hainan's rural energy intervention programs were undertaken as a major content of the "*CEV*" program. Aimed at improving the rural livelihoods and protecting rural environment and resources, Hainan's rural energy intervention programs focused on introducing and diffusing new rural energy technologies and systems in DRAs to replace the traditional household energy systems and ways of energy use. With the implementation of the energy programs, a few new energy technologies and systems were emerging in DRAs, including anaerobic digesters, energy-saving cook stoves, solar water heaters, liquefied gas tanks, and photovoltaic systems. Among the new rural energy technologies and systems, anaerobic digesters, energy-saving cook stoves, and solar water heaters were among the top energy systems being promoted by the local government. However, Hainan's rural energy intervention programs suffered problems of slow construction pace, poor construction quality, lack of effective maintenance and operation approach, limited use of the technologies, and high rates of abandonment. Many projects did not demonstrate the viability or benefits which the government had expected. A number of recognized challenges were mentioned by administrative stakeholder interviewees, including financial, technical, social and cultural, institutional and other problems. However, no assessment on the planning practice had been conducted on Hainan's rural energy intervention programs prior to the field study.

In the field study, Hainan's rural energy planning was assessed against the criteria of the evaluative framework established in Chapter Two. Based on the insights drawn from planning theory, it was identified that Hainan's rural energy planning had serious flaws and gaps which could have partly contributed to the program ineffectiveness. The flaws and gaps existed in three major stages of planning, including the operationalization, implementation, and monitoring stages. Although administrative interviewees' attitudes and actions in practice varied, the flaws and gaps in relation to each planning principle adopted in the evaluative framework were generalized.

For the operationalization stage, Hainan's rural energy planning practice had shortcomings in identifying existing problems, conceptualizing the goals, alternatives, consequences and choices, and developing workable plans to solve the problems. The tests of the equity and flexibility principles in the stage indicated that the principle of equity was recognized by most stakeholders but not all criteria were considered or fulfilled in Hainan's rural energy planning practice; and the principle of flexibility remained contentious among key informant interviewees and rarely executed in Hainan's rural energy planning practice. Both principles were only recognized by some administrative stakeholders. In fact, intense debates still existed on the necessity and importance of the flexibility principle. Some critical procedures of both principles were demonstrably missing, including but not limited to, identifying and articulating existing energy problems and objectives of the energy intervention programs, ensuring the effectiveness of delivering pertinent data, necessary initial impact assessment, precautionary and adaptive decision makings, valuing stakeholders' opinions, estimating possible program failures, and providing alternative or back-up plans. The absence of the critical procedures greatly reduced the equity and flexibility of the rural energy intervention programs. In addition to the lack of planning knowledge and expertise among the administrative stakeholders or planning practitioners, the planning shortcomings at this state were also connected with the ingrained bureaucratic administrative system and the flawed program approving mechanism.

For the implementation stage, Hainan's rural energy planning practice also had flaws in putting energy policies or plans into practice, in terms of defining and assigning tasks or responsibilities to stakeholders, and mobilizing stakeholders to fulfill the mutually agreed responsibilities. Based on the evaluative framework, the administrative stakeholders' attitudes and actions were examined through interviews, surveys, and direct observation. The assessment showed that the principle of efficiency was commonly accepted by most administrative stakeholders but was performed without enough scrutiny in practice. In the meantime, administrative stakeholders of Hainan's rural energy intervention programs acknowledged that proactive stakeholders' participation is necessary and important in program implementation. Yet, local democracy or grassroots in decision-making specified by Western theory and standards were absent in Hainan's rural energy planning practice. Both the local understanding and practices of the efficiency and participation principles in rural Hainan did not match the theoretical standards. The efficiency principles were generally acknowledged and emphasized by local administrative interviewees. However, the effectiveness of the new energy technologies and systems did not receive enough attention as necessary 'pilot testing' procedures and scrutiny on program effectiveness were demonstrably missing in most local program implementation processes. In the meantime, the participation principle was emphasized by local government officials. However, the stakeholder participation in Hainan's rural energy planning had seriously deviated from the theoretical insights due to local officials' strong advocacy of their dominance over the citizens. Accordingly, public participation in Hainan's rural energy planning remained at low levels with rare opportunities to contribute to policy improvements. Due to the constraints of lack of technical specialists and services, technical support was not readily available for most rural people that had been involved in the rural energy intervention programs. Community-based collective learning and conflict resolution was not achieved in rural Hainan.

For the monitoring stage, Hainan's rural energy planning had even more serious problems than the two previous stages. The monitoring stage is important to ensure the project has been implemented according to the planned schedule and to help decision-makers to measure how well they are achieving their targets. However, monitoring actions were seriously lacking in Hainan's rural energy planning practice. The critical assessment of the local monitoring practices was conducted against the continuity and reflectivity principles. It was found that the administrative stakeholders of Hainan's rural energy intervention programs were aware of the necessity and importance of the continuity principle, but the principle was not strictly executed and often stopped after government subsidy was released to the adopters of new energy technologies and systems. Periodic assessment, transparent information, continuous learning, and further incentives were lacking in local practices. Meanwhile, the reflectivity principle was overlooked by the administrative stakeholders and remained vague in practice due to the absence of updated monitoring results. The lack of necessary monitoring actions deprived the possibility of performing meaningful policy or program reflection. The reflectivity principle was overlooked by most decision-makers, as evidenced by the scarcity of preparing alternatives, policy adjustments, legislative measures, and strategy reflection. The lack of proper monitoring actions was identified as a major shortcoming of Hainan's rural energy planning practice.

Based on the critical assessment of Hainan's rural energy planning practice, it is clear that serious planning shortcomings exist in the rural energy intervention programs of DRAs. For decision-makers of rural energy intervention programs that suffered from failures or ineffectiveness, it is necessary to examine and consider whether the local practices also share some or all of the problems identified in the Hainan case. The integration of the insights drawn from planning theory into local rural energy planning practice will help fixing the planning shortcomings and gaps. However, the anticipated analysis showed that the integration of planning theory into local rural energy planning practice will not be easy because of the barriers at the *micro*, *meso*, and *macro* levels. Extending the assessment of the rural energy planning practice to the discussion of a broader rural development planning practice, it is clear that rural development planning practice in DRAs shares some common problems. Externally, rural development planning practice in DRAs is often confronted by the facts of limited resources versus ambitious objectives, low education levels and poor environmental awareness among the public, low levels of public participation and political will, and fragmented village leadership. Internally, rural development planning practice in DRAs has shortcomings and constraints of delivering formal planning professionalism, inappropriate institutional settings and mandates, entrenched and intense bureaucratic arrogance, inadequate punishing measures and actions, and insufficient legislative support and control. It is urgent and necessary for decision-makers in DRAs to pay more attention to program effectiveness and to adopt proper measures to increase or ensure program effectiveness. It is suggested that decision-makers in DRAs can consider the following five policy directions, including striving for resource opportunities, strengthening learning and training, making proper institutional arrangements, improving planning practice, and making use of and strengthening legislative and regulative support and control in practices.

6.3 Contributions

This study is among the first studies that aim for increasing the effectiveness of energy planning in DRAs through a critical assessment of the local attitudes and practices against insights drawn from planning theory. Guided by the theme of sustainable rural development, the study originated from the observation of a common and inconvenient problem in many DRAs where the rural energy intervention programs suffered from implementation problems and high abandonment rates. Highlighting the problem, the study brings academic attention to the gaps between planning theory and rural energy planning practice. The study first provides a synthesis of understanding and perspectives concerning energy, planning and community development in relation to sustainability as well as the challenges of rural energy planning in DRAs. Lessons arising from the synthesis indicated there was no empirical study devoted to the exploration of the conditions or opportunities of planning theory for improving the effectiveness of rural energy intervention programs. In particular, no studies have examined the possible gaps between planning theory and energy planning practice in DRAs, or the attempts of integrating planning theory and rural energy planning practice in DRAs. In the context of these gaps, the research extends academic knowledge on the possible gaps between planning theory and rural energy planning practice, in a developing country like China, that may be accountable for the persistent problems in rural energy intervention programs, as well as on the conditions and adaptations necessary to integrate planning theory into rural energy planning practice under the established political system and institutional settings. The empirical research results from rural Hainan have been shown to enhance particularly the studies on increasing program effectiveness for rural energy planning in the less-developed world.

Based on the review of planning theory and approaches, the study established an evaluative framework containing 24 criteria, against which the energy planning practice in DRAs could be examined and assessed. The evaluative framework can also be referenced or adapted to examine other development planning practice in DRAs. The evaluative framework incorporated the mainstreaming perspectives and principles of planning for strengthening the effectiveness of energy planning in DRAs. The evaluative framework not only can be used to evaluate the accomplished projects for 'fence-fixing' purposes, but also can serve as a guideline of to reduce risks of program failures or ineffectiveness in rural energy intervention programs. In either way, it indicates that rural energy planning and other development planning practice has positive potential for increased program effectiveness upon following formalized procedural framework or guidelines that incorporate insights from planning theory. Hence, the integration of planning theory and practice deserves more attention from both decision-makers and researchers.

Despite the scarcity in the literature regarding the efficacy of energy planning in DRAs and the application of planning theory and approaches in rural energy planning practice, the critical assessment of the energy planning processes in rural Hainan demonstrated that serious gaps between planning theory and rural energy planning practice existed. The local attitudes and actions on the equity, flexibility, efficiency, participation, continuity, and reflectivity principles were not up to the academic standards, which could partly explain the program ineffectiveness of the rural energy planning practice. The empirical evidence added to our knowledge and attention that program ineffectiveness of the rural energy planning practice can be reduced by fixing the gaps, and the integration of planning theory and practice can increase decision-makers' awareness of program effectiveness, enhancing the image of rural development authorities, and to a lesser extent, improving the decision-making, policy-making, and planning practice in rural development projects of DRAs. In the meantime, the research revealed that the role of integrating planning theory and practice towards program effectiveness is magnified when explicit, effectiveness-driven, feasible principles for rural energy planning are adopted as overriding guidelines or criteria. It appears that the rural energy planning in China's DRAs face tremendous resource, technical, institutional and political challenges which are mainly due to the nature of "being less developed" and the ingrained authoritarian system. The research findings suggested that many common problems identified in the literature about program effectiveness could be found in the Hainan case, as manifested by the inadequate conduct of equity, flexibility, efficiency, participation, continuity, and reflectivity principles in the planning practice.

Another contribution of the study has been the policy reflection on the existing theory-practice gaps and the challenges to integrate planning theory into rural energy planning or other development planning practice. There is abundant literature which recognizes the barriers of integrating theory into practice. The research results revealed that a whole raft of interrelated and mutually reinforcing barriers at *micro*, *meso*, and *macro* levels raised by Ostrom (1999) was generally found in Hainan's rural energy planning practice, although the internal problems of deficient planning professionalism, inappropriate institutional settings and mandates, entrenched and intense bureaucratic arrogance, inadequate punishing measures and actions, and insufficient legislative support and control were more salient in the Hainan case. Given the affirmed challenges of integrating planning theory into rural energy planning or other development planning practice, the study suggested a radical revolutionary approach to the integration of theory and practice may not be desirable or realistic in view of the existing political settings of DRAs, like rural Hainan. Promising means include adaptive approaches to reduce the negative impacts of the theory-practice gaps on program ineffectiveness as well as gradual incremental changes to the institutional settings of the DRAs. As the program ineffectiveness often frustrates decision-makers' aspiration of fostering sustainable rural development through rural energy intervention programs and other development problems, it will be interesting to see how the decision-makers in DRAs will respond to the identified theory-practice gaps as well as the call for integrating planning theory into local practices. All the findings and indications can raise academic interest and debate about the evaluative framework, program effectiveness, and the integration of planning theory in rural energy planning and other development planning practice in DRAs.

6.4 Limitations

The study has some identified limitations in the evaluative framework, the field research, and the policy reflection from the research findings. First, the evaluative framework included 24 planning criteria which are aggregated into six groups of planning principles, i.e., equity, flexibility, efficiency, participation, continuity, and reflectivity. However, it is acknowledged that the evaluative framework of the study could not include all useful planning insights and perspective that could be used to assess rural energy planning or other development planning practice in a case study. Therefore, there may be other theory-practice gaps not identified in the study of the case. The unidentified gaps will require more tests and assessments to be unfold. Second, the study has limitation for being as a single-case study. Although the study provides in-depth assessments on the policy contexts, local attitudes, and actions as per the evaluative framework of the Hainan case, the study lacks of comparisons with the rural energy planning practice in other contexts of DRAs. Third, the policy reflection arising from the study lacks testing and assessment in practice. Due to the time frame, funding constraints and the absence of adopting by local decision-makers, a longitudinal study could not be conducted to verify the challenges of integration. As a result, the anticipatory analysis of the foreseeable barriers of integration planning theory into rural energy planning practice lacks of empirical support and verification. The policy implications arising from the study thus deserve further experiments, testing, and adjustments.

Also, the case study has limitation in terms of the generalizability. The results demonstrate the gaps between planning theory and energy planning practice in rural Hainan. The policy suggestions and implications arisen from the study reflect the gaps and corresponding countermeasures. Although the study could not cover all energy intervention programs or their stakeholders in the province, the study sheds light on the energy planning practice in rural Hainan and has generalizability in Hainan's rural energy planning as a whole. As demonstrated in Chapter four, Hainan's rural energy planning has problems with regard to the six principles of the evaluative framework, i.e., equity, flexibility, efficiency, participation, continuity, and reflectivity. However, since the principles were elaborated by more specific criteria, the conclusions of the study cannot be generalized to an individual energy intervention programs in rural Hainan or rural energy planning practice elsewhere. The lack of generalizability of the case study is congruent with the basic characteristics of qualitative inquiry. Since the study was originally designed to be mainly qualitative and affiliated by quantitative methods, the study aimed to understand Hainan's rural energy planning practice from the viewpoint of respondents through detailed descriptions of their cognitive and symbolic actions as well as the rich ness of meaning associated with observable behaviours. Accordingly, the case study of Hainan is not generalizable in the traditional sense of the word, nor does it claim to be. However, the case study remains valuable in academia for containing redeeming features of providing in-depth empirical findings of a specific case.

6.5 Future Research Directions

The research triggered a number of additional research questions that may further extend theoretical and empirical knowledge of the links between planning theory and rural energy planning or other development planning practice in DRAs. Consideration of fixing the identified theory-practice gaps of rural energy planning in rural Hainan is valuable for establishing effectiveness-driven local planning guidelines in DRAs. There are some other possible questions for future research. Does the integration of planning theory with local practices necessarily increase the program effectiveness of rural energy planning or other development planning practice in DRAs? Does the execution of the insights drawn from planning theory for rural energy planning or other development planning practice have the same on program effectiveness in DRAs and more developed areas? How do decision-makers in DRAs cope with the challenges of integrating planning theory into local planning practice? How crucial may public participation at higher levels of planning be in overcoming the evident limitations of present practice? What changes in political atmosphere, institutional settings, social capital and capacity may take place in DRAs due to the efforts of integrating planning theory into local planning practice? Further research on these questions may generate more insightful models, frameworks, and suggestions to increase the effectiveness of the rural energy intervention programs and other development projects in DRAs.

6.6 Summary

The last chapter reviews the study flow of the thesis, synthesises the research findings, presents the contributions, addresses the research limitations, and points out future research directions. In the following sections of the thesis, bibliography is provided and relative documents used in the field research are attached.

Appendix A: Sensitizing Concepts

A.1 Energy

Energy, in its broadest sense, is "*the capacity of objects or systems to do work*" (Oxford World Encyclopaedia [OWE], 1998, p. 472). Measured in calories[1], energy exists in various forms, depending on the energy source (Liu, 2005). Liu (2005) summarizes the forms of energy as follows:

- Heat energy: due to random motion of particles
- Mechanical energy: due to speed (dynamic energy), elevation (potential energy), or movement (kinetic energy) of an object
- Electrical energy: due to movement of charged particles
- Chemical energy: due to the energy contained in chemical bonds
- Nuclear energy: due to binding energy of atomic nuclei
- Gravitational energy: due to gravitational action
- Light energy: due to electromagnetic radiation

Energy differs from matter in that it has no mass and does not occupy space (Fisker, 2005). Much of the energy available for use is low-quality energy that is diffuse, dispersed, at low temperatures, and difficult to gather (Dearden & Mitchell, 1998). The properties of energy are described by the first and second laws of thermodynamics: the first law states that energy can neither be created nor destroyed; it can simply be converted from one form to another. The second law states that a conversion of energy always produces some less useful form of energy, usually dissipated as heat energy (Liu, 2005). Human civilization and prosperity are closely related to energy (Liu, 2005). Cook (1971) provides estimates of daily human energy consumption at six different periods of societal development (Table A.1).

Table A.1 Historical Energy Consumption

Period	**Daily per capita Energy Consumption**				
	Food	Home & Commerce	Industry & Agriculture	Transportation	Total
Primitive	2				2
Hunting	3	2			5
Primitive Agricultural	4	4	4		12
Advanced Agricultural	6	12	7	1	26
Industrial	7	32	24	14	77
Technological	10	66	91	63	230

Source: Cook, 1971

Energy can be obtained from renewable and non-renewable resource. Non-renewable resources include fossil fuels and nuclear energy. Renewable energy refers to "*recycled energy that has the ability of natural self-recovery in the ecological system and will not be lessened gradually through natural processes or human utilization, including solar energy, hydro energy, wind energy, biological energy, tidal energy, wave power and geothermal energy etc*." (Editorial Board of Huaxia Concise Encyclopaedia [EBHCE], 1998, p. 749). Fanchi (2005) redefines renewable energy as energy obtained from sources at a rate that is less than equal to the rate at which the source is replenished.

Rural energy is a concept defined on the basis of geographical regions rather than on a particular mode of economic production, such as industrial production. Rural energy includes not only renewable energy (such as biomass, excrement, solar energy, and wind energy), but also non-renewable energy (such as mineral energy or fossil fuel energy). Currently, rural energy covers all types of know energies, with the exception of nuclear energy. Biomass energy, the dominant energy in DRAs, in the context of renewable

[1] A calorie is the amount of heat necessary to raise 1 g or 1 ml of water by 1 °C (Dearden & Mitchell, 1998).

energy is defined as "*energy generated from firewood, straw, carbohydrate-bearing crops, oil crops, hydrophytes, farming wastes, and animal excrement formed through direct burning, or after being processed into gaseous, liquid, or solid fuel*" (General Editorial Board of Encyclopaedia of China [GEBEC], 1994b, p. 1021). Rural renewable energy is defined as "*those natural resources located and consumed within rural areas to produce mechanical energy, heat energy, light energy, electromagnetic energy and chemical energy which are required for economic production and life in rural areas, and are produced from energy sources such as animal power, biomass energy, hydro energy, mineral energy, solar energy, wind energy, geothermal energy and tidal energy*" (GEBEC, 1994a, p.737).

A.2 Planning

Since modern planning emerged at the turn of the 19th century, planning has existed primarily as proposals for how societies and cities should develop, or could be developed, as part of political programs or professional practices (Healey & Hillier, 2008). It was not until the mid-twentieth century that planning became an important academic focus in terms of debates and conversations (Friedmann, 1987). From these debates and discussions, there have emerged hundreds of definitions for the term '*planning*'. Based upon the debates on planning theory, Wildavsky (2008) summarizes the branches of planning theory and submits the foundations of defining the term '*planning*' (Table A.2).

Table A.2: Foundations of Defining Planning

Foundation	Rationale
Planning as Control	Planning is a goal-directed behaviour. Planning is the attempt to control the consequences by current acts. The more consequences we control, the more we succeed in planning.
Planning as Cause	Causal knowledge is necessary in planning. If the consequences of contemplated actions cannot accurately be appraised, specified objectives will be achieved only by accident. Consequences of each action become the basis for the succeeding steps. Error in prediction is magnified because of its impact on future decision.
Planning as Power	Power is the probability of changing others' behaviour of opposition. Planning assumes power and planning is politics. Planning requires power to maintain the pre-eminence of future objectives.
Planning as Adaptation	An objective may be desirable but unobtainable. Objectives and the means for obtaining them are not always fixed. Planning is about continuous adjustment.
Planning as Process	Goals, alternatives, appraisals, etc. are at the heart of contemporary planning. Evaluation of formal planning depends on forging a valid link between intentions expressed in the plan and future performance.
Planning as Intention	A plan is judged by the degree to which its intentions have been carried out. When the intentions in plans are not realized, it is difficult to know whether this failure is due to poor performance or unreasonable expectations. Lessons can be learned about fulfilling intentions by noting what happens when early optimism is replaced by later rationalization.
Planning as Rationality	Planning is good because it is systematic rather than random, efficient rather than contradictory, and above all, rational rather than unreasonable.
Planning as Cost/Benefit	Planners tend to be spenders who try to help promote current investments that will lead to future increases in income.
Planning as Faith	Planners are men of secular faith. Faith in planning has an intermittent hold on political leaders. Governmental leaders often manipulate plans and planners for tactical purposes.

Source: Summarized by the author based on Wildavsky (2008)

Despite the diversity, Faludi (2008) defines planning as *the application of reasonable method to policy-making*, which is the foundation of the study.

A.3 Developing Rural Area

Rural areas are defined as areas where mainly agricultural activities are performed by farming communities (Hai & Khanh, 1999). With farms and villages as the fundamental micro-economic units, rural areas have low-intensity infrastructure for road traffic, utilities (electricity, water supply, sewerage, etc.) and housing (Qian, 1996). Hence, rural areas are relatively free from typical urban problems, such as congestion, overcrowding, air pollution, and over-industrialization (Henderson, 2002). Compared to urban areas, rural areas have a generally lower standard of living which often translates into greater social inequality, illiteracy, poverty, disease and a lower cultural standard (Lee, 1992). The rural environment entails an agro-ecosystem and a rural organization whose typical problems emanate from the way in which natural resources are used for agricultural production (Hai & Khanh, 1999). Problems can also arise from economic development, lifestyle and social evolution. Natural conditions have a substantial impact on agricultural production and the formation of different agro-ecosystems (Hai & Khanh, 1999).

In DRAs, agriculture is a significant (or even the most) important segment of the national economy (Tran, 1995). Farms are small in size, often divided into even smaller individual units measuring only 0.2-0.5 hectares (Tran, 1995), while methods of cultivation are mainly traditional, non-mechanized and rely on animal power and manual labour (Hai & Khanh, 1999). In developed rural areas, farms are large or very large, often measuring thousands of hectares, and agriculture is mechanized, industrialized, and most often, not the dominant sector of the national economy (Tran, 1995). DRAs have relatively weak infrastructure (Khanh, 1992). For example, roads connecting villages are often unpaved and made of earth. They are subject to erosion and are at risk of being washed away, even by regular rain. Most of these roads were built for the exploitation of forests and mineral resources, and not planned to connect villages or settlements. In developed rural areas, transport networks are generally built or upgraded according to a planned, overall infrastructure development program (Tran, 1995). While ready access to electric power is taken for granted in developed rural communities, electricity is lacking in most DRAs. In developed rural areas, social problems of communities such as public health, sanitation, cultural and educational needs, medical etc. are addressed by local or national governments. In many cases humanitarian and charity organizations also contribute substantially. But DRAs enjoy such benefits to a much lesser extent, mainly because of the limited resources of local and national authorities. Moreover, farmers' income in DRAs amounts to a fraction of that of their counterparts in developed countries (Hai & Khanh, 1999).

Appendix B: A Critical Review of Approaches to Planning

With the flourish of planning theory, various planning approaches have emerged since 1960s to contrapose the shortcomings of RCP. Other Contemporary major planning approaches include but not limit to the following seven categories, integrated planning, strategic planning, incremental planning, adaptive planning, advocacy planning, transactive planning, and collaborative planning.

(a) Integrated Planning

Integrated planning emerged in the 1970s as a holistic strategy to understand and protect the natural environment which is vital to the maintenance of life, to ensure quality of life, to regulate the type and pace of development in order to ensure that it does not exceed the carrying capacity of nature and to ensure that pressures on the environment be kept to a minimum, to exploit nature less and more efficiently, and to recycle more (Conyers & Hills, 1986). Unlike non-integrated approach which focuses on specific projects, markets or sites without considering the wider implications, linkages and trade-offs, integrated planning is an approach to planning that cuts across sectoral planning (Conyers & Hills, 1986; Tarsitano, 2006). The approach stresses an operational scope that is not comprehensive, but is directed to focus on key variables identified as relevant to the system in question (Mitchell, 2002). The approach assists in expanding and integrating the perspectives of the peer community and involving participants and generating solutions to problems built on consensus (Briassoulis, 1989). The term 'integrated planning' is encountered in various settings, such as transportation, land and water use, architectural engineering, energy, manufacturing, the military, and state and local government (Sandmeyer, Dooris, & Barlock, 2004). However, planning theorists acknowledge that the elements that factor into integrated planning vary with the subject or domain (Sandmeyer et al., 2004). In relation to the adoption of more sustainable technology, integrated planning can assist in identifying solutions that will contribute to a more constructive process (Briassoulis, 1989). As Mitchell (1986, p. 13) describes that, these are important in attempts to "*share and co-ordinate the values and inputs of a broad range of agencies, publics and other interests when conceiving, designing and implementing policies, programs or projects*". Being integrated requires managing a system in all its complexity in such a way as to ensure that all of its component parts work together harmoniously while respecting the environment and social/cultural equilibrium (Tarsitano, 2006). Integrated planning acknowledges that planning for a specific project requires inputs from various sectors, agencies or disciplines (Conyers & Hills, 1986). Table B.1 provides an outline of various aspects related to each aspects of an integrated planning approach.

Table B.1: Key Elements of Integrated Planning

Context	Addresses key variables of the problem: social, environmental and economic.
Vision	Frames the resource management problems in terms of the positive outcomes that can be agreed upon and achieved by stakeholders.
Culture & Attitudes	Facilitates the functions that have been agreed upon as management options. Agreements must be achieved.
Legitimation	Essential to the successful implementation of an integrated approach. Legitimation must be gained from stakeholders supporting the process.
Process & Mechanism	The 'rules of the game' that dictate how the system will operate and to ensure that "edge problems" will be resolved. This is where stakeholder involvement is delineated and where issues related to conflict resolution and negotiation occur.
Functions	Both generic and substantive. Generic Functions relate to management process (e.g. regulations, approvals), Substantive Functions are procedural and relate to interventions that are physical (e.g. technology and its implications).
Structures	The manner in which institutions and organisations facilitate efficient performance of functions.

Source: Mitchell, 2002

Expanding the realm of problem identification and decision-making to all concerned stakeholders can lead to the implementation of novel and previously unrecognized management options (Kay, Regier, Boyle, & Francis, 1999). An integrated action plan requires all management, prevention, and control activities in a specific planning setting include the following elements: planning, management and control (Tarsitano, 2006). Vergragt and Van Noort (1996) suggest that integrated planning might be beneficial in achieving the aims of constructive technology assessment because novel technology development involves multiple stakeholders, opinions and agendas. The approach has strengths in promoting ecological sustainability, proactive decision-making and balancing the interests of involved parties (Born & Sonzogni, 1995). In ideal form, integrated planning provides coordination and consistency between different sectoral responses and ensures that these responses strengthen and reinforce interventions by other sectors (Van Donk, 2003). Integrated planning is criticized for over-estimating the ability of planners to cover the whole package without enough respect to the existing or potential uncertainties and complexity (Mitchell, 2002). Usually, the quality of the plans varies considerably from area to area depending on its complexity degree, the skill and commitment of planners, technical staff and operating companies, and the administrative management capabilities of city councils, province, and region (Tarsitano, 2006). Van Donk (2003, p. 15) describes the utility limit of an integrated approach to planning in that "*although conceptually appealing, the formulation and implementation of plans under the approach have been riddled with contradictions, complexity and frustration.*" As a result, certain unforeseen criticalities might emerge at a later date that will need to be carefully considered and tackled during the various control activities of integrated planning.

(b) *Strategic Planning*

Strategic planning emerged in the military sector[2] in early 19th century (Baker, 1992). Being labelled as 'corporate planning', strategic planning has been adopted by private sector since 1970s and is increasingly recognized by public organizations (Kaufman & Jacobs, 1987; Bryson, 1995). Broadly speaking, a strategy is "*a comprehensive plan or stream of decisions that relates the strategic advantage of a firm with its external opportunities and threats in order to accomplish organizational goals and objectives*" (Stead & Stead, 2004, p. 104). Since competition is one of the drivers underlying strategic planning, the approach can aid in improving the competitiveness of an organization in private sectors by gaining competitive advantages over their rivals (Bryson, 1995). Strategic planning is a continual and iterative process which makes explicit the goals of an organization, the environments within which it operates, and the actions required to achieve the objectives (Seasons, 1989). It creates a feasible match between internal needs and resources, and external environmental conditions (Olsen & Eadie, 1982). The process of strategic planning comprises several steps: identification and clarification of mandates, mission formulation, specification of objectives, external environmental assessment, internal environmental assessment, strategic issue identification, strategy development, implementation, monitoring and evaluation (Bryson & Roering, 1988). The SWOT model is commonly used in strategic planning. The model includes internal factors (strengths and weaknesses) and external factors (opportunities and threats) analysis. Strategic planning is action-oriented and focuses on strategic issues and opportunities. Advancing the traditional RCP approach which is seen as mainly setting goals and objectives, strategic planning emphasizes the present and future context within which the organization will operate, and it does so to arrive at the steps that can be taken today in light of that knowledge (Denhardt, 1986).

More than forty years after its emergence in non-military sectors, strategic planning still remains an amorphous concept[3] and there are numerous different definitions and usages (Heracleous, 1998). The use of strategic planning are impeded by many factors and is inherently prone to fail due to the confrontational nature[4] of the process (Bryson, 1995). Cascella (2002) identifies three signs of poor strategic planning, including, 1) levels in an organization not aligned strategically, 2) organizations

[2] The military sector was one of the few non-business sectors to adopt strategic planning before the 1970s (Bryson, 1995).
[3] Heracleous (1998, p. 481) describes that, "*strategic planning is often used to refer to a programmatic, analytical thought process ... although there are frequent usages of the terms in the above ways, various authors still use these terms in fundamentally different ways*".
[4] Organizations are not generally comfortable when asked to question their current routines and performance (Bryson, 1995).

misallocate resources, and 3) operational measures insufficient for the task. Mintzberg (1998) argues that strategic planning has never been strategy making as the analysis in the planning process is not always synthesis and strategic planning should rather be called strategic programming. Often, individuals involved in management of an organization spend significant periods of time creating strategic plans, without devoting sufficient attention to the factors required to implement the plans (Mintzberg, 1994). Citing both inter and intra organizational politics as an impeding factor of developing a strategic plan, Goldsmith (1997) criticizes that strategic planning, on occasion, is simply a 'ritual' that has to be gone through to appease a decision-maker. Shapek and Richardson (1989) suggest that strategic planning is not suitable in public sectors because the constraints of legislation limit the flexibility available to the managers of public sectors[5] (Shapek & Richardson, 1989). For example, widespread adoption of strategic planning by the public sector in US began in the early 1980s and over 264 US state agencies had adopted the approach by 1991 (Barry, 1994). However, this adoption may have only lasted for a decade (Barry, 1994). Ayal (1986, p. 51) suggests that strategic planning is particularly problematic within non-profit organizations due to the following reasons: 1) The mission for many non-profit organizations is rather diffuse, and goals and objectives are multiple and more difficult to define; 2) Non-profit organizations, more than the typical business firm, have multiple constituencies, frequently with conflicting goals[6]; and 3) Leadership in many non-profit organizations is volunteer, changes frequently, and though usually highly devoted, frequently lacks the time, staff, and other resources required for a proper strategic planning job. Consequently, there may not always be real benefits from planning and it may simply be an administrative hoop that organizations jump through (Mintzberg, Ahlstrand, & Lampel, 1998).

(c) <u>Incremental Planning</u>

As the RCP approach requires a level of knowledge, analysis, and organizational coordination that may be impossibly complex (Campbell & Fainstein, 1996b), doubts questioned whether synoptic planners have any special capacity to coordinate all the specialists[7] (Altshuler, 1965). The critique leads to Lindblom's endorsement of the "*Science of Muddling through*"[8], in which he argues that planners should abandon RCP and explicitly define their efforts as incrementalism, relying on 'successive limited comparisons', to achieve realistic, short-term goals[9] (Lindblom, 1959). The planning process should be fragmented, evolutionary, and largely intuitive and the strategies evolve over time as a result of small incremental steps and decisions (Quinn, 1978). The approach accepts the idea of 'bounded rationality', recognizing the limits of the cognitive capability of decision-makers in coping with the complexity of the real world (Alexander, 1986). Incremental planners claim that the complexity of the comprehensive public interest prevents planners from serving it directly (Campbell & Fainstein, 1996b). They believe not all alternatives can be identified, and the cost in time, effort and money to obtain additional data and to identify a broader mix of alternatives is high (Alshuler, 1965). Instead of optimizing, it is more practical to focus on attainable goals that are generally satisfactory (Lindblom, 1974).

Incrementalism portrays a method of social change made under the assumption that the status quo with only marginal changes is achieving desired goals (Durand, Nelson, & Patel, 1982). Policy makers accept previous decisions mainly without review, focusing their attention on a limited number of policy changes that would not cause radical departures from existing reality (Lindblom, 1959). In this manner, the

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[5] Managers of public sectors are often not the ones who make policies, since policy is typically created by elected officials (Shapek & Richardson, 1989).

[6] Resolution and decision-making is usually 'political' in nature, and thus less amenable to formal planning (Ayal, 1986).

[7] Lindblom (1959) argued that the comprehensive model required a level of data and analytical complexity that was simply beyond the grasp and ability of planners. In fact, the actual practice of planners is rarely comprehensive; by default, planners fall back on a more modest, incremental approach.

[8] Also referred to as *Incremental Planning* or as *Disjointed Incrementalism* (See Mitchell, 2002; Lindblom, 1959).

[9] Given the overwhelming dominance of the RCP in the 1950s and 1960s, Lindblom made a significant contribution to planning thought by pointing out that rationality need not be the only conceptual basis for the planning process—that in fact it is possible to develop alternative strategies that pay greater attention to the political realities of planning practice (Brooks, 2002).

incrementalist approach is compatible with the idea contained in the precautionary principle[10] (United Nations General Assembly [UNGA], 1992). Mitchell (2002) summarized the characteristics of incremental planning, including:

- The problem is not always clearly defined[11].
- Conflicts among goals, values and objectives are acceptable.
- Limited alternatives that differ only incrementally from the existing policies are considered.
- Limited impacts of alternatives are identified.
- Under incrementalism, ends can be modified with regard to available means.
- No single correct or optimum solution exists.
- The decision or policy process never ends.

With these attributes, the incremental planning approach seems suited to dealing with environmental problems of uncertainty and complexity. However, incrementalism has been criticized as the main weakness of the approach (Campbell & Fainstein, 1996b). Since incrementalists believe that an evolutionary and incremental approach is best, such planners are too timid or conservative to be prepared to consider a radical shift or revolution in policies and practices (Mitchell, 2002). Brooks (2002) argues that Lindblom's description of incrementalism remains at the theoretical level without empirical evidence to support his assertions. Dror (1964) argues that incrementalism is over-ideological as it discourages activities associated with rationality, and thus reinforce inertia and anti-innovation. Blum (1974) supports the idea by stating that, planners cannot be completely rational does not mean that they cannot be more rational; they cannot consider all alternatives does not mean that they cannot consider a number of the more probable or more desirable ones, and they cannot flawlessly forecast does not mean they cannot try, however imperfectly, to explore the future. Brooks (2002) indentifies that incrementalism contains its own political risks because it tends to offer small solutions for large problems[12]. Etzioni (1967) also criticizes the assumption of incrementalism of accumulating small steps can lead to a significant change. He states that there is nothing in the incremental strategy to guide their accumulation; the steps may be completely random, going in many directions but not leading anywhere. Brooks (2002) criticizes that incrementalism is inefficient when it comes to correcting a course of action that proves to be inappropriate. Alexander (1986) points out that the ultimate outcome resulting from many decentralized sensible decisions is frequently a state which nobody wants. Consequently, "muddling through" or incrementalism is so sub-optimal that it becomes only an emotional form of ad hoc opportunism and exploitation without regard for the future and those who will have to live in it (Berry, 1974).

(d) Adaptive Planning

Adaptive planning, which can loosely be defined as the learning by doing, relies on an accumulation of credible evidences to support a decision that demands action (Armitage, 2005; Haney & Power, 1996; Walters & Holling, 1990). The approach embodies a simple imperative: policies are experiments; learn from them (Lee, 1993). The adaptive approach strives to minimize conflict while maximizing use of available data and knowledge for learning from the developing system and making educated decisions in a cost-effective way (Thom, 2000). Holling (1978) first introduced the adaptive approach after he identified that an inflexible and reactionary style of environmental policy making had become powerless in an environment of uncertainties. Based on the observation of generally continuous human civilization and prosperity in uncertain conditions, Holling (1978, 1986) advocates the customary way of handling

[10] The precautionary principle is a decision-making tool meant to guide society towards a sustainable future, in the face of scientific uncertainty. There is no single, universal definition of the precautionary principle, but the best known definition is likely the following: "Where *there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation*." (UNGA, 1992, Principle 15, p. 4).

[11] Sometimes, the major task for the policy maker or planner is to determine the nature of the problem to be handled.

[12] Brooks (2002) provides some specific examples, including opening fire hydrants to deal with neighbourhood unrest; appointing commissions to study problems that merit immediate action; combating drugs by 'just saying no'; dealing with the nation's urban school crisis by having cities endorse a list of goals, as in the first President Bush's America 2000 project, etc..

the unknown—learning by doing through trial-and-error[13]. By reducing rather than eliminating uncertainty, the goal of an adaptive approach is to develop flexible and resilient policies (Dearden & Mitchell, 1998). Management should provide allowance for initiatives rising from uncertainties (Holling, 1978). Based on Holling's ideas, several scholars have stimulated and expanded the understanding of adaptive planning. Parma et al. (1998, p. 19, p. 22) define the approach as "*ecological intervention with a plan for learning about the system*" (p. 19), and "*the key to learning is to try and compare the effects of contrasting management actions*" (p. 22). Noble (2000) distinguishes the adaptive approach from traditional approaches and states that the approach is more focused and more practical as the approach is characterized of an integrated holistic rather than a comprehensive holistic approach. Lee and Lawrence (1986) compared the adaptive approach with the traditional approach from five aspects (Table B.2).

Table B.2: Comparison of Conventional and Adaptive Approaches

	Conventional Approach	**Adaptive Approach**
Process	Answer oriented	Question oriented
Design strategy	Optimal solution to problem at hand	Multiple solutions (resilient mix)
Burden of proof	Bias towards study	Bias towards action plus monitoring
Purpose of monitoring	Compliance and crediting	Learning and adjusting
Range of utility	Problem curable	Continuing management
	Project not repeatable	Project repeatable
	Experiments too risky	Experiments acceptable
	Project failure is a management failure	Failure can be productive

Adapted from Lee & Lawrence, 1986

The adaptive approach accepts surprise, uncertainty and the unknown (Comiskey, Dallmeier, & Alonso, 2000; Elzinga, Salzer, & Willooughby, 1998). While an adaptive approach thrives on information collection and use, it also enables action in the face of information shortage (Habron, 2003). Lee and Lawrence (1986) regard projects as inevitable experiments[14]. Planning for and adapting to surprise and uncertainty will provide an active rather than passive basis for more informed decisions (Lessard, 1998). Adaptive planning takes complexity and uncertainty seriously, treating human interventions in natural systems as experimental probes (Jones & Greig, 1985; Lee, 1993; Wilhere, 2002). It enables ongoing improvement of management policies and practices based on lessons learned from operational activities (Dallmeier, Alonso, & Jones, 2002). The adaptive planning approach focuses on learning and acquiring more information, but only information that helps foster learning and incorporates uncertainty (Habron, 2003). Base on a trial-and-error approach[15], also known as 'reactive learning' (Hilborn, 1992), adaptive planning leads to small, incremental changes over time and allows major changes as a result of accumulation (Halbert, 1993). Lessard (1998) also incorporates and enumerates Walters and Holling's (1990) ideas and focuses more on research and experiment design since deliberate design will permit unambiguous assessment of transient responses to policy changes[16]. Adaptive planning acknowledges

[13] In Holling's view, while people remain to learn and benefit from the experiment, errors or mistakes generate new information and insight which lead to new knowledge. In this manner, accumulated experience and knowledge provide the departure point for new ideas and initiatives. Holling (1978) states the effectiveness of the trial-and-error approach requires: (1) the experiment should not destroy the experimenter or cause irreversible changes in the environment; (2) the experimenter should remain to learn and benefit from the experiment; and (3) the experimenter should be will and able to start over, if perhaps being humbled and enlightened by a previous 'failure'.

[14] Because of imperfect knowledge or one can never be strictly comprehensive, no measure can be guaranteed to perform as anticipated or intended (Lee & Lawrence, 1986). In other words, some projects will fail, but others will do better than expected.

[15] An adaptive approach allows the understanding gained with a project that 'failed' to meet performance criteria can be incorporated into planning the next project (NRC, 1992).

[16] He emphasizes that before working on existing policies planners or managers should identify existing certainties and substantial changes, and expose uncertainties. After that, it is necessary to identify experimental designs that distinguish clearly between localized and large-scale effects, and choose the best possible use of opportunities for replication (Lessard, 1998).

regular adjustments to policies based on investments in available and reliable information, making the approach relatively inexpensive in the long run while yielding excellent returns in the sustainable use of natural resources (Hilborn, Walters, & Ludwig, 1995; Smith & Walters, 1981; Walters & Green, 1997).

Adaptive planning also has some problems. The adaptive approach can be classified into two groups, passive and active (Walters & Hilborn, 1978). Hurlbert (1984) affirms the important role of monitoring and evaluation in adaptive planning, but he also criticizes that monitoring in a passive adaptive approach is done without controls, replications, and randomization. Consequently, a passive adaptive approach cannot establish clear cause-and-effect relationships between intervention activities and changes in ecosystem conditions[17] (Wilhere, 2002). Under the approach, planners and managers cannot determine whether the observed responses were caused by planning or management activity of interest, by some other activity, or by some "natural" process. An active adaptive planning approach can compensate the shortcomings of a passive approach, but deliberate experiment in an active approach is more complex and more expensive (Wilhere, 2002). Thom (2000) states there are three main ingredients of an effective adaptive planning, including a clear goal statement, a conceptual model and a decision framework[18]. In connecting goal, model and framework, monitoring and management are important for adaptive planning to achieve its promise (McConnaha & Paquet, 1996; McLain & Lee, 1996; Shindler, Steel, & List, 1996; Smith, Gilden, Steel, & Mrakovcich, 1998). Habron (2003) focuses more on the management aspects and suggests effective adaptive planning needs to, (1) reduce bureaucracy, (2) foster productive discussion and understanding among stakeholders, (3) provide financial support, (4) provide technical support, and (5) provide coordination support. Lessard (1998) understands that public involvement should be inherent throughout all the tasks in adaptive planning. Grayson, Doolan, and Blake (1994) add that public involvement in adaptive planning enables cross-disciplinary links to be formed and focuses the group on defining achievable management options and agreeing on important indicators of the system.

(e) Advocacy Planning

Advocacy planning grew in America during the mid-1960s with major objectives of defending the interests of the weak or the poor, and allowing planners to represent groups whose interests are threatened (Davidoff, 1965; Hudson, 1979; Khakee, 1998; Wheeler, 2004). Davidoff (1965) suggests that planners should advocate and defend the interests both of government and of other interest groups, organizations or individuals who are concerned with proposing policies and the results of the planning process. Planners in advocacy planning, unlike those in transactive planning, are 'experts' who work not *with*, but *on behalf of* groups that have traditional been underrepresented (Davidoff, 1965). Advocacy planning has since evolved from defending excluded interests, into equity planning, where advocacy is found in the process itself (Marris, 1994). Advocacy planning challenges the myth of a unique public interest and supports the development of plural plans (Davidoff, 1965; Hudson, 1979; Khakee, 1998). The multiple objectives of advocacy planning are established based on the premise of plural society, which comprises many groups with diverse interests and values (Davidoff, 1965). As Davidoff (1965) suggests that planners should be able to engage in the political process as advocates of the interest both of government and of such others groups, organizations, or individuals who are concerned with proposing policies for the future development of the community. From this perspective, advocacy is a way to include citizens with the participatory process, where 'inclusion' means not only citizens being heard, but also being well-informed about the underlying reasons for planning proposals (Allmendinger, 2002). Davidoff (1965) indicates that pluralism will be capable of improving planning practice through providing a medium for presenting alternative choices strongly supported by their proponents, and creating a competitive environment for the public planning agency and the others to win political support.

[17] That is to say, without controls, replication, and randomization, uncertainties become more and more uncertain.

[18] A good goal drives the design of the project and helps guide the development of performance criteria; a clear conceptual model stimulate the knowledge base to construct the project to meet the goal; and a decision framework incorporates knowledge gained through projects and formulates a decision on actions to take if the system is not meeting its goal (Thom, 2000).

These might lead to superior plans that could be accepted by many. Davidoff thinks that the concept of advocacy does not imply nullifying the significant role and obligation of the public planning agency.

Checkoway (1994) acknowledges Davidoff's contribution of advocacy planning and highlights its shortcomings, including charges that advocacy planners are not always representatives of their client communities, that they do not empower them to advocate for themselves that they diverted them from more powerful forms of social change, and that the advocacy planners lack the power to implement their plans. Alexander (1986) sees two shortcomings of advocacy planning. The first is the appropriateness of the legal model in the political context[19]; and the second is the ineffectiveness in building support for constructive alternatives. Booher and Innes (2002) criticize advocacy planning as an extension of the idea of planner as expert working for a client, implying that there is not equal exchange of information or communication and that advocacy planners are in a position to advocate as they see fit. Forester (1989) questions the effectiveness of advocacy planning and argues that advocacy is already virtually mandated whenever planners are encouraged to undertake meaningful consultation and public involvement[20]. From a Marxist perspective, Piven (1970) does not think advocacy planners can act on behalf of the poor by merely practicing a form of cooperation which only provides an illusion of influence[21].

(f) *Transactive Planning*

Transactive[22] planning was first developed in 1973 by Friedmann who called for more decentralized decision-making by the local people, more emphasis on processes of personal and organizational development, and the recognition of the importance of personal growth, cooperative spirit, and freedom from manipulation (Hudson, 1979; Khakee, 1998; Mitchell, 2002). Friedmann's transactive planning emphasizes that citizens and civic leaders, not planners, have to be at the core of planning if plans are to be implemented (Friedmann, 1987). Friedmann (1973) sees planners to contribute invaluable information to the planning process, such as theory, new perspectives, and processed knowledge, while citizens/clients contribute intimate knowledge of context, community priorities, and operational details. This approach seeks to draw potentially affected populations into the planning process from the very beginning, when problems still need defining (Friedmann, 1996). This approach assumes that there exist various interests within society and the interpersonal dialogue triggers a mutual learning process leading to an intensive communication about measures (Khakee, 1998). Constant communication between planners and the public is promoted, which ideally results in reciprocal education and involvement between planners and the community (Friedmann, 1996). The planner's role in transactive planning is to develop a set of community relation strategies, and to inform community-based groups about the policies which affect them (Forester, 1989). Further, transactive planning is regarded as a democratic process; planners should be open to knowledge possessed by citizens, particularly those "… *in the front line of action – households, local communities, and social movements*" (Friedmann, 1987, p. 394).

Mitchell (2002) differentiates transactive planning from RCP in that local people will have more control over planning in a transactive approach whereas the control of planning rests with planners or the planning institution in a traditional rational comprehensive approach. The planning process in the transactive model involves more face-to-face dialogues (interactions) and mutual learning with the people affected by decisions (Hudson, 1979; Khakee, 1998; Mitchell, 2002). Transactive planning does not view planning purely as a scientific technique, but considers planning as a decentralized function incorporating interpersonal dialogues and mutual learning (Friedmann, 1987). Increased interaction is stressed in transactive planning, particularly through verbal communication. This principle is the premise for social,

[19] In this planning approach, the role of planners resembles that of lawyers which tend to be adversarial (Alexander, 1986).

[20] Forester (1989) sees that planners do not shape just documents, but the participation process - by determining who is contacted, who participates, and who persuades whom - not just by shaping which facts citizens have, but by shaping their trust and expectations.

[21] Piven (1970) explains that this illusion is all the more insidious because the planner actually believes it.

[22] The term 'transactive' stems from Friedmann's (1973) depiction of planning process as a set of transactions.

or ‘mutual’ learning[23]. First advocated by Vickers in 1965, mutual learning is a less bureaucratic style of planning that allows for broad participation, resulting in both planners and citizens gaining knowledge (Hodge, 1998). Friedmann (1996) suggests that transactive planning works best in small groups of up to twenty people. However, participation of the citizens may take time and high costs which parts of the population do not have, especially the poorer ones (Mitchell, 2002). Sometimes the population may not be prepared to plan for the long run and thereby to postpone short term satisfaction (Hostovsky, 2006). Transactive planning requires that both planners and citizens have the capacity to listen sympathetically and share the responsibility for problem definition and solution, which may not always be possible (Friedmann, 1996). Friedmann (1987) identifies two major criticisms of the transactive planning model: conflicting personalities among people and unwarranted personal trust.

(g) Collaborative Planning

Collaborative or communicative planning is based upon the ideal of democratic participation by all who are affected by a plan, not just who are in a position to influence and implement planning change (Healey, 2003). The approach is characterized by a focus on the communicative, interactive and institutional dimensions of the planning process (Healey, 1992). The communicative action theorists place great emphasis on the fact that planning communications are not just exchanges of words but reflect a variety of institutional, political, and power relationships (Healey, 2003). Collaborative planning brings together the concepts of power, equity and quality of process in the discipline of planning. The approach is becoming more important because planning requires teamwork and the approach can result in network power (Booher & Innes, 2002). Planning requires linking knowledge to action. Collaboration can be used as a tool to link institutional knowledge to action, whether in the form of decision-making, policy development or agenda setting (Friedman, 1987). Collaborative planning has theoretical roots in the social learning tradition and advocates that undistorted communication, interaction and relationship-building between government, interest group, other major sectors of the community and the public can improve planning and policy development through social learning and consensus-building (Healey, 2003). This approach to planning theory takes its departure from fundamental social changes, such as globalization, individualization and fragmentation, as well as the transition that is commonly referred to in the literature as “government” to “governance” (Healey, 1992).

Collaborative policy processes are increasingly in use as ways of achieving results in an era distinguished by rapid change, social and political fragmentation, rapid high volume information flow, global interdependence, and conflicting values (Booher & Innes, 2002). One of the keys to developing a theory of collaborative planning, and elaborating the paradigm for communicative planning will be to give a central place to role-play simulation as a method of interaction and bricolage as a mode of collective reasoning (Innes & Booher, 1999). A key consideration for collaborative processes is that communication should take place between all who feel that they are stakeholders in the issue (Healey, 2006). Forester (1989) suggests four characteristics of good communication in planning, including, comprehensible, sincere, legitimate, and true[24]. Collaborative planning suggests that strong and defensible strategies will emerge by discussing the various interests that stakeholders have in an issue. One of the most important outcomes of the approach and the currency that ensures decisions can be made is the “*generation of social and intellectual capital*” (Healey, 2006, p. 70).

Despite its merits, collaborative planning is criticized for its lack of consideration of power. Murtagh (2004) acknowledges that collaborative planning places value on the input of all citizens, but he also recognizes that those who do not have strong political voices and knowledge of the planning projects can be difficult to engage. Blumenberg (2002, p.161) offers a caution about collaborative planning and suggests that “*this consensus-based approach assumes equal power among participants*.” Galbraith (1983)

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[23] Social learning or mutual learning is an important process of transactive planning.
[24] Forester (1989) states that communication that falls short of these principles is distorted, which fuels distrust.

suggests that consensus building is not really possible when power is unequally distributed. Harris (2002) identifies that collaborative planning advocates have exaggerated the possibilities of accommodating collaborative forms of planning within the existing planning frameworks. Low (1991) extends that domination is part of the operational rules of society in which planners are enmeshed and undistorted communication which collaborative planners advocate is not possible with the existence of domination, repression, and ideology. Another important shortcoming of the collaborative approach is that there is no common structure for every collaborative planning process, aside from the emphasis of communication (Healey, 2006). Based on her book "*Collaborative Planning: Shaping Places in Fragmented Societies*", Healey (2003) summarizes that collaborative planning has two major shortcomings. First, the approach focuses too much on agency and too little on the broader structuring forces that shape both the windows of opportunity through which active agents can innovate and the power relations that influence the initiatives that agents seek to develop. Secondly, collaborative planning as an ideal form may not be able to be realized in the planning process due to the conflicts of the benefits of various stakeholders.

Appendix C: More Information on the Study Location

C.1 Rural China

China is the largest country in terms of area in East Asia with a total of approximately 9.6 million square kilometres and the fourth largest in the world, after Russia, Canada, and the United States. At the end of 2008, China has the largest population of all countries in the world with 1.328 billion people – approximately one fifth of the world's total population (National Bureau of Statistics [NBS], 2008). Among its large population, China has a large proportion of people living in the rural areas[25]. At the end of 2008, 721.35 million (or 54.32% of the total population) people living in the rural settlement and involving in agriculture (Figure C.1). Since 1949 when the new China was established, it has taken almost fifty years to solve the problem of starvation across the country. A dramatically increased comprehensive agricultural productivity has been achieved and a stable relationship between the supply and demand of agricultural products has been established since the late 1970s' when the "Open-Door" Policy was adopted in China. In 2008, the output of Chinese grain crops, cotton, oil seeds, aquatic products and fruits ranked the first in the world and the average amount of food that Chinese people possessed per person[26] has reached the average level of the world (NBS, 2008). The income of China's rural people has grown considerably since late 1970s'. In 1978, the average income of rural people was only 134 RMB Yuan[27] per capita and had almost tripled by 1985. In the following years, the average income of China's rural people kept increasing and reached 4,761 RMB Yuan in 2008. It is estimated that the income level of Chinese rural people will keep increasing in the next several years (NBS, 2008).

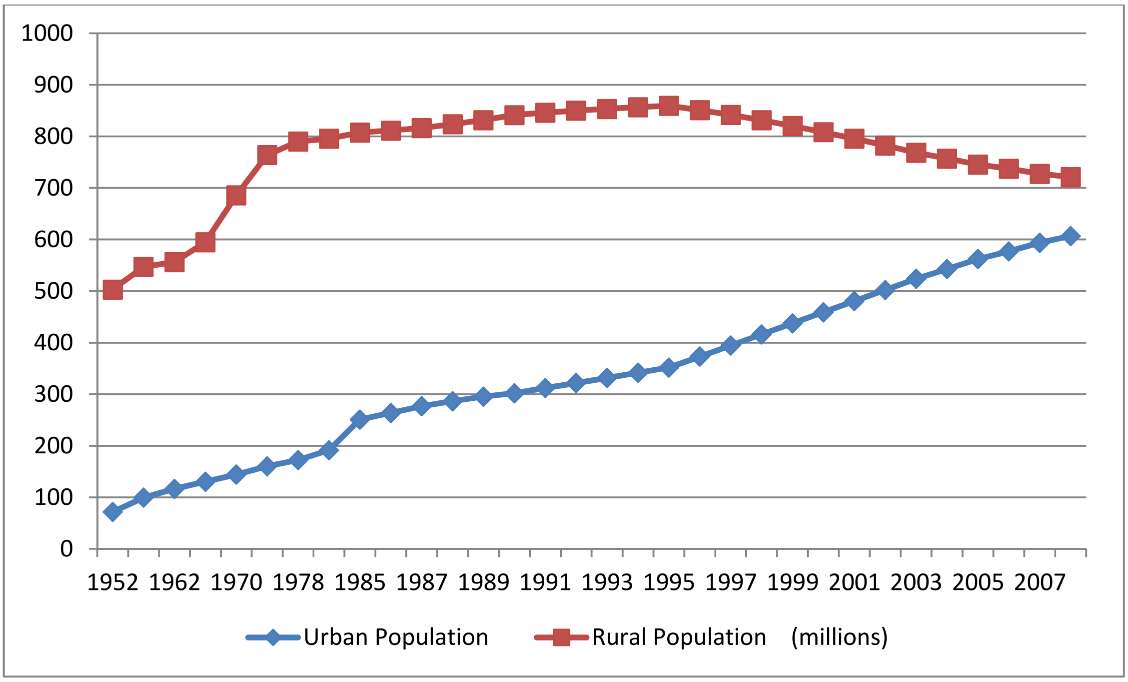

Figure C.1: Urban vs. Rural Population in China

Source: Created by the author based on NBS, 2008

[25] China's rural population has been decreasing since the middle of 1990s mainly due to the population control policy, rapid urbanization and rural-urban migration. At the same time, China's urban population keeps increasing in terms of both the number and the proportion to the total population.

[26] In 2008, the average amount of food that Chinese people possessed per person was 398 kg, which was 26 percent more than that of 1978 (NBS, 2008).

[27] 1 RMB Yuan equals about 0.2 Canadian Dollar.

In spite of the considerable growths that took place in Chinese agriculture and rural economy, the economic gap between the Chinese urban and rural economies keeps widening (Figure C.2). In 2008, the Chinese urban population earns three times more than the rural population does on average (NBS, 2008). Most of the Chinese rural areas, which account for a large proportion of the Chinese territory and accommodate most the Chinese rural population, remain undeveloped because of the comparably weak economic basis and natural endowment. Due to the additional constraints of geographical location, basic infrastructure, financial resources, and development opportunities, the rural poor have typically left behind the overall fast growth of China. In 2007, China still had about 15 million rural people who were in absolute poverty and about 29 million rural people who were labelled as poor[28] (NBS, 2007). Among the Chinese poor, about forty percent are ethnical minority people[29] (NBS, 2007). In the western provinces and regions, the proportion of minority people who are listed as 'poor' is much higher than forty percent[30].

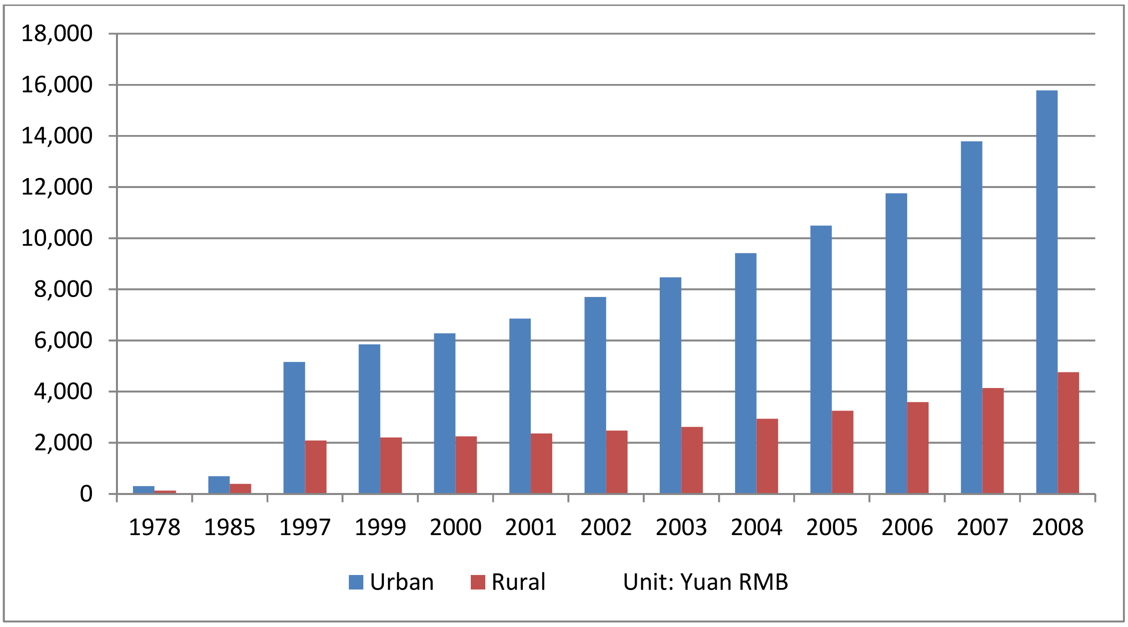

Figure C.2: Average Income of Chinese Urban and Rural People

Source: Created by the author based on NBS, 2008

Since the late 1980s, Chinese government and scholars have been paying increasing attention to the so-called "three agro-problems[31]" to achieve a more balanced development in China (Ren, Li, Guo, & Wang, 2008). For agriculture, a main problem and task is to realize agricultural industrialization through which a "Production-Supply-Distribution" can boost the agricultural productivity and commercialization. For rural, main tasks include enhancing rural development and reforming the household registration policy by which the rural free labour can be emancipated and utilized. For farmer, the main tasks are strengthening education and reducing the burden (Lu, 2008).

[28] According to NBS (2007), people with annual income less than 785 RMB Yuan is listed as absolute poor and people with annual income between 786 and 1067 RMB Yuan is listed as poor in China.
[29] In 2007, the Chinese minority population accounts for nine percent of the total Chinese population (NBS, 2007).
[30] For example, the three existing absolute poor regions of Sichuan province are of minority people and ninety percent of the poor rural people are minority ones in Puer city of Yunnan province (NBS, 2007).
[31] It is referred to as the *san nong wen ti* in Chinese pinyin, i.e. social and economic issues related to agriculture, rural development, and farmers (Ren et al., 2008).

C.2 Environment Problems in Rural Development

The desire to address poverty and widening gaps between both urban and rural areas has figured in the Chinese government's push to stimulate rural development (Brown, Waldron, & Longworth, 2005). Tangible measures have been undertaken to provide infrastructure and other macro-level support aimed at a more conducive environment for rural development (Brown et al., 2005). As discussed in chapter two, growth and expansion-led development have the potential risk of degrading local resources, polluting environment and further impoverish the rural poor people. Rural China has similar problems. Given the large and increasing population, it has been a top development question whether the agricultural resources would meet the demand of its population, providing an adequate supply of food, clothing, shelter, and fuel. Unequivocally, China does not want to rely on others to feed its population (Brown, 1995). The problem underlying the goal of self-sufficiency is the need of increasing agricultural production within the constraints of limited diminishing resources in a sustainable way.

However, a further problem is manifested which threatens the sustainability and the quality of life engendered for the majority—the problem of rural environmental pollution and degradation. In other words, the Chinese agricultural growth has been achieved at the expense of wide-range blight on the agricultural environment. The improper agricultural practices are threatening the long-run quality of the rural environment and the health of those who work in it and who consume from it (McCoy, 2000). Specifically, the inappropriate agricultural practices include but not limited to the overuse of chemical fertilizers and pesticides, the deteriorating rural environment, and the unscientific waste water irrigation.

The overuse of chemical fertilizers and pesticides has been proven to have tremendous negative impacts on the quality of soil, water and air through surface runoff into the soil profile, aquifer by percolation, and volatilization into the atmosphere (Neitsch, Arnold, Kiniry, & Williams, 2001). Unequivocally, the average amount of chemical fertilizers and pesticides used per hectare in Chinese agricultural land is above the average level of the world (Duan, 2002). The total amount of chemical fertilizers used in Chinese agriculture increased from 78,000 tons in 1952 to 37.91 million tons in 1985 (Duan 2002). Jiang (2000) announced 93 million hectares of the Chinese farmland were polluted because of overusing pesticides. The annual overall pesticide usage in Guangxi province, for instance, was 24,064 tons in 1990 and 42,375 tons in 1998 with an average growth rate of 8.45%. The average amount of pesticides used per hectare increased from 9.27 kilograms in 1990 to 16 kilograms in 1998. The amount was more than the safety limit[32] of pesticides for healthy agriculture (Duan, 2002).

Agriculture is one of the main victims of the Chinese industrial expansion. The mushrooming of rural industrial enterprises has led to more noise, water and atmospheric pollution, deforestation, soil erosion and floods in some areas and drought in others. Seven million Chinese enterprises, large and small, have produced too much pollutant which is ruining the rural environment, including soil, water and air. Statistics (Jiang, 2000) shows that more than 130,000 hectares of farmland was polluted by industrial solid wastes, and over 5.3 million hectares of land had been affected by air pollution. During the past several decades of years, industrial waste water other than night soil became the main source of waste water irrigation in China because of the outspread of cities and the overuse of chemicals, especially in the North where water resource is scarce. Jiang (2000) announced that 7.3 percent of the country's irrigated farmland was harmed by polluted water—a jump of 1.6 times over the figure in the 1980s. However, little progress has been made to control and improve the pollution problems caused by Chinese rural industries so far (Brown et al., 2005).

C.3 Governmental Administrative Structure

The general governmental administrative structure (hierarchy) of the Chinese government, including the provincial government of Hainan, from the highest (national) level to the lowest (village) level is shown

[32] The safety limit amount of pesticides for healthy agriculture is 15 kilograms per hectare (Duan, 2002).

in Figure C.3. In the top-down administrative system, the highest right organization in China is the National People's Congress which is held every five years. The Congress has the highest authorization in legislation, appointment of governmental officials, and inspection. The Chairman is selected in the National People's Congress. Under the Chairman, the State Council administers ministries and departments at the national level. Likewise, there are People's Congresses at the provincial and city levels. The governors and mayor are selected by public representatives in the People's Congresses. The government at the provincial and city/county level comprises different departments which administer inferior governmental organizations within their own fields.

The administrator at the bottom level is the village leader, who is usually selected directly by the village residents (Shi, 1999a, 1999b). In a village, there is a village council comprising several members who are in charge of administrative tasks of the village under the leadership of the village head (Shi, 1999a, 1999b). One ladder up the village level is the district level or the local level government. The officials of the local government are appointed, organized and administered by the government at the city/county level. As the superiors of village leaders, local governmental officials participate, coordinate, and administer community development tasks. In order to the head of the district government, local governmental officials also report to governmental officials at the city/county level. They are the linkages between community residents and government at upper levels.

C.4 A Brief History of Hainan

In China's ancient history, Hainan was always a backwater of the Chinese Empire or a miserable place of exile and poverty. Li, Deyu, a Prime Minister in China's Tang Dynasty[33], was exiled to Hainan Island which he dubbed as "The Gate of Hell". After the People's Republic of China was established in 1949, Hainan was only an affiliated island to Guangdong Province and was used as a navy base to protect its surrounding islands and territories which are in contention with other Southeast Asian countries (Xu, 1988). Hainan's development remains substantially behind other areas of Southern coastal China. Some scholars suggest that this was resulted from the "colonial policy" of the mainland towards the island in the pre-reform period: as an outpost of national defense and a source of domestic rubber production developed after the US-led embargoes of the early 1950s (Cadario, Ogawa, & Wen, 1992). Hainan did not attract significant investment in non-agricultural activities even after China's reforms began in 1978 (Xu, 1988). The limited support from the central government for infrastructure and industrial development in Hainan has made the province generally backward.

In the 7th National People's Congress on 13 April 1988, Hainan was designated by the Chinese central government as an independent province which comprises two main urban prefectures, Haikou and Sanya, six county-level cities, four counties and six minority autonomous counties (Gu & Wall 2007). In the same year, Hainan was granted preferential economic and tax treatments from the central government and became a Special Economic Zone[34] [SEZ] of China. As the largest SEZ of China, the preferential treatments allow Hainan to offer foreign investors an attractive package of tax exemptions, duty free status of production inputs, etc. Additionally, the central government declared its intention of making Hainan a special area that goes beyond other SEAs in system reform. Subsequently, Hainan was to have a "small government and large society", implying minimal economic intervention from the central government and few state-owned enterprises (Cadario et al, 1992). Specifically, the province was allowed to offer investors land-use rights on a leasehold basis for up to seventy years, to operate a free market in foreign exchange and, in general, to function primarily by the principles of market economy, without

[33] From 618 AD to 907 AD.

[34] A Special Economic Zone is a region that has economic laws different from a country's typical economic laws. Usually the goal is to increase foreign investment, introduce advanced technologies and create job opportunities. There are five SEZs in China—Shenzhen, Zhuhai and Shantou in Guangdong Province, Xiamen in Fujian Province, and Hainan Province.

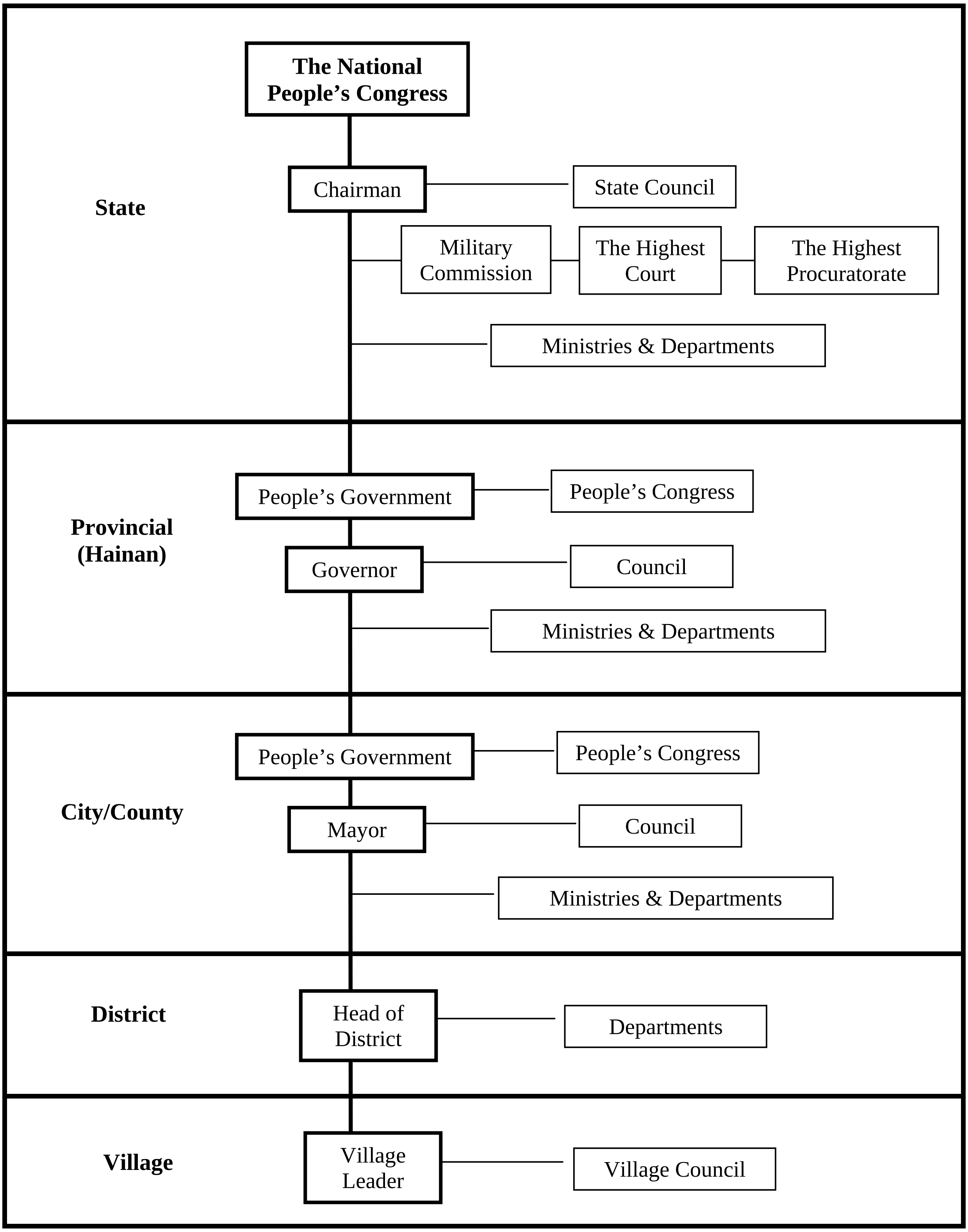

Figure C.3: Governmental Administrative Structure in China

Source: Created by the author based on Shi, 1999a & 1999b discrimination among enterprises on the basis of their ownership status (Cadario et al, 1992). In terms of taxation, the income tax of an enterprise would be collected at fifteen percent rather than 33 percent at the national normal rate. Hainan also differs in its ability to offer comparably more relaxed operation of business scope and foreign currency remittances. Foreign investors are encouraged to establish enterprises with preferential treatments of loans, site selection and land use. In addition, visa approval procedures for foreigners are more convenient than the rest of China. Hainan is the only province in China that implements "Visa Issued on Spot" for temporary visitors, making the province more accessible (Cadario et al., 1992).

Due to advantageous economic policies, Hainan has drawn much attention from both domestic and abroad investors, leading to great changes and remarkable economic achievements. In the year of 2004, Hainan's GDP achieved 69.17 billion RMB Yuan which represents an eleven-time increase than 5.73 billion RMB Yuan in 1987 (Hainan Provincial Bureau of Statistics [HPBS], 2004). However, Hainan's economy was developed as an enclave of free-market chaos operating on the periphery of the law. Instead of establishing a solid economic foundation, the province became a place for auto smuggling, real estate speculation and corruption[35]. Regarding the economic structure, agriculture is still the mainstay of Hainan's economy and accounts for 36.3 percent of the provincial GDP[36] (HPBS, 2004). The main agricultural products include natural rubber, smallholder rice paddies and vegetable plots. Growth in the past decade has been concentrated on commercial crops, such as coffee, tea, banana, pepper, sugar cane, and tropical medical herbals. Hainan's economic development has experienced regional disparities. In particular, the construction of the eastern freeway between the cities of Haikou and Sanya has spurred economic development in cities and townships along the freeway. On the other hand, in the western part of Hainan, where infrastructure construction has not received much attention from the provincial government, economic development has lagged behind.

C.5 Socio-Demographic Context of Hainan

In spite of its resources and the rapid economic growth pace after the establishment of the province, Hainan is still among the most economically backward provinces in China (HPBS, 2004). The rapid urbanization did attract more people to come to the urban centres, but Hainan is still dominantly rural due to relatively limited investment in local infrastructure and industry. With a large population base, rural population has kept increasing and represents a dominant proportion in the provincial population. As shown in Table C.1, rural population accounted for more than ninety percent of Hainan's population before 1983. The proportion of rural people in the total population has decreased gradually since 1986, but it was still more than seventy percent in 2003. Today, there are about six million rural people living in ten thousand villages across Hainan. While the history of economic development in Hainan is to some degree the one of agricultural development, most rural people in Hainan, especially the indigenous Li, Miao, Zhuang and Hui minorities, depend on local agriculture for a livelihood (Xia & Li, 1994). Approximately sixty to seventy percent of a Hainan farmer's average income is generated by exporting vegetables and fruits to mainland China during the winter season (Li, 1998). As a result, the considerations and researches about agriculture, rural areas and farmers are strategically important in constituting and developing the economic development strategies for Hainan province.

The minority population accounts for an important share of Hainan's total population. In 2003, there are 1.36 million minority people in Hainan, representing 17.2 percent of the total population (HPBS, 2004). Hainan is home to the Li, Miao, Zhang, Hui and other ethnic groups with respect population of 1.24 million, 64 thousand, 31 thousand, 9 thousand and 11 thousand (HPBS, 2004). Mainly concentrated in the south-central part of the province, most minority people are living in developing

[35] For example, the provincial government imported 90,000 duty-free Japanese cars in 1993 and resold in mainland for a profit of 150 percent.
[36] The highest weight of agriculture in provincial GDP among Chinese provinces and autonomous regions.

rural areas. For example, the Li and Miao Autonomous Prefecture in the south-central part of the province covers an area of 1,169 square kilometres and has a population of 100 thousand and 59 percent of the population are Li minority people (HPBS, 2004). Also, there are regions in Hainan with Hui (Moslem or "Utsat") and Indonesian Chinese minorities (Pang, 1996). Without written script, the spoken language of the Li people belongs to the Chinese-Tibetan language family (Wu, 1991). Although a new Romanized script was created for the Li ethnic group in 1957 with the government's assistance; many of the minority people now understand and speak the Chinese official language, Mandarin.

Table C.1: Population and Its Composition in Hainan

Year-end	**Total Population of Hainan** (10,000 persons)	**Urban Population**		**Rural Population**	
		# (10,000 persons)	% of Total Population	# (10,000 persons)	% of Total Population
1952	259.40	20.75	8.00	238.65	92.00
1957	290.81	33.19	11.41	257.62	88.59
1962	335.18	45.16	13.47	290.02	86.53
1965	365.79	34.48	9.43	331.31	90.57
1971	454.50	35.74	7.86	418.76	92.14
1974	487.77	37.46	7.68	450.31	92.32
1977	516.36	41.00	7.94	475.36	92.06
1980	552.53	49.35	8.93	503.18	91.07
1983	580.66	55.75	9.60	524.91	90.40
1986	605.63	73.60	12.15	532.03	87.85
1989	638.79	112.43	17.60	526.36	82.40
1992	671.32	126.55	18.85	544.77	81.15
1995	702.42	146.45	20.85	555.97	79.15
1998	733.31	175.09	23.88	558.22	76.12
2001	769.50	190.89	24.81	578.61	75.19
2003	790.26	204.63	25.89	585.62	74.10

Source: Adapted from HPBS, 2004

Appendix D: Interview Guide
(Sample Questions for Government Officials)

1. Please provide the basic information of your position as a governmental official – institution, administrative level, & your roles in relation to rural energy planning.

2. Broad discussions on environment, energy, resources, livelihoods, & planning in developing rural areas.

3. Please introduce the policies, plans, & information relative to rural energy uses & planning in Hainan, particularly on the rural energy intervention programs.

4. How do you agree or disagree with the following concerns as the motivations of the rural energy intervention programs?

	Strongly disagree	Disagree	Neutral/ don't know	Agree	Strongly agree
Energy needs of rural people	☐	☐	☐	☐	☐
Improving rural livelihoods	☐	☐	☐	☐	☐
Following-up superior decisions	☐	☐	☐	☐	☐
Pressures from nearby provinces	☐	☐	☐	☐	☐
Pressures from nearby countries	☐	☐	☐	☐	☐
Fulfilling provincial mission	☐	☐	☐	☐	☐
Setting green images of jurisdiction	☐	☐	☐	☐	☐
Loss of forest resources	☐	☐	☐	☐	☐
Threats to environment/resources	☐	☐	☐	☐	☐
Costs to ecological rehabilitation	☐	☐	☐	☐	☐

5. Please describe the rural energy planning practice, specifically in the rural energy intervention programs regarding the expectations, procedures, contents, impacts, problems, & challenges.

6. On a scale from 1 to 5, how do you agree with that rural energy planning should address the following issues/statements respectively? (Note: 1 = strongly disagree, 2 = disagree, 3 = neutral/don't know, 4 = agree, 5 = strongly agree) Also, please elaborate on whether the issues/statements have been performed in Hainan's rural energy planning practices based on your knowledge and experience. Why or why not?

At the operationalization stage:

- Aims at positively improving the welfare of all people, especially the poor & disadvantaged;
- Addresses sufficiency & opportunities of current generation in ways that do not compromise future generations' opportunities;
- Identifies energy problems & objectives of energy intervention programs, which are fully informed among all stakeholders, particularly local people to be intervened;
- Makes pertinent data & information accessible to all & communicate relevant information to stakeholders;
- Concentrates on a limited number of key factors leading to the identified energy problems & provides reliable information for decision-making;

- Considers factors of energy sustainability, including accessibility, efficiency & acceptability against local geographical & economic conditions as well as barriers of proposed energy intervention programs;
- Considers various opinions by involving interested & affected public, professional, social groups & government bodies throughout the decision-making process;
- Prepares alternative options for the proposed energy intervention programs upon the identified problems;

At the implementation stage:

- Acknowledges 'trial & error'–testing the effectiveness of experimental projects in limited destinations before wide implementation & promotion;
- Implements energy intervention programs based on local conditions & seeks for time/cost effectiveness;
- Emphasizes 'learning by doing'–acquiring insights from both successful & unsuccessful experiences;
- Prepares initial incentives to responding & affected people for participating in the programs;
- Defines the duties & responsibilities of leading & participating organizations & ensures exchange of information & collaboration among agencies;
- Requires all stakeholders to exert their functions in energy intervention programs collaboratively;
- Provides technical support to the local people–fully explains existing problems of energy uses with a focus on the rationale & potential impacts of energy intervention programs;
- Facilitates social learning among all stakeholders on the energy issues in question to mediate potential conflicts which may discontinue the energy intervention programs;

At the monitoring stage:

- Conducts regular assessment of the energy program to influence the decision-making & planning process;
- Updates & makes relative data & information accessible to all, & communicates with stakeholders;
- Encourages local people to keep learning the technologies/devices from their colleagues & other sources;
- Provides incentives to local people for continuous using new technologies or devices;
- Considers development options & alternative proposals;
- Has adaptive capacity to learn from & adjust policies & plans based on results from project assessment;
- Seeks legislative opportunities to regulate environment & resource devastating activities;
- Prepares strategies to keep the use of new energy technologies/devices active & widen their applications at a broader scale.

7. Do you have any other comments or suggestions on planning for rural energy intervention and other development programs in Hainan or elsewhere?

8. Please identify other stakeholders of rural energy planning in Hainan & recommend other officials, specialists, & village leaders for further interview.

Appendix E: Interview Guide
(Questions for Planners, Technical Specialists, & Scholars)

1. Please provide some basic information on how your job relates to rural energy planning in Hainan, e.g., the institution or company you work in, your position, main tasks, and roles.

2. How do you see rural energy planning as a collaborative work that requires various actors' participation?

3. How do you see your role as an intermediate between the government and the public? How do you facilitate the implementation of government energy policies and plans? How do you reflect your local experience to the government to impact policy adjustments and reorientation?

4. Please discuss the local rural energy planning practice, in terms of the goals, objectives, contents, financial sources, implementation, monitoring and evaluation.

5. Based on your knowledge and experience, please offer comments and insights on why rural energy intervention programs in Hainan have succeeded or failed. Have these insights reached or been adopted by the decision-makers to generate meaningful policy adjustments which lead to more effectiveness?

6. What do you see as the barriers that prevent the rural energy intervention programs from being more effective in both your and other stakeholders' capabilities?

7. Could you identify any planning theory or approach that had been adopted in Hainan's rural energy planning practice?

8. On a scale from 1 to 5, how do you agree with that rural energy planning should address the following issues/statements respectively? (Note: 1 = strongly disagree, 2 = disagree, 3 = neutral/don't know, 4 = agree, 5 = strongly agree) Also, please elaborate on whether the issues/statements have been performed in Hainan's rural energy planning practices based on your knowledge and experience. Why or why not?

At the operationalization stage:

- Aims at positively improving the welfare of all people, especially the poor & disadvantaged;
- Addresses sufficiency & opportunities of current generation in ways that do not compromise future generations' opportunities;
- Identifies energy problems & objectives of energy intervention programs, which are fully informed among all stakeholders, particularly local people to be intervened;
- Makes pertinent data & information accessible to all & communicate relevant information to stakeholders;
- Concentrates on a limited number of key factors leading to the identified energy problems & provides reliable information for decision-making;
- Considers factors of energy sustainability, including accessibility, efficiency & acceptability against local geographical & economic conditions as well as barriers of proposed energy intervention programs;
- Considers various opinions by involving interested & affected public, professional, social groups & government bodies throughout the decision-making process;
- Prepares alternative options for the proposed energy intervention programs upon the identified problems;

At the implementation stage:

- Acknowledges 'trial & error'–testing the effectiveness of experimental projects in limited destinations before wide implementation & promotion;
- Implements energy intervention programs based on local conditions & seeks for time/cost effectiveness;

- Emphasizes ‘learning by doing’–acquiring insights from both successful & unsuccessful experiences;
- Prepares initial incentives to responding & affected people for participating in the programs;
- Defines the duties & responsibilities of leading & participating organizations & ensures exchange of information & collaboration among agencies;
- Requires all stakeholders to exert their functions in energy intervention programs collaboratively;
- Provides technical support to the local people–fully explains existing problems of energy uses with a focus on the rationale & potential impacts of energy intervention programs;
- Facilitates social learning among all stakeholders on the energy issues in question to mediate potential conflicts which may discontinue the energy intervention programs;

At the monitoring stage:

- Conducts regular assessment of the energy program to influence the decision-making & planning process;
- Updates & makes relative data & information accessible to all, & communicates with stakeholders;
- Encourages local people to keep learning the technologies/devices from their colleagues & other sources;
- Provides incentives to local people for continuous using new technologies or devices;
- Considers development options & alternative proposals;
- Has adaptive capacity to learn from & adjust policies & plans based on results from project assessment;
- Seeks legislative opportunities to regulate environment & resource devastating activities;
- Prepares strategies to keep the use of new energy technologies/devices active & widen their applications at a broader scale.

9. Do you have any other comments or suggestions on planning for rural energy intervention and other development programs in Hainan or elsewhere?

10. In addition to the government policies and plans, please recommend other documents or reports on local energy intervention programs for more information and extended reading.

Appendix F: Interview Guide
(Sample Questions for Village Cadres)

1. Please introduce the basic information of the village, such as the demographic information, local economy, problems in community development, and opportunities for future development.

2. Please describe your leadership and administrative roles in the rural energy intervention programs.

3. How do you compare the rural energy intervention programs with other community development initiatives, such as village renovation, developing economic agricultural products, establishing community-based industries, and public education?

4. How do you see your role as an intermediate between the government and the public? How do you facilitate the implementation of government energy policies and plans? In additional to the local residents, how do you collaborate with other actors in the rural energy intervention programs?

5. What are the local challenges that impede the implementation of government energy policies and plans?

6. Based on your knowledge and experience, please offer comments and insights on why rural energy intervention programs in your village have succeeded or failed. Have these insights reached or been adopted by the decision-makers to generate meaningful policy adjustments which lead to more effectiveness?

7. What do you see as the barriers that prevent the rural energy intervention programs from being more effective in both your and other stakeholders' capabilities?

8. Could you identify any planning theory or approach that had been adopted in Hainan's rural energy planning practice?

9. On a scale from 1 to 5, how do you agree with that rural energy planning should address the following issues/statements respectively? (Note: 1 = strongly disagree, 2 = disagree, 3 = neutral/don't know, 4 = agree, 5 = strongly agree) Also, please elaborate on whether the issues/statements have been performed in Hainan's rural energy planning practices based on your knowledge and experience. Why or why not?

At the operationalization stage:

- Aims at positively improving the welfare of all people, especially the poor & disadvantaged;
- Addresses sufficiency & opportunities of current generation in ways that do not compromise future generations' opportunities;
- Identifies energy problems & objectives of energy intervention programs, which are fully informed among all stakeholders, particularly local people to be intervened;
- Makes pertinent data & information accessible to all & communicate relevant information to stakeholders;
- Concentrates on a limited number of key factors leading to the identified energy problems & provides reliable information for decision-making;
- Considers factors of energy sustainability, including accessibility, efficiency & acceptability against local geographical & economic conditions as well as barriers of proposed energy intervention programs;
- Considers various opinions by involving interested & affected public, professional, social groups & government bodies throughout the decision-making process;
- Prepares alternative options for the proposed energy intervention programs upon the identified problems;

At the implementation stage:

- Acknowledges 'trial & error'–testing the effectiveness of experimental projects in limited destinations before wide implementation & promotion;

- Implements energy intervention programs based on local conditions & seeks for time/cost effectiveness;
- Emphasizes ‘learning by doing’–acquiring insights from both successful & unsuccessful experiences;
- Prepares initial incentives to responding & affected people for participating in the programs;
- Defines the duties & responsibilities of leading & participating organizations & ensures exchange of information & collaboration among agencies;
- Requires all stakeholders to exert their functions in energy intervention programs collaboratively;
- Provides technical support to the local people–fully explains existing problems of energy uses with a focus on the rationale & potential impacts of energy intervention programs;
- Facilitates social learning among all stakeholders on the energy issues in question to mediate potential conflicts which may discontinue the energy intervention programs;

At the monitoring stage:

- Conducts regular assessment of the energy program to influence the decision-making & planning process;
- Updates & makes relative data & information accessible to all, & communicates with stakeholders;
- Encourages local people to keep learning the technologies/devices from their colleagues & other sources;
- Provides incentives to local people for continuous using new technologies or devices;
- Considers development options & alternative proposals;
- Has adaptive capacity to learn from & adjust policies & plans based on results from project assessment;
- Seeks legislative opportunities to regulate environment & resource devastating activities;
- Prepares strategies to keep the use of new energy technologies/devices active & widen their applications at a broader scale.

10. Do you have any other comments or suggestions on planning for rural energy intervention and other development programs in your and other villages?

11. In addition to the government policies and plans, please recommend other documents or reports on the energy intervention programs in your village for more information and extended reading.

Appendix G: Survey Questionnaire (Villagers)

Name of Informant： ______________________________ Date： _______________________________

Please fill in the blanks or choose the best answer(s) and mark with “×” in “☐” all that apply for each question. If you have uncertainties about the questions, please feel free to ask the interpreters.

Demographic & Household Information:

(1) Gender:
☐Female ☐Male

(2) Educational Level:
☐0 – 6 years ☐Some Secondary Education
☐High School Graduate ☐College Graduate
☐University Graduate/Bachelor’s Degree or above

(3) Age:____

(4) Ethnicity:
☐Han ☐Li ☐Miao ☐Hui ☐Mixed ☐Other, please specify:_____________

(5) Occupation:
☐Agriculture ☐Fishery ☐Forestry ☐Animal Husbandry ☐Other, please specify:___________

(6) Residential Settings:
☐Mountain ☐Forest ☐Grassland ☐Waterfront ☐Other, please specify:__________

(7) Number of People in Your Household:____

Residential Energy Uses

(1) Residential energy system(s) in your household:

Energy Systems	Usage (cooking, lightening, heating, recreation, etc.)
☐Open-fire stove	
☐Energy-saving stove	
☐Stove of liquefied gas	
☐Biogas digester	
☐Solar energy device	
☐Photovoltaic device	
☐Electronic device	
☐Other device, please specify:	

(2) How do you agree or disagree with that the energy intervention programs help community capacity building?

Strongly disagree	Disagree	Neutral/do not know	Agree	Strongly agree
☐	☐	☐	☐	☐

(3) Have you participated in any rural energy intervention programs? Are there any changes of your household energy sources or energy systems?

____

____

(4) How do you agree or disagree with the following problems that impede you from participating rural energy intervention programs?

	Strongly disagree	Disagree	Neutral/do not know	Agree	Strongly agree
Financial problems	☐	☐	☐	☐	☐
Market problems	☐	☐	☐	☐	☐
Technical problems	☐	☐	☐	☐	☐
Institutional problems	☐	☐	☐	☐	☐
Social & cultural problems	☐	☐	☐	☐	☐

Others, please feel free to elaborate:____

____

____

(5) To make the current participation mechanism better, how do you think about the following types of participation? Why?

	Strongly disagree	Disagree	Neutral/do not know	Agree	Strongly agree
Public hearings	☐	☐	☐	☐	☐
Citizen advisory boards	☐	☐	☐	☐	☐
Community meetings	☐	☐	☐	☐	☐
Citizen representatives	☐	☐	☐	☐	☐
Citizen surveys	☐	☐	☐	☐	☐
Stakeholder workshops	☐	☐	☐	☐	☐
Civic institutions	☐	☐	☐	☐	☐
Telephone hotline	☐	☐	☐	☐	☐
Internet surveys	☐	☐	☐	☐	☐

Others, please specify:____

____

____

(6) To make the rural energy planning practice better, how do you agree with the following concerns?

	Strongly disagree	Disagree	Neutral/do not know	Agree	Strongly agree
Flexible policies/plans	☐	☐	☐	☐	☐
More learning opportunities	☐	☐	☐	☐	☐
Improving in practices	☐	☐	☐	☐	☐
Improving energy systems	☐	☐	☐	☐	☐
Active learning	☐	☐	☐	☐	☐
More participation activities	☐	☐	☐	☐	☐
Stakeholders’ info. sharing	☐	☐	☐	☐	☐
More support	☐	☐	☐	☐	☐
More cooperation	☐	☐	☐	☐	☐

Others, please specify:____

____

Please try to answer the following questions, especially if you participated in rural energy intervention programs:

(1) Before adopting new energy system(s), were you aware of or familiar with the facts/programs of…

	Yes	A little	No
The Eco-province Strategy	☐	☐	☐
The Civilized & Ecological Village Program	☐	☐	☐
The problems of traditional energy uses	☐	☐	☐
The objectives of the energy intervention programs	☐	☐	☐
The rationale of the energy system(s) to be adopted	☐	☐	☐

(2) To what level do you participate in the rural energy intervention programs? Why?

☐As a token, I have representatives and I do not have real input or power in the process.

☐Tasks are assigned, with incentives; officials decide agenda and direct the process.

☐My opinions are asked. Then, experts and officials analyze and make decisions.

☐We local people work together with experts and officials to determine priorities, responsibility remains with officials for directing the process.

☐We local people, experts and officials share knowledge to create new understanding and work together to form action plans, with outsider facilitation.

☐We local people set our own agenda and mobilize to carry it out, in the absence of outside initiators and facilitators

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____

(3) How do you evaluate the local environment/resources? ☐Very good ☐Good ☐Poor

(4) Is protecting rural environment/resources important to you? If yes, why?

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____
____

(5) Have the new energy systems/technologies become the primary energy providers in your household? ☐Yes ☐No ☐Not sure

(6) Have the energy intervention programs impacted your livelihoods in a positive and/or negative way? How? ☐Positive only ☐Negative only ☐Both

____
____
____

(7) Overall, are the energy intervention programs good or bad? ☐Good ☐Bad ☐Not sure

(8) Do you have any other concerns or suggestions on rural energy planning or the energy intervention programs?

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