An Investigation into the Lexicon of Waste

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

Since the onset of the Industrial Revolution, the increase in population, urbanization, cheap energies, and new technologies have bankrupted the environment into destruction. This chaos has created a society that transformed itself into one of continual wasting, where energy and resources are constantly dissipating. The myriad of new materials, the decline of the skilled craftsman, and cheap construction are part of the lexicon that defines the 21^{st} century built landscape and ultimately contribute to current plight. Architecture will become an increasingly significant factor in determining the sustainability of the built environment, as defined in terms of life span, carbon footprint, and in our ability to confine this dissipated and inert energy into near infinite circulation. This thesis investigates methods to maximize the value of existing resources such as waste in the context of a much larger framework of systems—societal, socioeconomic, geopolitical, and environmental factors that concern the current discourse. An analysis of design methods and strategies into the ecology of waste, such as: cradle to cradle, secondary re-use of post consumer materials, embodied energy, life-cycle analysis tools, and design for deconstruction—aid in a series of themed hypotheses and experimental projects. These projects use waste and wasted landscape to seek answers to a series of questions that deal with the future predicament of our cities in order to shift perceptions and form contemporary methodologies that assist in calibrating potentials for future waste and waste-scapes.

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INTRODUCTION

As a society we are becoming increasingly sensitive to our symbiotic relationship with the environment and the impact that we have on the vulnerability of the earth. As the thermodynamics of these systems integrate into an ecosystem that is constantly in pursuit of equilibrium, thermodynamics imparts an infrastructural framework on how we should approach these topics simultaneously in the near future. Entropy Law is the Second Law of Thermodynamics and deals with the physical and material world where everything is finite and eventually terminates. It is a law governing the horizontal world of time and space and is communicated in our quotidian lives indirectly through various topics such as architecture, urbanization, economy, and agriculture. Since the earth is a closed-loop system, all its energy, nutrients, and resources are not infinite but will eventually cease to exist. Entropy controls these physical and energetic activities, which explain the recent succession into environmental strife. It also explains the existence of pollution, death, and decay—all synonymous with waste.

The last half of the 20th century presented cultural implications on this topic as society's mentality shifted from frugality to astronomical feats of consumption. The flow of goods and substances, of people, and industries are the essence of our economy today and are driven by consumerist influences. The resulting consequences ultimately have an entropic effect of horizontal urbanization and formation of waste-scapes, such as places of abandonment, contaminated sites, wasted space, landfills, and junkyards. This wasteful mindset causes us to become emancipated from the bonds of nature through exploitations, unlimited expansion, and material abundance, which eventually lead to devastating cyclical outcomes in our closed environmental system. Since our mindset is so deeply rooted in those of capitalism and economics, it is particularly difficult to come out of this paradigm for living, which is one of continually replacing or fixing objects, technology, and energy during times of crisis, and with newer (not better) alternatives without facing the consequences.

Waste is an important discourse, yet one of the least examined enigmas of the 21st century. This makes waste an ideal subject for examination, as it affects society, culture, architecture, infrastructure, the environment, and its landscape. To fully understand its implications and limitations, this thesis focuses on how architecture can be used as a tool to mediate between waste and waste-scapes, and how waste-scapes can be transformed into a positive place for economic stimuli. By investigating possible solutions in dealing with our wastefulness, from design-for-deconstruction to secondary reuse of post-consumer material, cradle-to-cradle design, and the design of zero-waste communities, we may better understand how these two themes—architecture and waste—together, can make an immense contribution in today's society. Though waste is the main topic in this thesis, it is better understood in the context of industrialized urban societies and while industrial waste is mentioned, this thesis largely targets consumer sources of waste and their perspectives on wasting. It is also imperative to question *wasting* and *wastefulness* and furthermore to acknowledge that the position this thesis takes on is only part of a solution to a growing problem and is one of many streams that work towards the maximization of resources and the minimization of waste.

Since waste contains large amounts of embodied energy it is especially devastating when packaging takes up a large percentage of garbage production. The goal then, is to maximize the added value of these materials in order to keep this energy from continually dissipating. Its ephemeral qualities keep us from seeing its full potential as building materials that house qualities similar to existing technological achievements in the construction industry. Through secondary reuse, it retains this value and reclaims the material destined for landfill by freeing potential embodied energy costs. The process of recycling may no longer seem to be a feasible option, given its high-energy consumption; therefore we must reuse and design buildings for disassembly in order to ease the salvaging process and encourage reuse in future buildings. These buildings are also inherently flexible and allow for modification or renovation to conform to the volatile nature of our lifestyle needs. With the flux of demolition wastes that are becoming increasingly difficult to dispose of and with increasing amounts, landfill taxes are becoming infeasible. Design for deconstruction is proving to be not only environmentally responsible, but an economical choice. Evaluating and reusing existing resources may redefine the existing dichotomy between architecture and the natural environment. This discipline may aid architects in re-imagining the urban fabric of cities and communities, where the beginning of change stems from the abolition of cultural stigmas and the rehabilitation of acceptance surrounding this discourse.

The thesis is composed of three parts: *past, present,* and *future,* with the insertion of photographic essays that document and summarize a topic in each chapter. These photographic essays will uncover and reveal our relationship and dependence on everyday objects and how this contributes to a larger framework of global depletion and chaos that is often kept hidden and secret from public view. It generates, dialectically, new insights about our relations to technology, to beauty, to production and consumption, and distills the logic of excess. The images act as a conveyer of a visual-cultural system of layers that have multiple meanings and perceptions, and reinforce the magnitude of adaptive reuse. The three written installments work together to give a comprehensive look into the waste crisis, where each section builds upon an argument introduced in previous sections. The *past* introduces implications with our current cultural, socioeconomic, and geopolitical situation by observing how the past has influenced present conditions. The *present* acknowledges the past by evaluating current initiatives and how architecture may be a discipline that can aid in the offset of the accelerative process of environmental degradation. Lastly, part three concludes by investigating how *future* communities can harness to the best of their potential, past and present technologies in a sustained and symbiotic environment between man and nature.

This dissertation should be read as a tabula rasa set in motion by the future and understood by way of observation and experimentation exuding limitless ideas and possibilities. All information and statements are directed and projected at North American culture and by no means meant to be observed as kitsch Third World solutions. This thesis hinges upon several assumptions:[1]

[2] Several assumptions are adapted from: Martin Pawley, *Garbage Housing* (England: Architectural Press, 1975), 109.

1. Waste of any kind can provide high-performance building materials as long as it satisfies the building criteria. This can be either implemented in original form or with other manufactured building product that aids in the reuse of waste; or, that the reutilization of waste materials are modified for suitability of application.

2. The buildings constructed from this waste are not only globally acceptable, but concepts can be easily conceived by the unskilled or do-it-yourselfer and does not require intensive reprocessing. Some embodied energy is required, however, it is far less than remanufactured or new material, and energy spent is considered renewable.

3. The merging between economy and reuse in waste will bring about positive changes, especially the change in cultural perception and stigma

associated with waste and building products. These positive changes are a) reduced strain on global resources, b) the gaining of additional resources that would have been lost due to landfilling, and c) that waste-scapes will contribute to the betterment of society and improvement of the environment.

4. That reutilizing waste is feasible for any government, the economy, and capitalist society. This in turn will facilitate reduction in consumption, renewed partnership between people and the environment, and economic stability through waste-scapes and the regeneration of resources.

5. All three projects are equally weighted. Moreover, the Ontario Place project in Part III is to be seen as a jovial re-envisioning of a future eco-society and not seen solely as a sustainability proposal. Rather, it strives to engage the possibilities between the waste stream and communities as well as to transform societal perspectives on waste.

The city of Leonia refashions itself every day: every morning the people wake between fresh sheets, wash with just-unwrapped cakes of soap, wear brand-new clothing ,take from the latest model refrigerator still unopened tins, listening to the last-minute jingles from the most up-to-date radio.

On the sidewalks, encased in spotless plastic bags, the remains of yesterday's Leonia await the garbage truck. Not only squeezed tubes of toothpaste, blown-out light bulbs, newspapers, containers, wrappings, but also boilers, encyclopaedias, pianos, porcelain dinner services. It is not so much by the things that each day are manufactured, sold, bought that you can measure Leonia's opulence, but rather by the things that each day are thrown out to make room for the new. So you begin to wonder if Leonia's true passion is really, as they say, the enjoyment of new and different things, and not, instead, the joy of expelling, discarding, cleansing itself of a recurrent impurity…

The more Leonia expels goods, the more it accumulates them….As the city is renewed each day, it preserves all of itself in its only definitive form: yesterday's sweepings piled up on the sweepings of the day before yesterday and of all its days and years and decades.

- Italo Calvino, *Invisible Cities,* 1974

PART I | PAST

P E T R O L I A

Because the world is now consuming resources at more than twice the rate of their development and discovery, resource exploitation and urban development are closely aligned phenomena; the seeds of contemporary cities are often to be found in newly discovered resources or in the great wealth that has accrued to some small oil-spoilt states.

- Mason White, Resource Fields in *Fuel*

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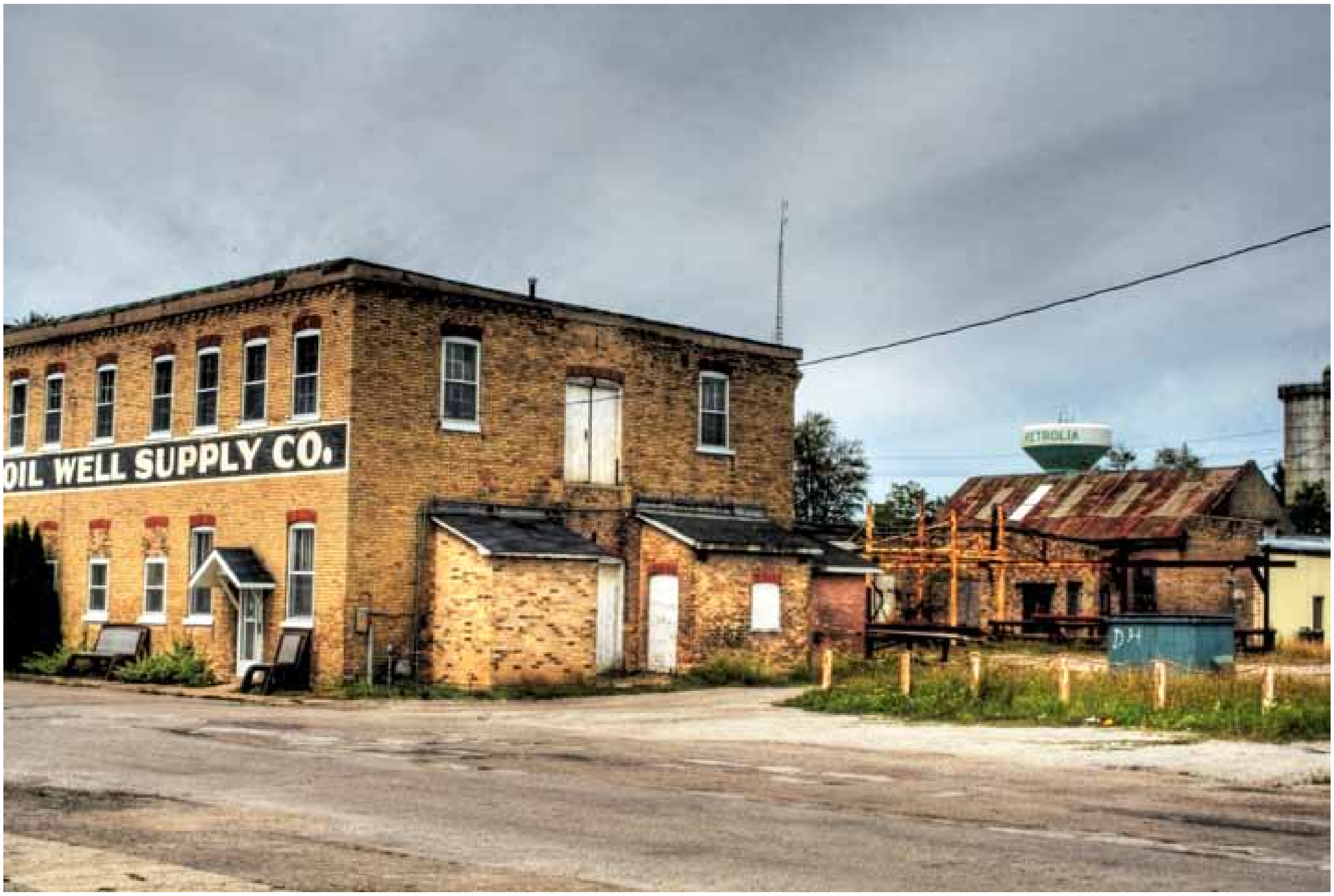

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1.1 THE WASTE CRISIS

Civilization has gotten itself into a precarious predicament when the discovery of cheap energy made it possible to fuel the industrial revolution through the nineteenth-century. As massive changes in agriculture, mining, manufacturing, and transport occurred, these changes ultimately had a profound effect on the socioeconomic and cultural face of North America. "For the first time in history, the living standards of the masses of ordinary people have begun to undergo sustained growth, nothing remotely like this economic behavior has happened before," [1] asserts economist Robert E. Lucas, Jr. This feat in history still lingers to the present day.

[1] Robert E. Lucas, Jr., *Lectures on Economic Growth* (Cambridge: Harvard University Press, 2002), 109–10.

Futurist, Alvin Toffler describes these milestones in history as part of three waves. The first being the age of agriculture, which took thousands of years to achieve; the second is the industrial society, from the late eighteenth-century through to the mid-1900s, and lastly the third wave, a wave of post-industrialist societies made up of a knowledge based community, of technology, science, information, diversity, and mass-customization.[2] This is *our* age. After exhausting the global resource base, we seek other alternatives for material-less consumption, through electronic databases, the Internet, and wireless communications. It seems now we are living the American-Dream, but the question still holds whether we can find solutions to sustain it, even at the expense of the environment.

[2] Alvin Toffler, *The Third Wave* (New York: Bantam Books, 1980)

This knowledge-based society is interwoven into interdependent matrices of complicated cybernetics, technology, and interdependent artifacts. "The more we cultivate knowledge, the more our environment assumes this character; the more it does, the more effective knowledge becomes....Trash is the interdependent artifact that confronts knowledge at its limits." [3] Our limited ability to solve the waste crisis is astonishing especially since we are so rooted in the origins of our waste. The perplexing matter stems from how waste is the one substance that continually looms over civilization throughout history and instead of solving the crisis, we cast it off in marginal *waste-places*: landfills, alleyways, the ocean; anywhere but within our domains. Perhaps too, instead of dealing with the waste crisis, we prefer to

[3] Barry Allen, "The Ethical Artifact: On Trash," In *Trash*, ed. John Knechtel (Cambridge, Mass.: Alphabet City, 2007), 206.

hide our misfortunes from public eye as garbage is perceived to be the most symbolically damaging, and is an irritating and visible form of waste.

What is waste anyway? Or one may ask, what is the root? We describe it in a variety of ways, usually having connotations such as: *defiled, foul, unhygienic, and unsanitary*; all synonyms for *dirty*. Though the word has many meanings, there can be no clear and accurate depiction of the word 'waste' as it is defined differently between countries, cultures, socioeconomic groups, people, and even species to species. To begin, we must understand what the term 'waste' implies.

Originally, the word 'waste' came from the Latin—'vastus', meaning unoccupied or desolate; relating to the Latin 'vanus', meaning empty or vane; and hovered around descriptions such as barren, useless, and hostile to man.[4] The Oxford English Dictionary (OED) has hundreds of synonyms describing waste, all with negative connotations and centred on man. However, the description that is created and used in this dissertation, and also one that is commonly accepted is that—*waste is subjective to the user, who once took value in the object, place, or material, and henceforth has no value or usefulness to the user*. Waste can be a person, place, object, material/element, landscape, and interstitial space. Though the development between inception, birth, decline, death, and eventually wasting, is natural and essential to sustain life and growth, it is a necessary process that enables progression and development.

[4] Kevin Lynch, *Wasting Away* (San Francisco: Sierra Club Books, 1990), 146.

The mantra of scientific germ theories that stemmed from particular infectious diseases was made popular and widely accepted as heaps of garbage piled up in cities, forcing municipalities to take waste under their stewardship. This situation later lead to huge infrastructural projects and urban sprawl. Trash is created by sorting and requires a decision as to whether to keep or discard. Even the simple act of weekly laundry, sorting colours and fabrics involves systematic ordering and classification, "eliminating dirt [then] is thus [seen] as a positive process." [5]

[5] Susan Strasser, *Waste and Want* (New York: Metropolitan Books, 1999), 5.

Figure 1.1. Three waves in history: 1. Agriculture 2. Industrial Society, and 3. Information Society. Graph shows approximate progression.

Americans are the leading cause of the waste crisis, producing nearly 300 million tons of municipal solid waste each year at 30 per cent of the world's waste, while Canadians fall far behind, producing only 5 million tons.[6] In 1970, America produced 70 per cent of the world's waste at the same tonnage with only 6 per cent of the world's population.[7] To understand the magnitude of this, the Manhattanites of New York City dispose 38,000 tons of waste paper each day, enough to fill a volume the size of the Empire State building every two weeks.[8] Disputes arise in recycling as paper uses many chemical products such as hydrogen peroxide, chlorine, ozone, bleach, fungicides, glues, and inks—representing a great challenge in this field.[9] This is especially evident when one considers that paper is the most abundant material in the municipal solid waste stream at just over 60 per cent. For half a century, all this urban refuse ended up in Fresh Kills landfill on Staten Island and it has since been dubbed the world's largest man-made object,[10] "25 times the size of the Great Pyramid of Khufu and 40 times the size of the Temple of the Sun at Teotihuacan.

[6] Pierre Bélanger, "Trash Topography," *The Canadian Architect* 52, no. 1 (January 2007), 17.

[7] Kevin Lynch, *Wasting Away* (San Francisco : Sierra Club Books, 1990), 49.

[8] Michell Joachim, "Urban Refuse: Housing & Wall E.," *evolo* 1 (Fall 2009): 62.

[9] Daniel Kula and Elodie Ternaux, *Materiology* (Amsterdam: Birhauser & Frame, 2009), 27.

[10] Barry Allen, "The Ethical Artifact: On Trash," In *Trash,* ed. John Knechtel (Cambridge, Mass.: Alphabet City, 2007), 208.

[11] William Rathje and Cullen Murphy, *Rubbish! The Archaeology of Garbage* (New York: Harper Collins, 1992), 4.

Previous page: Figure 1.2. Garbage.

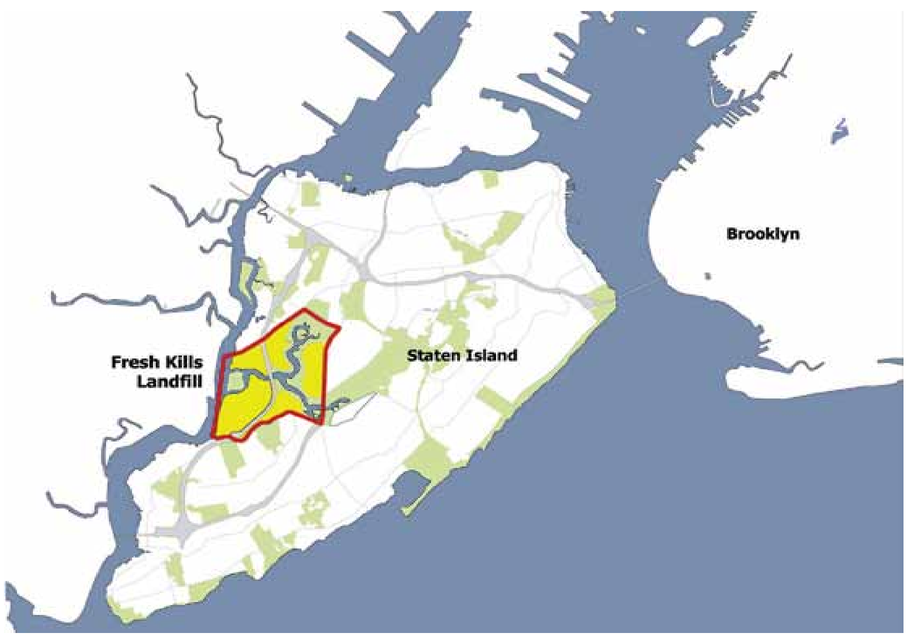


Figure 1.3. *Left,* Empire State Building

Figure 1.4. *Right,* Fresh Kills, 2200 acres on Staten Island

The volume is approaching that of the Great Wall of China." [11] It is not that Americans are producing less garbage, but that the world is catching up to their wasteful proclivities.

For centuries quotidian life involved little to no waste. Wasting is a new concept brought on by early-nineteenth-century "industrialization, urbanization, and codes, [that] tie civility to cleanliness [turning] it into a problem." [12] The success of mid-twentieth-century economic growth and progress, and modern cultural ideals of cleanliness, morphed the process of wasting into a positive act and defied frugality. Being thrifty had low-class connotations, as there was no need to save things any longer as mechanized and standardized production offered a variety of cheap materials to the industries. The outcome of these products contributed to the throwaway culture as these items were often inexpensive and easily worn out; sometimes obsolete after a few uses or even discarded after single use.

[12] Mira Engler, *Transforming America's Waste Landscapes* (Maryland: John Hopkins University Press, 2004), xvi.

As more women entered the work force, they were no longer able to keep up their share of housework. Paper companies such as Kimberly-Clark Corporation, left with a surplus of military gauze and gas mask filters after the First World War abruptly ended, were forced to find new uses for their materials. Kotex®, a brand that is so common to women today, is one of the results of this material.[13] Manufacturers deliberately designed personal products specifically to encourage repetitive consumption, and targeted these women because they were more likely to find apt solutions for their lifestyle through disposables. Products such as sanitary napkins, Kleenex®, paper towels, and disposable plates, circumvented ac-

[13] Giles Slade, *Made to Break* (Cambridge, Mass.: Harvard University Press, 2006), 20.

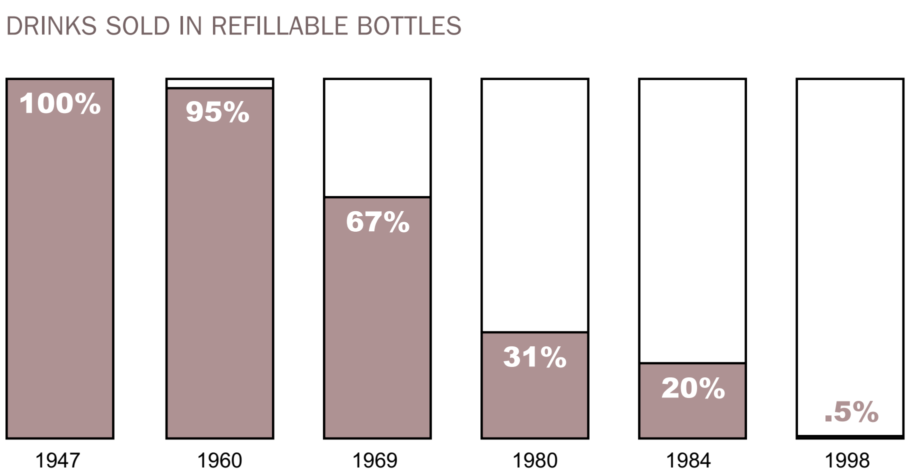


Figure 1.5. The decline of refillable beverage bottles in the U.S.

cusations of wastefulness because they were considered convenient for working mothers, hygienic, uncontaminated, and sterile.[14] It is this throwaway ethic that produced significant development in the history of product obsolescence.

[14] Ibid., 17.

Later, this mentality became more and more acceptable as things were thrown away that were not immediately useful. Television and radios broadcast advertisements in polemic statements such as "miserliness is despicable," "hoarding is vulgar; both are selfish, fatal to

Figure 1.6. Disposables found in household after one day.

[15] Clarence Wilbur Taber, *The Business of the Household*, 2nd ed. (Philadelphia: Lippincott, 1922), 438.

[16] Vance Packard, *The Waste Makers* (New York: Pocket Books, 1963), 15.

[17] Annie Leonard, "The Untold Story of Consumerism," *Kabbalah Today* (Apr./May 2006), http://www.kabtoday.com/epaper_eng/content/view/epaper/7396/%28page%29/3/%28article%29/7412 (accessed 29 Oct. 2009).

character and a danger to the community and nation", [15] "Buy days mean paydays...and paydays mean better days...the job you save may be your own." [16] The Government of the United States orchestrated consumerism after World War II to revitalize the economy.[17] The productive economy of that time demanded that consumerism should be a way of life. It implied that we take the act of buying, using, and throwing out as a ritual of life that seeks ego satisfaction in consumption where things could be discarded and replaced. Perhaps the invention of disposability itself can be seen as a precursor to the freedom and emancipation of traditions and values, a motive to promote forward thinking and change in humanity through progress.

The Industrial Revolution was really more of an economic revolution, driven by the desire for acquisition in capital. The market designed artifacts like cars, buildings, clothes, and other products with a finite usefulness so that consumers would be forced to upgrade and replace. This approach created an endless cycle of disposing, buying, and working off debt only to dispose and buy again. Business and capitalism have no pity for the environment; they are there to make profit, to take from us for their own benefit. Money as a value of self-worth quickly replaced traditional home values and morale. Making the greatest volume of goods and distributing it to as many people meant success, and success would be more attainable if it was to be done in the most efficient manner. Efficiency lowered the bottom line of a product and the cost of an item, thus pushing both increased consumption and turnover rate. The shift in the manual labour force to mechanization was a slow one, and it was perhaps Henry Ford's invention of the assembly line and General Motors (GM) consumer expertise that set the mark on how companies in the future should produce goods and services.

Inspired by the Chicago Beef Industry in the early 1900s, Ford observed how a moving line of workers, materials, and product significantly reduced the overall manufacturing time of a product. Adopting this model in his factory, the workers performed single operations, where previously, knowledge and skill was necessary.[18] This allowed him to hire anyone for the job as well as more employees than was previously possible. As efficiency lowered costs and made mass production feasible, this lowered cost allowed for an increase in salary for factory workers. The salary in 1914 was $2.34 a day; after the introduction and success of the assembly line, it was $5, more than double the rate! Ford argued that the cars were not going to drive themselves, that the reductions in cost for vehicles are "so low in price that no man making a good salary will be unable to own one…[It is a] car for the great multitude."[19] The Ford Model T became the first automobile ever to be mass-produced.

The automobile industry was also the first to realize the marketability of cars as fashionable objects that can become outmoded by changing minor details. General Motors was the first to promote this idea with the introduction of new styling every season. GM changed the overall look, the shell, and feel of the interior without any major mechanical advances on the theory that in fashion, style sells. Minor changes such as introducing new paint colours, trims, different bumper styles, fins, and streamlining contributed to the *obsolescence of desirability*. As a result, decline of quality in the overall product from these style changes can be attributed to the strain of having to keep up with the latest design shifts. Vehicles were depreciating at a precipitous rate and twice as fast as they had previously.[20]

However, the Industrial Revolution did create a number of positive social changes that contributed to a higher standard of living. With the aid of mechanized production, leisure time replaced long hours of labour. People began to work less and make more money and were able to spend more money and spend more time with family. Life expectancy greatly increased, as well as the population. This induced many changes in medical care and education, in addition to improvements in telecommunications and technology, taking comfort and convenience to a position of entitlement.[21]

[18] William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002), 22.

[19] Ibid., 24.

[20] Vance Packard, *The Waste Makers* (New York: Pocket Books, 1963), 78.

[21] William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002), 26.

Next page: Figure 1.7. Similarities between the Ford assembly line [*top*] and the meat assembly line [*bottom*].


内脏检验
Viscera Inspection

DEATH-DATING & E-WASTE

Today the average North American consumes more than twice the amount of things deemed as 'necessities' than they did at the end of WWII. As a result, living quarters increased in size in order to accommodate all these items. Corbusier's a-house-as-machine-for-living-in idea of mass-produced standardized housing types epitomizes this mass society's need for housing as a machine for storing all the rubbish they accumulate. Consumption from need to necessity is one of the most significant cultural enigmas, yet

Figure 1.8. General Motors' Cadillac. Annual model change used to create the "dissatisfied" consumerz.

[22] Giles Slade, *Made to Break* (Cambridge, Mass.: Harvard University Press, 2006), 19.

[23] Ibid., 20.

it is the least examined phenomena of the 20th century. Mass consumption infiltrated a previously frugal nation into an insatiable state of being.[22] Automobiles became one of the first agents of waste (its later implications can be seen in section 1.5) as General Motors was the first to examine and exploit this trend by saying that "in order to make people *want* things, we [need] to create the 'dissatisfied consumer'," which led to the launch of the first advertising campaign designed to manipulate consumers into discontent, arguing that, "the key to economic prosperity, is the organized creation of dissatisfaction." [23] On this note, a new sub trade of marketing emerged in the 1920s called *consumption economics*, which introduced product obsolescence to the world of fabrication.

It was believed that the means to success of a healthy growing society was either by changing the physical appearance of an object or by creating a mindset that was quintessential for antiquation. The process of creative destruction involved three processes:

1. Obsolescence of function
2. Obsolescence of quality
3. Obsolescence of desirability

[24] Vance Packard, *The Waste Makers* (New York: Pocket Books, 1963), 47.

The first process involves the previous product becoming outmoded because the current product performs better or more efficiently. The second process is one that involves *death-dating* where products are meant to break down or wear out before an anticipated date. Sometimes this renders reparation obsolete, as it is much cheaper to buy a new one, leading the consumer into a continual cycle of purchases. The third category is one that we are currently most familiar with and is psychologically the most challenging, where styling and other superficial changes make it more desirable.[24]

[25] Ibid., 65.

Perhaps the most stressing form of obsolescence comes from this third category, also called *psychological obsolescence* because it is the most damaging to the environment and to our fundamental traditional social ideals surrounding this discourse. The essence of this principle is founded upon wasting and acquisition. From an economical and consumer standpoint, the principle is socially justifiable because it redistributes wealth. The Chicago Tribune, in their studies of suburbia, indicates that "the inhabitants of the new suburbia are virtually concerned with taste and style," [25] and that their preoccupations with fitting in are a symptom of our generation along with lack of self expression and rational values.

Psychological obsolescence poses many significant threats to the environment in the forms of landfills, contaminated sites, and depletion of resources. The volatile nature of trends and fashion contribute to the growing concern of the waste crisis as a result of its ephemeral qualities. Current dilemmas with mobile phones and electronic waste (e-waste) threaten our future predicament. With micro and nanotechnology, products are becoming exponentially smaller, requiring parts to be soldered in place. Reparation is becoming increasingly infeasible as electronics are becoming inexpensive; it is much more convenient to buy and replace than to operate on a broken object. At this point, the cost of labour may also outweigh the cost of replacement.

E-waste inherently carries toxic and radioactive chemicals such as lead, mercury, xylene, trichloroethylene, Freon 113, sulphuric acid, and cadmium. Together these chemicals saturate our landscapes and injure our existence. By 2010, approximately 3 billion units of electronics will have been thrown out at a rate of 400 million per year, equivalent to 1,000 elephants thrown out each hour.[26] According to the Environmental Protection Agency (EPA), this does not account for the 75 per cent of obsolete computers and electronics stored in homes and other facilities, nor does it account for manufacturing waste.[27] For example, semiconductors require huge amounts of material while undergoing manufacturing; only 1 per cent of this material is actually useful, the rest is discarded. The Basel Action Network, an organization focused on the challenges arising from the injustice of the toxic trade, states that "the electronics industry is the world's largest and fastest growing manufacturing industry, and as a consequence of this growth, combined with rapid product obsolescence, discarded electronics or e-waste, is now the fastest growing waste stream in the industrialized world." [28]

So where does all the e-waste end up? Devastatingly, most of it does end up in our incinerators and landfill where opportunity is given for these toxic chemicals to leach out. Government efforts to 'recycle' e-waste can be deceptive as the environmental benefits are low and very labour intensive as it involves a process of dismantling, shredding, burning, and even exporting. Recycling e-waste is greatly discouraged and therefore exported because of market conditions and manufacturing inputs.

The U.S. is the largest exporter of e-waste. There are three primary reasons why exporting to third world countries, such as Asia, has gained popularity. These include low cost, at about $1.50 an hour, lax regulations, and legal issues despite international law, as the U.S. refuses to honour a Chinese ban by preventing essential exports.[29] Of the 80 per cent of e-waste that is collected, about 90 per cent of that goes to China,[30] leaving them with no choice or freedom from toxic exposure. In fact, Chinese scrap yards can extract up to 23 valuable materials that would have been deemed impossible to extract by our standards, diverting what might have been thrown into American landfill.[31] Entirely motivated by economics, the e-waste problem is one of America's best-kept secrets. The problem with this industry is not only short-lived products but also the design of the products themselves. The industry pushes out products with little regard for its life cycle and the impacts that it may have at the end of its short life.

[26] Jennifer Gabrys, "Media in the Dump," In *Trash*, ed. John Knechtel (Cambridge, Mass.:Alphabet City, 2007), 158.

[27] "Statistics on the Management of Used and End-of-Life Electronics," *Environmental Protection Agency*, http://www.epa.gov/osw/conserve/materials/ecycling/manage.htm (accessed November 15, 2010).

[28] Jim Puckett et al., *Exporting Harm: The High-Tech Trashing of Asia* (Seattle, WA: The Basel Action Network, 2002), 7.

[29] Ibid., 8.

[30] Mark Kingwell, "The Truth in Photographs: Edward Burtynsky's Revelations of Excess," In *China*, Edward Burtynsky (Gottingen, Germany: Steidl, 2005), 134.

[31] Ted C. Fishman, "The World's Future Take Root in China's Cities," In *China*, Edward Burtynsky (Gottingen, Germany: Steidl, 2005), 13.

Next page: Figure 1.9. The E-waste Problem: This image shows millions of circuit boards discarded around the globe, ending up in China's junk yards.

Obsolescence is a dangerous concept orchestrated by the Industrial Revolution and aided by governmental influences. The productive economy forcefully demands that consumerism should be a way of life. It is based on the invention of buying on credit and loans, further driving our nation into national debt. It was not until after the Second World War that product obsolescence became a natural and inherent route for all manufactured goods, at first to revitalize the economy. Former President George W. Bush promoted this concept after 9/11 in the guise of economic stimulus in order to support the war efforts and troops in the Middle East. His proclamation states, "We need to stimulate the economy through boosting consumer confidence with some kind of money in the hands of consumers." [32]

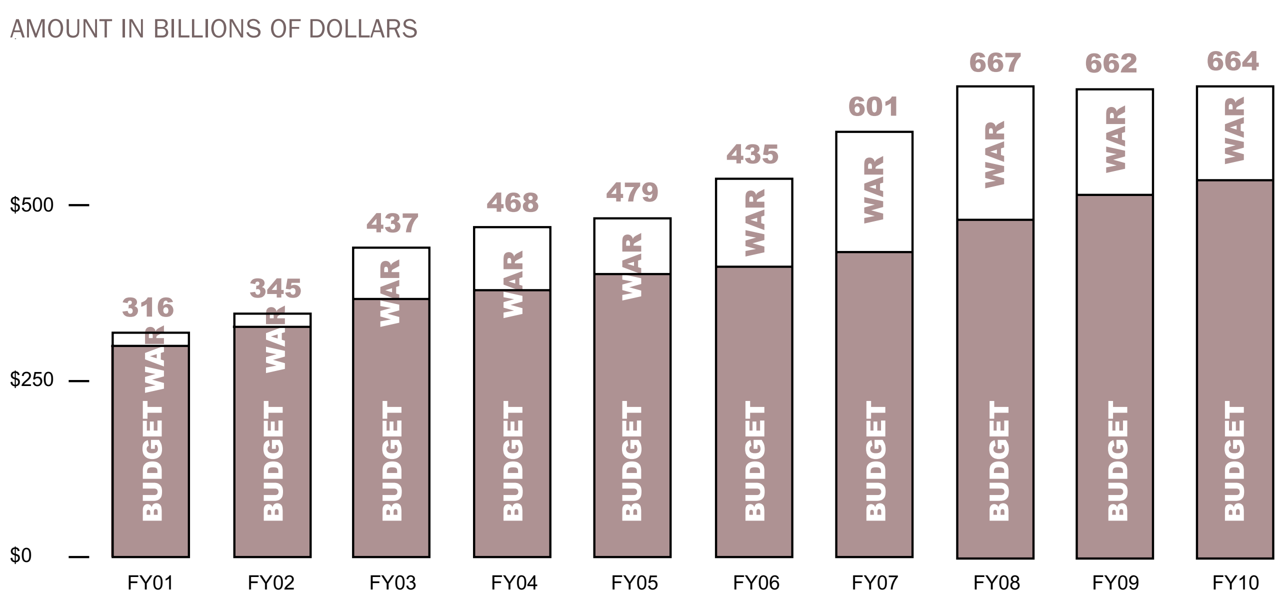
The frightening thought that of "every dollar spent by the federal [U.S.] government, 43 cents goes to pay for wars—past, present, and future….Today, the U.S. military is the largest single institutional consumer of energy in the nation, and over 80 per cent of federal energy budget goes to the Defense Department." [33] The budget of the Department of Defense has risen more than 100 per cent from just over $300 billion during fiscal year 2001 to a total of $708 billion in the up coming 2011 fiscal year,[34] due to our incessant need to occupy the competitive market for access to goods and resources.

[32] Alan Berger, *Drosscape* (New York: Princeton Architectural Press, 2006), 4.

[33] Jeremy Rifkin, *Entropy: A New World View* (New York: The Viking Press, 1980), 157.

[34] Department of Defense. 2010. *Defense Reviews: Budget Proposal (2011) and War Funding Supplemental Request* (no. 084-10, Feb 2010)

Figure 1.10. U.S. Department of Defense budget from 2001-2010 signifying over 100 per cent increase due to war and other related efforts.



Winston Churchill, at the onset of the First World War, was the British prime minister who was the first to found and exploit the equation between war and oil, as it was he who made the shift from coal to oil in order to improve speed and efficiency of the navy.[34] This strategy has been in place ever since and has fueled our massive infrastructure of oil capitalism to insure our economic stability. Its political value for dominance in global power and trading commodity has since been felt, particularly during the eight-year reign of the George W. Bush administration where a strong military presence has not been felt since the Second World War. One of many actions the administration undertook was the removal of a federal law banning offshore drilling, Bush said, "This means that the only thing standing between the American people and these vast oils reserves is action from the U.S. Congress." [36] The lifting of the ban resulted in large sums of money and casualties spent to keep foreign access open; "ultimately, the cost of oil will be measured in blood: the blood of soldiers who die in combat, and the blood of many other casualties of oil-related violence." [37]

[35] Imre Szeman, "Oil Futures," In *Fuel*, ed. John Knechtel (Cambridge, Mass.: Alphabet City, 2009), 21.

[36] "Bush lifts executive ban on offshore oil drilling," *CNN,* July 14, 2008, under "CNN Politics," http://www.cnn.com/2008/POLITICS/07/14/bush.offshore/ (accessed June 17, 2010).

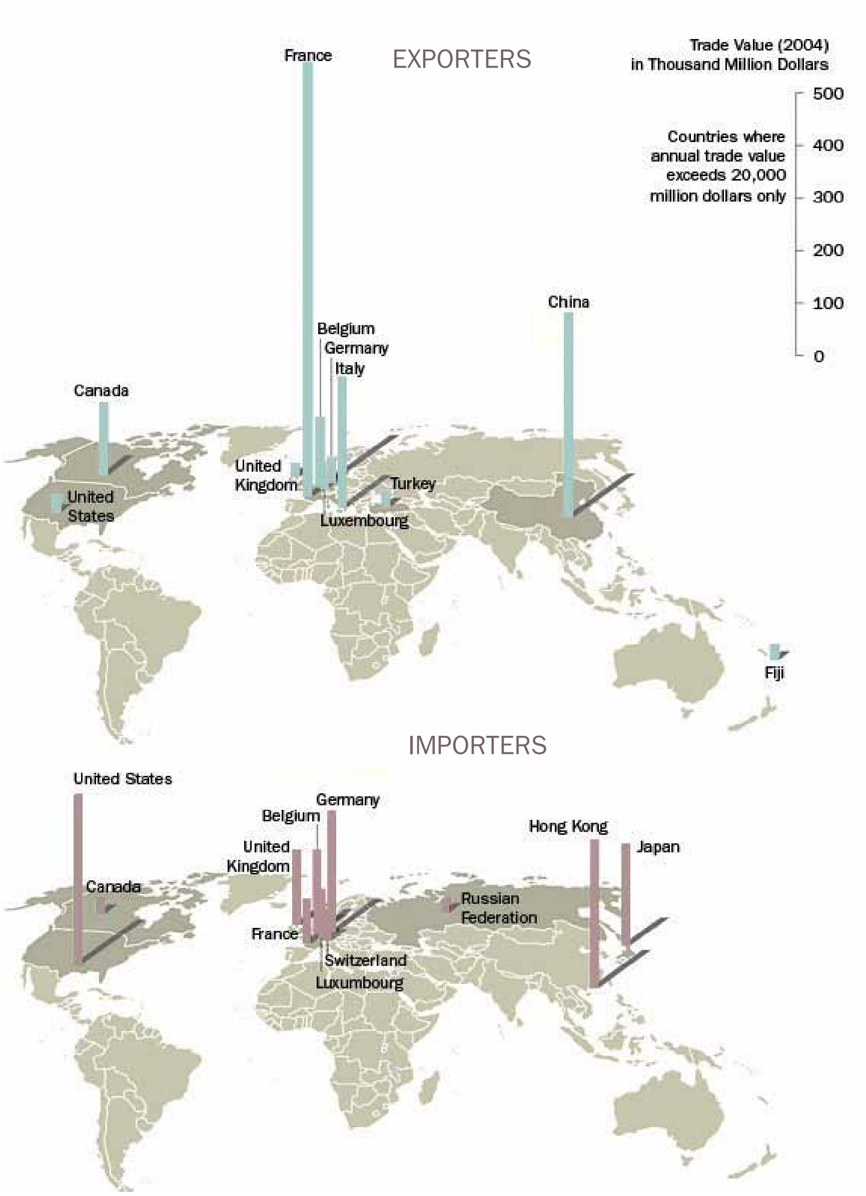
[37] Michael Klare, *Blood and Oil: How America's Thirst for Petrol is Killing Us* (New York: Penguin, 2004), 183.

Figure 1.11. Soldiers and oil pumpjacks is a *crude reality.*

It has been rumoured that upon election to his presidency, George W. Bush had received larger sums of money towards his election campaign than did any other administration in running. Indications were that most contributions came from oil and gas companies. These amounted to over 4.5 million dollars[38] from contributions alone, and Bush, who handpicked from the oil industry caused a political scandal as the acquisition of oil set the stage for geopolitical awareness of the consequences oil has on the environment and our dependence on it. Humanity as a whole recognizes that oil is essential for maintaining modern life.

[38] Mark J. Parlmer, "Oil and the Bush Administration," *Earth Island Journal* (Autumn 2002) http://www.thirdworldtraveler.com/Oil_watch/Oil_BushAdmin.html (accessed June 20, 2010)

Inherent in almost everything we produce, mass quantities of petrochemicals derived from oil are required for the production of 'things' such as plastics, clothes, automobiles, as well as modern technologies such as computers, cell phones, and electronic devices. We have become a *consumer nation*, where these *necessities* define our identity and control our actions. Slave to them, they become what we *need* instead of what we *want*. They fill our closets and our garages and we gauge success based on what we own and the resulting status it provides in our lives and our communities. These 'things' cloud our vocation as inhabitants of the earth, where instead of embracing natural environments we cover it with masses of debris and waste. Though we thought these commodities would enhance our lifestyle and existence, the majority of society is still ignorant that consumerism destroys our balance with nature and actually accelerates ruin in peoples' lives.



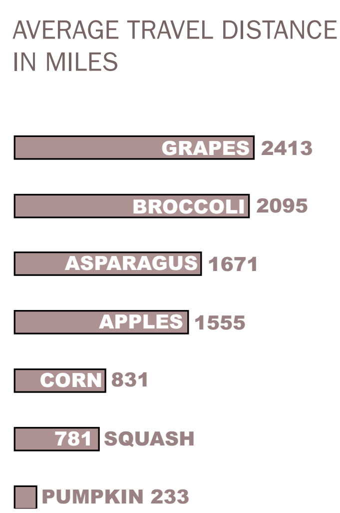


Figure 1.12. *Left,* World imports and exports of water, shows France being the major exporter of water and the United States being the largest importer, where large quantities of water comes from France and Fiji.

Figure 1.13. *Right,* Average travel distance for food to reach our tables.

1.5 POPULATION INCREASE + URBANIZATION = DEPLETION

As a society we are currently seeing the effects of the depletion of oil in our quotidian lives not to mention its effect on global warming. The issue is not of 'running out' of oil, so much as not acquiring enough to keep the global economy running that will lead to a collapse. Even a shortage of 10-15 per cent in an oil dependant country is enough to collapse its economy and reduce its citizens to poverty.[39] Perhaps the most dramatic consequence of oil depletion is of agriculture. Pesticides and agro-chemicals are made from oil; commercial fertilizers are made from ammonia, which is derived from natural gas that will be peaking in the near future, and most farming tools are power driven by oil-derived fuels. Food shortage will be an outcome as transportation and distribution will become expensive. The average distance of transport of food in the U.S. is almost 2400 km (1500 miles) before it is made available, and in Canada the average is 8000 km (5000 miles).[40] In the future, food prices will skyrocket and for those less fortunate, starvation and famine will take hold even on a global scale.

To produce 300 million tons of food, enough to feed the urban population of the world, we will need to consume 6 billion tons of fuels and raw materials. In addition, we will need to produce 250 million tons of manufactured goods, and 5 trillion kilowatt-hours of electricity.[41] Fuel prices will inflate, as millions of commuters will have to drive from their suburban homes for greater distances to acquire goods or arrive at work. Covering the cities with cement and concrete destroys the earth's resiliency; plowing forests to make way for new roads and buildings does not help the global warming predicament, not to mention water scarcity. There are about 6.4 million kilometers of paved roads in America,[42] paving tampers with natural water cycles since water does not percolate fast enough to replenish ground water source. Approximately 3 per cent of all water on earth is potable[43] and it is likely to get even scarcer.

Population growth has devastating consequences especially when relying on non-renewable resources. There simply will not be enough to go around, and this will result in inequality and uneven distributions of global resources. Previous scholars have warned us of the effects of over population since the late 18th century. Thomas Malthus, once said that by the end of the 18th century, humans would reproduce exponentially and with devastating consequences. Largely unpopular during this period, his piece

[39] Matt Savinar, "Peak Oil," *Life After the Oil Crash*, http://www.lifeaftertheoilcrash.net/ (accessed October 27, 2009).

[40] Stephen Hesse, "Matters of Survival in a Shattered World," *The Japan Times*, April 25, 2005. http://search.japantimes.co.jp/member/member.html?fe20050421a1.htm (accessed November 1, 2009).

[41] Martin Pawley, *Building For Tomorrow* (San Francisco: Sierra Club Books, 1982), 23.

[42] Alan Berger, *Drosscape* (New York: Princeton Architectural Press, 2006), 170.

[43] Sam Bozzo, *Blue Gold: World Water Wars,* DVD, (United States: Purple Turtle Films, 2008)

titled *Population: The First Essay*, published in 1789 challenged the 'perfectibility' of man. His concern with unequal nature in relation to food supply and population, led to predictions that concerned the post-war Baby-Boom era. These are housing shortages that confronted the construction industry, and more recently, environmentalists on resource depletion. His premise was that "population growth must come to a halt [in order to] convert economic system[s] to one of sustainability, lowering per capita consumption." [44]

In 1970, America generated 1.7 trillion kilowatt-hours of electricity, more than the world's 4 leading energy consumers combined, and less populated than the combined 4, the Soviet Union, Japan, German, and United Kingdom.[45] Overwhelmingly, over a quarter million babies are born each day, and even more impressive is its exponential growth historically. For example, it took 2 million years for the world population to reach 1 billion; to reach the second billion, it took only 100 years; the third billion took only 30 years between 1930-1960; and the fourth billion took only 15 years between 1960-1975.[46] Rapid growth is a primary contributor to the modern urban sprawl phenomena, and in 2008 more than half the people in the world live in urban areas. Cities are now shifting from vertical to horizontal growth, essentially detaching themselves from the urban core and moving towards the marginal periphery, disregarding traditional definitions of city. The problem that these cities will face is the limited resources which are incapable of responding to the magnitude of change. At the same time these cities will need a rapid urban development plan in order to accommodate the migration. At minimum, to accommodate the needs of expanding cities we must, on a global scale, "build houses, hospitals, ports, factories, bridges, and every other kind of facility in numbers that almost equal all the construction work done by the human race up to now," [47] thus putting more strain on the environment.

[44] William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002), 49.

[45] Ibid., 99.

[46] Ibid., 100.

[47] William Ophuls, "the Scarcity Society," *Skeptic* (July-August, 1974): 50-51.

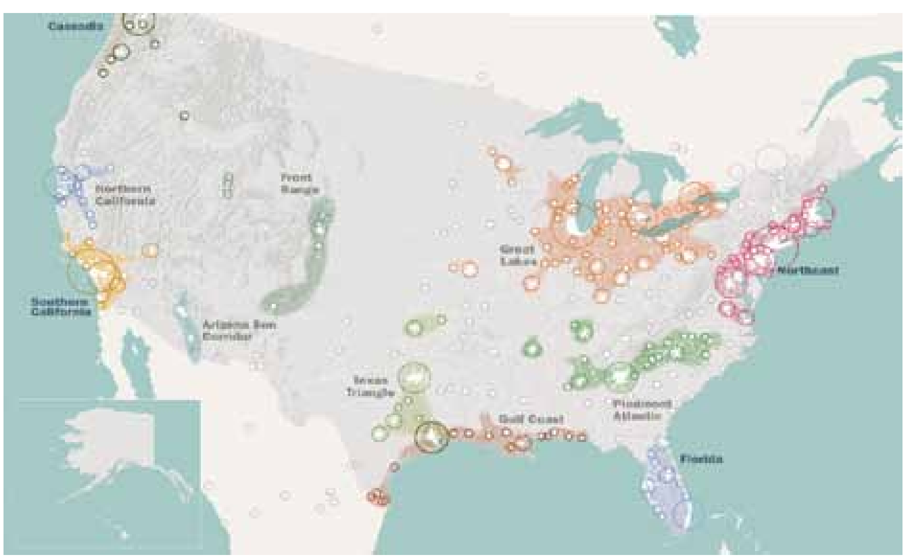
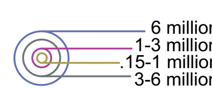


Figure 1.14. Prediction of migration trend by 2050 depicts population growth in the eastern U.S., mostly in the Great Lakes region.

POPULATION



1.6 TECHNOLOGY OR TECHNO-UTOPIA?

Since energy is perceived economically rather than energetically, its reality is often imperceptible, leading nations to believe that there will be new and better alternatives to the energy crisis by leaning on science and technology. A new wave of assumptions has led to two possible solutions that many espouse to, primarily because it allows us to continue living in modernity. This is the concept of techno-utopia. The first solution suggests that it is presently too late to change our environmental predicament, that technology can hinder the entropic effects of global warming and other disastrous outcomes by advancing current techniques to limit our carbon footprint. An example of this is hybrid automobiles, whose concept is perceived as buying time for more credible energy sources. The second solution branches off from the delusions that science and technology will free us from environmental responsibilities by creating new or perfecting known forms of energy, such as hydrogen-fuels, nuclear, or synfuels. This familiar discourse had led politicians astray while desperately investigating other suitable alternatives. Current Canadian Prime Minister, Stephen Harper believes that "with technology change, massive reductions in emissions are possible…[He] has reason to believe that by harnessing technology we can make large-scale reductions in other types of emissions, [however], it will have to be done as part of technological turnover." [48]

[48] Imre Szeman, "Oil Futures," In *Fuel*, ed. John Knechtel (Cambridge, Mass.: Alphabet City, 2009), 24-25.

The assumptions that technology will save us at the very last minute so we can continue living in modernity are all but utopic fantasies that hinder us from coping with the problem at hand. History has shown us that technology has never appeared in the nick of time, ready to compensate in areas in which we are lacking. Instead, most alternatives are inaugurated prematurely due to urgency before it is suitable for us to adopt and apprehend. In a constant state of future shock, a term Toffler uses to describe a premature state of society that has undergone "too much change in too short a time," [49] we are left to cope with suffering from stress and disorientation. This disregard to perfect and develop existing methods of technology will henceforward create more chaos and instability in our insecure circumstances. Popular energy alternatives that seemed promising are in the

[49] Alvin Toffler, *Future Shock* (New York: Bantam Books, 1970), 2.

long term, proving to be less beneficial. Similar to the processes of recycling, there is rarely little advantage to substitute one material for another; the same is true for energy sources. Finding newer energy sources is not necessarily a positive thing; it ultimately costs more and consumes more energy than the preceding method in the long run, but it does provide temporarily benefits. Whether or not the benefits outweigh the implications, we cannot deny that we are entering a state of global chaos.

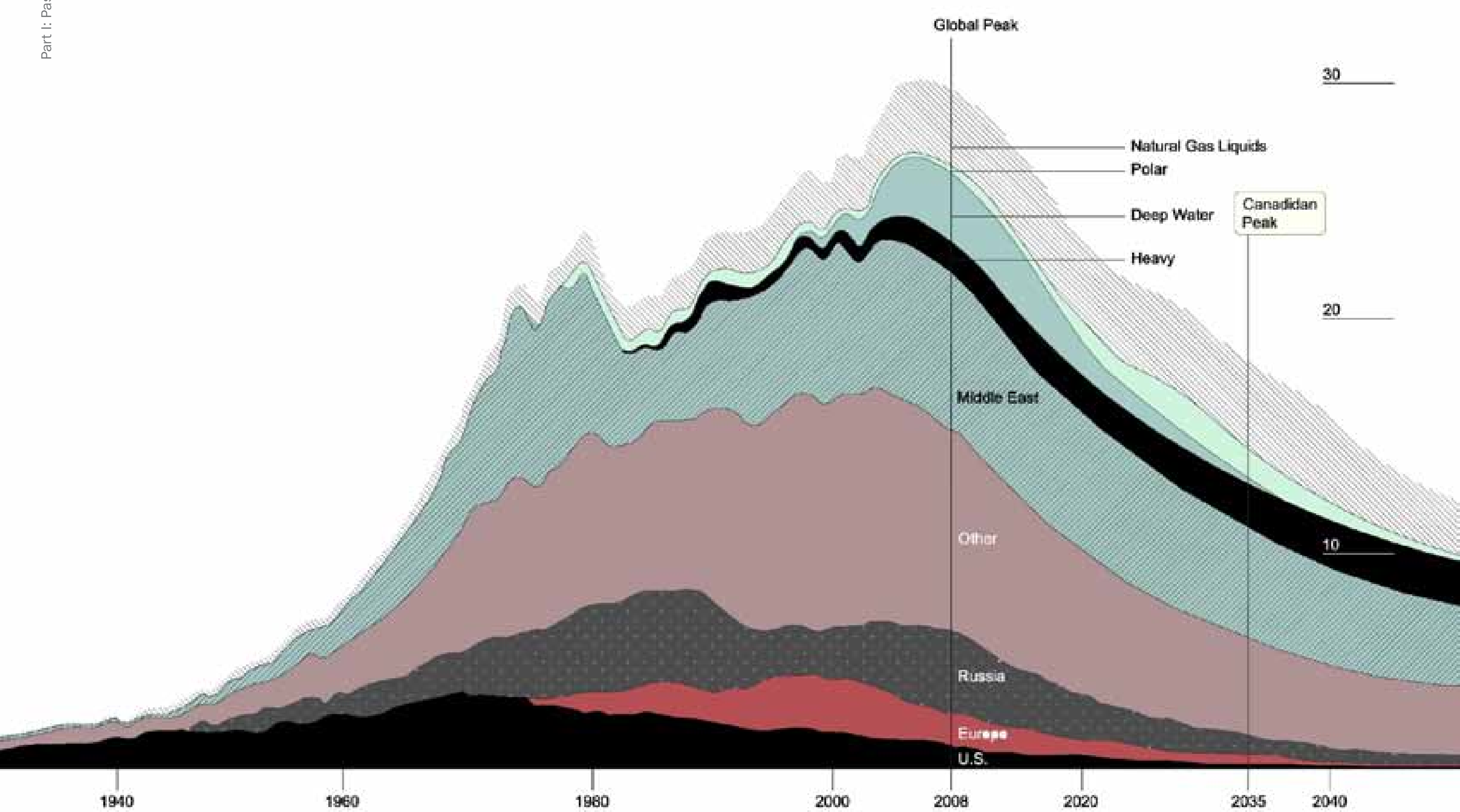
The gravity of the situation (and a known fact for that matter) is that we are in debt, using more resources than we are able to replenish, and accelerating into an entropy watershed. With viable petroleum reserves becoming scarcer, industries are now tapping into unproved reserves. These are reserves that may not have been recoverable under previous existing economic and political context in partnership with capable technological innovations. Canada has the second largest oil reserve and the largest reservoir of crude bitumen in the world, with pipelines now extending to the United States. It is expected that by 2030, 5 million barrels a day will be pumped into the US refineries.[50] However, this process is extremely arduous, unprofitable, and highly uneconomical as in order to extract oil from tar sands it takes approximately 2 tons of tar sand to produce 1 barrel of oil.[51] Under the backdrop of the current plight, it seems to be a feasible preference. One does not extract oil out of tar sands, only as a last resort, and only if we are desperate enough.

[50] Kelly Doran, "Tar Sands" in *Fuel*, ed. John Knechtel (Cambridge, MA: Alphabet City, 2009), 282.

[51] Jeremy Rifkin, *Entropy: A New World View* (New York: The Viking Press, 1980), 106.

Figure 1.15. Tar sands in Alberta, projected to be the future resource of oil as it "contains 13 per cent of the world's known oil reserves. Canada's forecast peak in 2035 comes after that of every other oil-producing nation." (Doran, *Fuel*, 284)

GLOBAL OIL PRODUCTION
IN GIGA BARRELS/ANNUM



With hydrocarbons on the brink of extinction, the economy is making its shift to other non-renewable energy sources. The allure begins to take precedence with new alternatives such as synfuels, hydrogen fuels, and nuclear energy. These choices all have repercussions that render such alternatives unfit for future projections. For example, synfuels are derived from non-renewable resources. The misnomer, *synthetic* fuel, is a derivative of coal. American bureaucrats predict that the country's coal reserves have enough coal to last 500 years, but what they do not broadcast is that current consumption rates are increasing by 4.1 per cent annually, which means that there is only enough coal for 135 years.[52]

[52] Jeremy Rifkin, *Entropy: A New World View* (New York: The Viking Press, 1980), 102.

Aside from additional pollution, current technology requires tremendous amounts of energy to extract 1 barrel of liquid oil, and hundreds of million tons of coal must be extracted each year to keep up with current consumption rates. The procedure may not even be feasible given the large amounts of water required for each stage during the extraction process. Water is already a precious commodity. Perhaps the primary limiting factor of this method is the climactic effects of carbon dioxide emissions. As calculated by the Carbon Dioxide Information Analysis Center (CDIAC) for the United Nations, in 2008 global emission from CO_2 had reached 29 billion metric tons annually.[53] Other examples of fossil fuel based programs share similar fates; oil shale, like tar sand also needs large quantities of shale to produce a single barrel of oil in addition to the large amounts of water required for the manufacturing process. This method may only provide 2 per cent of current energy needs of America.

[53] CDIAC, "Carbon dioxide emissions (CO2), thousand metric tons of CO2" for *The United Nations* (2008), http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749&crid= (accessed September 12, 2010).

Nuclear energy, whether it is fission or fusion, has even more implications; though at first glance seem promising. The cost of this operation and health problems inherent in these methods outweigh the benefits. Mining the uranium can cause fatal illnesses, primarily cancer, and may also affect communities located nearby. Every reactor in some way or other is leaking some amount of radioactive material, and it takes only one radioactive particle to invade one cell to cause genetic mutations.[54] Fortunately, it takes over 2 billion dollars to construct a power plant and this does not include the "hidden cost" that goes into it, making this type of energy very expensive.

[54] Jeremy Rifkin, Entropy: A New World View (New York: Bantam Books, 1989), 108.

> *Contrary to widespread belief, nuclear power is no longer a cheap energy source. In fact, when the still unknown costs of radioactive waste and spent nuclear fuel management, decommissioning and perpetual care are finally included on the rate base, nuclear power may prove to be much more expensive than conventional energy alternatives such as coal.* [55]

[55] David Dickson, " Nuclear Power Uneconomic Says congressional Committee," *Nature* (May 11, 1978): 91.

These reactions produce between 400 to 500 pounds of plutonium each year. If someone were to get their hands on this, they could easily construct thousands of atomic bombs or disperse it into the air and contaminate cities for up to 100,000 years, instigating nuclear war.[56] Though nuclear fusion produces less radioactive waste, the energy in each reaction is harder to sustain and will require significantly more energy in order to prolong it. The required energy to sustain the reaction will ultimately be more energy than its productive outcome. Secondary heat emissions that go unused from these plants will require tremendous amounts of water from nearby rivers and lakes to cool disrupting ecosystems. The process involves materials such as deuterium-tritium derived from lithium, and this stock is not limitless.

[56] Jeremy Rifkin, *Entropy: Into the Greenhouse World* (New York: Bantam Books, 1989), 125.

There have been many recent government support programs for hydrogen fuel cell technology and this technology is becoming internationally widespread as climate changes are taking effect. Canada has been actively involved in this market since the 1980s, and by the late 1990s, became the world's leading country in the development of hydrogen technologies. This ranks Canada first in the world with revenues of 135 million dollars followed by the US. In 2003, the Bush administration released a 5 year 1.7 billion dollar initiative to bring hydrogen fuel to cars by 2020.[57] Fuel cells are highly efficient in energy conversion and have the potential to replace internal combustion engines and electric hybrids. Some of the reasons for the recent popularity of this approach, unlike previous methods, is that it has the potential to offset climate change and at the same time does not compromise our health or the industry. Alternative carbon-free sources will play an important role in future technologies as a convincing and viable long-term option.

[57] Kevin Fitzgibbons, "Future Prospects & Public Policy Implications for Hydrogen & Fuel Cell Tech. In Canada," presented to *United Nations Int. Conference*, Maastricht, Netherlands (November 7-9, 2005): 8.

Though hydrogen fuel is considered 'carbon-free', it is usually either extracted from hydrocarbons or nuclear energy sources since molecular hydrogen is not available in conveniently minable reservoirs. Obtaining hydrogen then must be made in matter containing hydrogen, such as fossil fuels or water. The simplest way to extract hydrogen is by extracting it from fossil fuels as it requires no further energy input, but the process is not better than burning fuel in cars. It emits carbon dioxide into the environment and does not change the sensitivity of global CO_2 emissions nor lessen consumption on valuable hydrocarbons, as 90 per cent of hydrogen is produced from fossil fuels today.[58] While decomposing water does not strain global resources, it requires an astronomical consumption of water and high electrical input generated from primary energy sources, though less than that of fossil fuels. Another option would be to extract hydrogen from water by electrolysis, but this method consumes approximately 50 kilowatt-hours of electricity per kilogram of hydrogen produced.

[58] Ibid., 4.

The key challenge hindering hydrogen fuel emerging into global markets is from technological and economic costs of materials for transport, storage, infrastructure, and performance requirements. Hydrogen is a light diffuse gas and one of the easiest to explode when mixed with air, which makes tunnels and underground parking dangerous. It is also costly, in the case of cost per unit advantage compared to regular automobiles. This is calculated to be a hundred times more expensive, as estimated by the National Research Council of Canada (NRC). Policy support also cuts across the mandates of several federal environmental ministries and also brings implications for almost all ministries under federal jurisdiction from transport, aboriginal affairs, trade, defense, and health and safety.[59] The lack of established markets and complex regulations presents high levels of uncertainties, mainly in securing risk and liability.

[59] Kevin Fitzgibbons, "Future Prospects & Public Policy Implications for Hydrogen & Fuel Cell Tech. In Canada," presented to *United Nations Int. Conference,* Maastricht, Netherlands (November 7-9, 2005): 8.

1.7 AN ENTROPIC STATE OF MIND

Up to this point, we, as a society have been largely influenced by historic scholars such as Francis Bacon, René Descartes, and Isaac Newton. These men saw the world as entities of a working machine, easily manipulated, measurable, and predictable. Their paradigms allowed us to believe that we have the understanding to exploit the earth's secrets and control it for human advancement. For example, Descartes believed that mathematics was the key tool in exploitation as it represents total order, reducing all quality to quantity and then proclaiming that only space and location are relevant in deducing the world. In that very moment, he successfully abolished any uncertainty of chaos that lingered in the universe and successfully convinced us that the world we live in was one of precision and not of disorder, thus emancipating us from any associations to nature.[60]

[60] Jeremy Rifkin, *Entropy: Into the Greenhouse World* (New York: The Viking Press, 1989), 35.

Much of our recent techno-utopic efforts have been made without the realization of the fundamental truth. We torment ourselves over the current environmental predicament, torturously hoping to find new ways for technology to solve global problems, all the while accelerating ruin and further depleting the earth. The truth, however, is that we are entering a state of entropy watershed. This is not a new discovery; the laws of thermodynamics have existed for several centuries and only now does it seem relevant as techno-utopia provides precedence that this law is in fact at work.

Perhaps it was not until Apollo 8 had taken the first photographs of the Earth in 1968, that we became conscious of our failures. This event launched thousands of environmental movements, as it was the first time that the public was able to see that we are but a tiny speck in the universe, an insignificant node in the historic timeline. The realization that we are a single entity in the universe prompted public consciousness. Trapped in its fragility we realize the earth is a closed-looped system where survival is dependent on collective human effort.

Figure 1.16. The first photo of the Earth.

Continually seeking equilibrium, the earth is constantly dissipating energy. "Impossible to either create or destroy energy, the amount of energy in the universe has been fixed since the beginning of time and will remain fixed." [61] The transfer of earth's energy happens as exampled by the conversion of fossil fuels to gas, to CO_2. However, the Second Law of Thermodynamics states that every time energy from the earth is transferred or transformed, something gets *lost in translation*. This loss is entropy, the inability for this energy to perform work in the future. This matter becomes dead, inert, inefficient, useless, and wasted. This is partially the reason why we have not been able to find a credible solution to the energy crisis or why climate change has been accelerating so rapidly since the dawn of the Industrial Revolution. Pollution and CO_2 emissions are all by-products of this wasted unavailable energy. Inert, it sits in the environment further accelerating the process of equilibrium, a state in which entropy has reached its maximum. Many people believe that we can find a way to keep this energy within the closed-looped system by somehow recycling this energy from within its system, such as recycling material or cradle-to-cradle. Though both are innovative ideas, they are not solutions to the entropy problem. We do not have the power to reverse time, but we can control its speed of demise and prolong the inevitable by first reducing our consumption. Only if we must should we consume; but consume wisely,[62] choosing products that have none or little environmental impact, and lastly, reusing what exists in order to prevent matter from entering into the state of entropy.

The Fourth Law of Thermodynamics, advanced by Nicolas Georgescu-Roegen enforces the idea that material entropy is continually increasing and that "in a closed system, the material entropy must ultimately reach a maximum." [63] As previously stated, rarely are there advantages in substituting one material for another; the end result is always less efficient.

[61] Jeremy Rifkin, *Entropy: A New World View* (New York: The Viking Press, 1980), 33.

[62] Kevin Lynch, Wasting Away (San Francisco: Sierra Club Books, 1990)

[63] Nicolas Georgescu-Roegen, "The Steady State and Ecological Salvation," *Bio Science* (Aptil 1977): 268.

This can be seen if one substitutes copper with aluminum. When the process of substitution is no longer feasible, we look to recycling to keep material reservoirs in constant balance. Recycling is just another way to slow down entropic processes; it is an initiative created to make ourselves feel better about the spiraling effects of global depletion. It creates additional pollution, as it requires input of energy to collect, transport, and transform materials. "A little over 1 percent of our total mineral needs can be met in the foreseeable future through recycling." [64]

The efficiency of recycling is debatable. Most metals can be recycled indefinitely without actually depleting its material property. Alloys are difficult to recycle since separating and refining different materials in the compound becomes a tricky task and is often infeasible. Though some metals recycle better than others, aluminum is one the most efficient metals when it comes to recycling, having an energy efficiency of 95 per cent. In comparison, steel hovers around 60 per cent. Plastics, according to the EPA, achieve an energy efficiency of 90 per cent; however, the material value precipitates at an incredibly high rate. The altered properties of plastic due to down-cycling require chemicals and other additives to maintain quality, and therefore may contain more additives than virgin plastics.[65] Made from a make up of carbon, this synthetic material was once seen as the greatest shift in substitution and is the best example of material entropy. Due to the unbreakable bond of polymers, it is said that every item of plastic ever created is still lingering somewhere in the world: in our landfills, streets, even in the ocean. Plastic is ironically and auspiciously one of the most symbolic materials of the industrial society and of our consumer culture.

[64] Jeremy Rifkin, *Entropy: A New World View* (New York: The Viking Press, 1980), 117.

[65] William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002), 58.

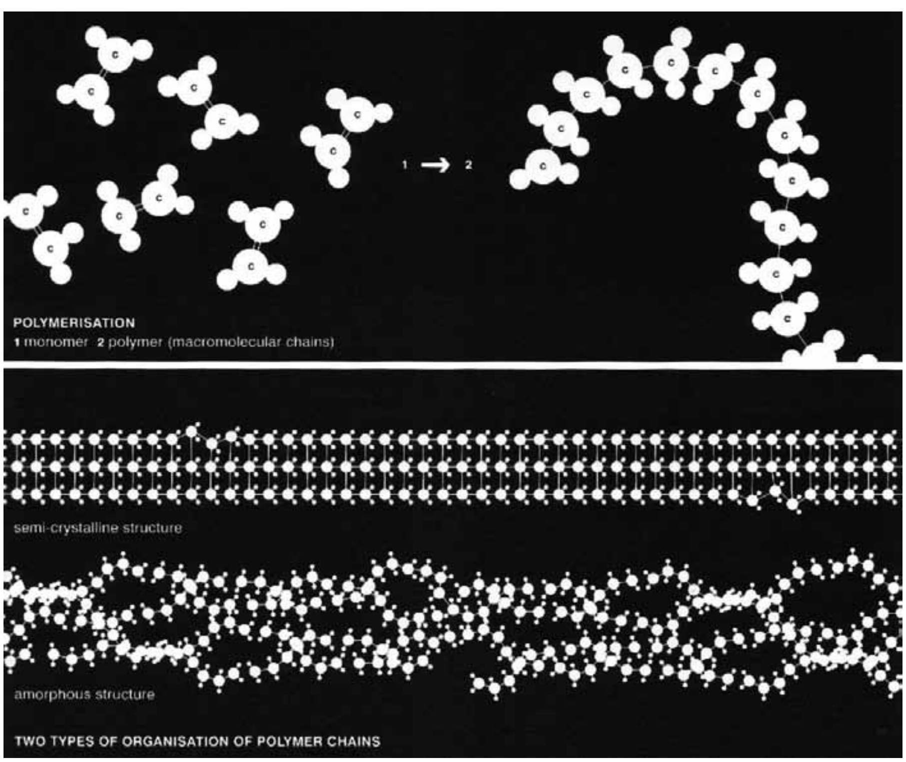


Figure 1.17. Polymer bond in plastics.

Next page: Figure 1.18. Recycling often down-cycle materials. *Turtle Island Recycling,* Toronto

1.8 A HYPOTHESIS: A World without Oil

Rarely do inhabitants of any city pause to ponder the efforts of complexity that integrate themselves into quotidian life, and the integrated systems that work in tandem to ensure society's comfort. These *invisible* systems support urban flow and flux, from garbage pickup, subways, street lights, power grid, water flow, food transport, to postal service. New York City, more than any other metropolitan city, relies heavily on the workings of this invisible infrastructure. From its birth, it has been a place of inventiveness, almost science fiction in nature, with its pneumatic tube postal service, underwater tunnels, and automated vacuum assisted collection (AVAC) for waste. New York City becomes a place where people are conditioned to expect nothing less. Albeit this makes New York an interesting subject for exploration into the complexity of urban life, viewed as one of the most densely populated and densest agglomeration of infrastructural workings seen in comparison to any other city.

Imagine Manhattan in the year 2050 when oil production slows to be almost nonexistent, leaving this oil dependant city torn by hardship and ruin for generations to come. Nothing comes in and nothing leaves the island. The population will dwindle as disease and famine sweep the city, taking the weak, old, and the young with it. Those who remain will be forced to use existing resources for survival. The once glamourous Upper Eastside and Wall Street areas of the city will become obsolete; they remain only recognizable as ruins after the citizens have ransacked and demolished the buildings for materials—glass, copper wire, metal pipes, plastics, paper—anything they can salvage for survival.

The rising sea levels change the waterfront to be almost unrecognizable. Citizen-led efforts are held to alleviate stress on an already burdened civilization before it may be too late. The earth has proven itself to be less resilient than predicted, and it is furious. Its fury lies in our ability to take advantage of its selflessness while stealing every piece of armour it has created over the course of its existence, and now, the earth is merciless in its vengeance. Since news and newspapers do not come as frequently as they used to, it has become almost impossible to predict the weather and its patterns, rendering the city vulnerable and open to the violent attacks of climate change.

The sorting of rubble and rubbish becomes a natural activity; heaps of waste produced by the city accumulates but has nowhere to go. The problem cannot be hidden any longer as waste is no longer being moved to disposal sites; it will become a visible crisis that needs resolution. It will create thousands of jobs and a union of positive community relationships at a time of urgency and extremity. Waste will define the city and its built environment with undulating layers forming a ubiquitous landscape.[66]

[66] Carmen Lau, "Excess Culture: An Integrated Framework of Systems," in *Responsive Environments* (Cambridge, ON: Riverside Architectural Press, 2010), 90-95

This study will investigate the conditions of Manhattan as an Island and its potential for flooding. A permanent flood barrier solution will be implemented by reutilizing waste as the primary resource and building material. The points of interest are the 4 architectural and topographical conditions that pose the most problematic locations for flooding: the Meatpacking District, Battery Park, the South Street Viaduct, and East Harlem. These are all potential locations to implement a continuous flood barrier.

The plan is to consider the type of waste that will be projected onto the city at a time when there will be little or no movement within cities. Since vehicles will no longer be seen as a primary mode of transport, its material will be seen as a resourceful readily available form of 'trash' that people can salvage parts from in order to create the structural system of the barrier. Presently in Manhattan, approximately 48 per cent of the population own vehicles. The Metropolitan Transportation Authority (MTA) has approximately 5,900 buses that run intercity, 13,087 taxis, and around 40,000 for hire vehicles amounting to approximately 3,500,000 tires.[67] As previously stated, tires are among the largest and most problematic source of waste since approximately one tire is discarded per person per year. The U.S. Environmental Protection Agency reports 290 million scrap tires were generated in 2003.[68] With landfills minimizing their acceptance of whole tires and

[67] "2005 Annual Report," *Metropolitan Transportation Authority*, http://mta.info/mta/investor/pdf/2005_annual_report.pdf (accessed Nov. 10, 2009).

[68] "Management of Scrap Tires", *U.S. Environmental Protection Agency*, http://www.epa.gov/epaoswer/non-hw/muncpl/tires/index.htm (accessed Nov. 29, 2009).

Figure 1.19. Detail b: Tire retaining wall, stacking method [left]. Detail c: Landfill using baled inorganic waste [right]

Next page: Figure 1.20. Future scenario of Pier 57, Meat Packing District.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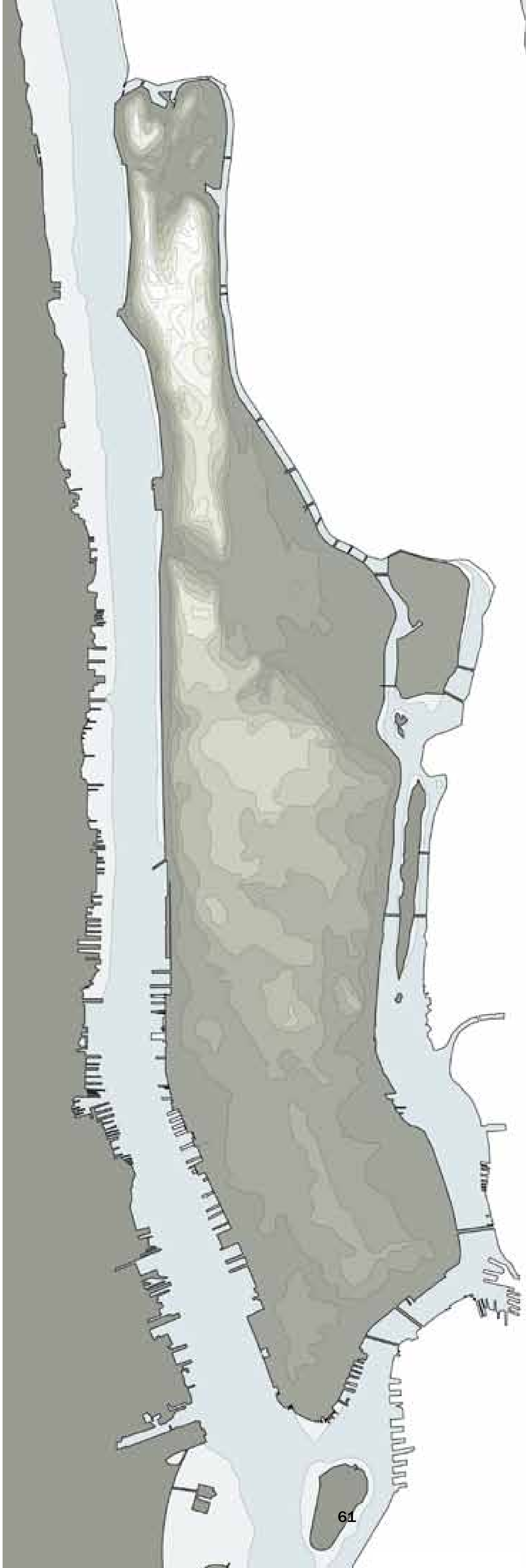

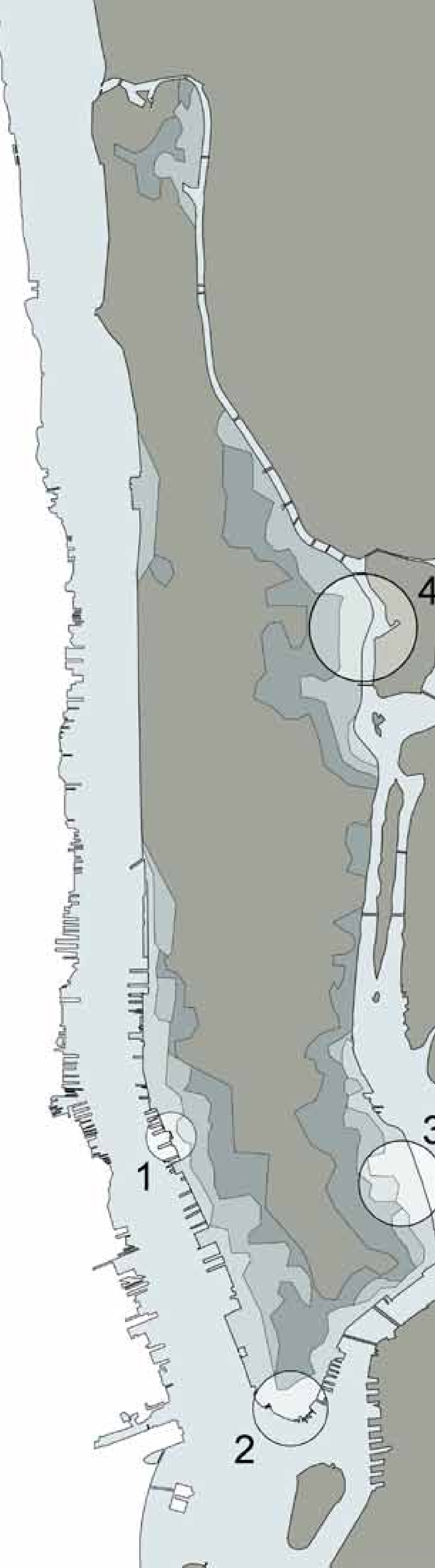
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category I hurricane
category 2 hurricane
category 3 hurricane

1. recycling, storage, water treatment facility
2. scale house, transfer house, sorting
3. wetland for leachates
4. sorted shipping containers + agriculture bins
5. flood barrier using building blocks of *waste*
6. methane plant

Previous pages: Figure 1.21. *Left*. Time line sequence.

Previous pages: Figure 1.22. *Middle*. Topographical conditions of Manhattan Island [*left*] and areas likely to be subjects of flooding [*right*].

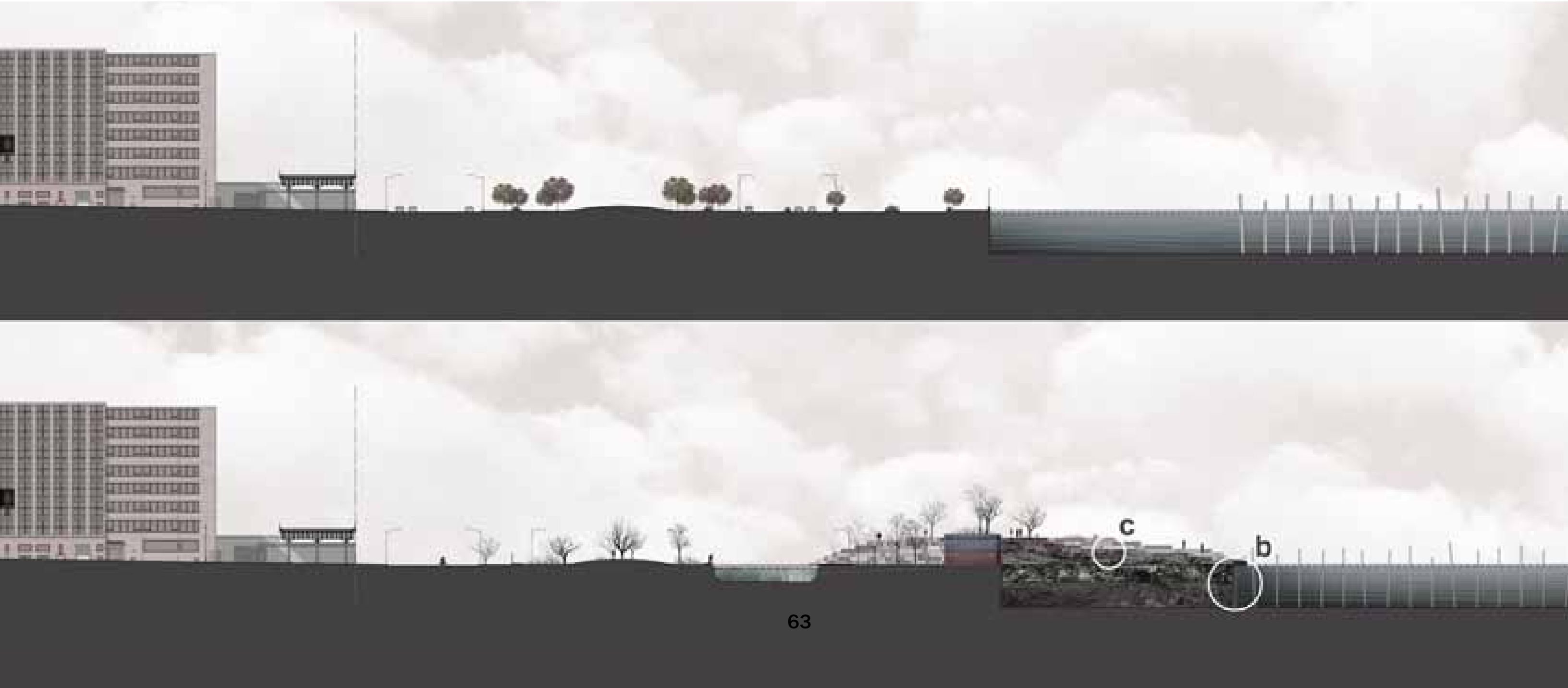
Previous pages: Figure 1.23. [*Top right*] Area 1 of focus, the Meat Packing District, flood zone before barrier system. [*bottom right*] Area 1 after implementation of flood barrier.

Figure 1.24. [Top] Original Section. [Bottom] New section implementing flood barriers utilizing city waste.

the health and environmental risks of stockpiling tires, society must invent new and creative uses for them. The proposition for utilizing these tires include a landfill where the perimeter is made with tires that are then filled with demolition debris or stones and then interconnected by cementing between each course. The left over vehicles are next filled with carefully selected plastics and other non-toxic inorganic materials, and put through a hydraulic crusher to consolidate waste into bales. The bales are then prepared to be used as building blocks for infill.

Layers of encapsulated waste are separated by demolition waste and debris of crushed concrete, bricks, stones, and sands acting as filler between gaps. At the top of the landfill, above the water table, is another strata of waste; these are items that require remediation. The waste is then separated into different cells to be compacted and then capped with soil or thick plastics (i.e. a tarp) primarily whatever is available (see Figure 1.21). Harvesting methane from anaerobic digestion will create sustainable renewable energy for the city by utilizing bioreactors and enzymes to speed up the breakdown of garbage and thus produce more methane in the process. The leachates are drained and collected into a pond of constructed wetland for safe remediation of wastewater effluents (see Figures 1.23). It is inexpensive to construct and operate, and does not require a high level of maintenance because of its synergistic relationship with the environment.

The land is shaped by the barriers, and at the same time serves as programmatic relief for its citizens. Parks, new living spaces, meeting places, trading markets, educational spaces represent a forum built by its people from abandoned shipping containers, cars, pop bottles, plastics, carpets, and debris which is woven together by whatever is left of the city. What was seen as a dismissed unwanted inconvenience in our lives, that being waste, will prove to be a coveted resource in changing our built environment and urban



fabric, in bringing together communities and providing support during future turmoil.

A World without Oil is an exercise that provides a dystopic glimpse into the consequences of consumerism and how a society may shift from being consumers to citizens. The process of consumerism, the waste crisis, urbanization, and depletion did not arrive as a lengthy process and had not become an issue until industrialization. These issues act as a precursor to A World without Oil where it tells a story of the challenges that citizens will face in a metropolis (in this case Manhattan) when global warming takes hold and carbon-based energy cease to exist due to exploitation of resources. These issues generally run parallel to each other, since urbanization is a derivative of population growth—a fertile ground for economy, industrialism, and consumerism causing unnecessary waste. Unnecessary wasting is a relatively new concept that accelerated new modes in thinking, shifting our priorities, morality, and how we interact in society and with our environment. Only recently have we begun to see the negative results from our past actions that have created a new vocation for the present 21st century architect.

Since this profession is fully integrated and participates in society, architects more than ever, are involved in the research of human ecology and how it effects the environment and vice-versa. The exploration of waste and architecture may play an important role in remediating past practices. Thus the contemporary architect recognizes that sustainability will pave the way for future course of actions. The current trend exploits the gain and hidden potential of wasted resources and maximizes renewable energy in the built environment. Therefore architecture has become a tool that is used to contribute to better living and environmental responsibility. After all, it is literally and metaphorically the interstice that explores the realms tangential to man and nature.

...in regard to nature's elements we have no gratitude. For what delights and for what outrageous uses does she not subserve mankind? She is flung into the sea, or dug away to allow us to let in the channels. Water, iron, wood, fire, stone, growing crops, are employed to torture her at all hours, and much more to make her minister to our luxuries than our sustenance. Yet in order to make the sufferings inflicted on her surface and veins of gold and silver and mines of copper and lead; we actually drive shafts down into the depth to search for gems and certain tiny stones; we drag out her entrails…

- Pliny the Elder, *Natural History,* circa A.D. 76

PART II | PRESENT

Y A R D S A L E S

"Solid wastes" are the discarded leftovers of our advanced consumer society. This growing mountain of garbage and trash represents not only an attitude of indifference toward valuable natural resources, but also a serious economic and public health problem.

- Jimmy Carter, 39th U.S. President

Plate 23, *70s Electronics, Toronto,Ontario*

Plate 24, *Exhausted Kitchenware, Toronto, Ontario*

Plate 25, *Exhausted Feet, Toronto,Ontario*

Plate 26, *Toys #1, Toronto, Ontario*

Plate 27, *Toys #2, Toronto,Ontario*

Plate 28, *TV, Toronto, Ontario*

Plate 29, *Pedals, Toronto, Ontario*

Plate 30, *Crystal, Toronto, Ontario*

Plate 31, *Knick-Knacks #1, Toronto,Ontario*

Plate 32, *Bored Games, Toronto, Ontario*

Plate 33, *Yardsale #1, Toronto,Ontario*

Plate 34, *Yardsale #2, Toronto, Ontario*

Plate 35, *Thrillers, Toronto, Ontario*

Plate 36, *Plush #1, Toronto, Ontario*

Plate 37, *Plush #2, Toronto,Ontario*

Plate 38, *Knick-Knacks #2, Toronto, Ontario*

Plate 39, *Knick-Knacks #3, Toronto,Ontario*

Plate 40, *Records, Toronto, Ontario*

Plate 41, *Yardsales #3, Toronto,Ontario*

2.1 THE PYRAMID SCHEME

Recycling is a process indicative of our economic wellbeing made widely popular and accepted as part of our daily life since the early 1970s. It is a symptom of middle-class altruistic behaviour, driven by personal and social gains. "Social scientists conclude that recycling is spurred by some combination of extrinsic and intrinsic goals—monetary incentives, utilitarian and personal gains, and ideological and political motives." [1] Recycling does not change continual habits of consumption and industries are able to justify and promote this act because their product extends durability, identity, and eliminates any evidence of reuse. While reuse is logically a more effective way to prevent waste, tossing something into the recycling bin does not require further imaginative reevaluation.

[1] Mira Engler. *Transforming America's Waste Landscapes* (Baltimore: Johns Hopkins University Press, 2004), 129.

A pyramid scheme has been devised to summarize a conventional hierarchy for waste prevention with avoidance as the most favoured choice followed by minimization, reuse, recycling, energy recovery, and lastly landfilling. Landfilling as a last resort is best

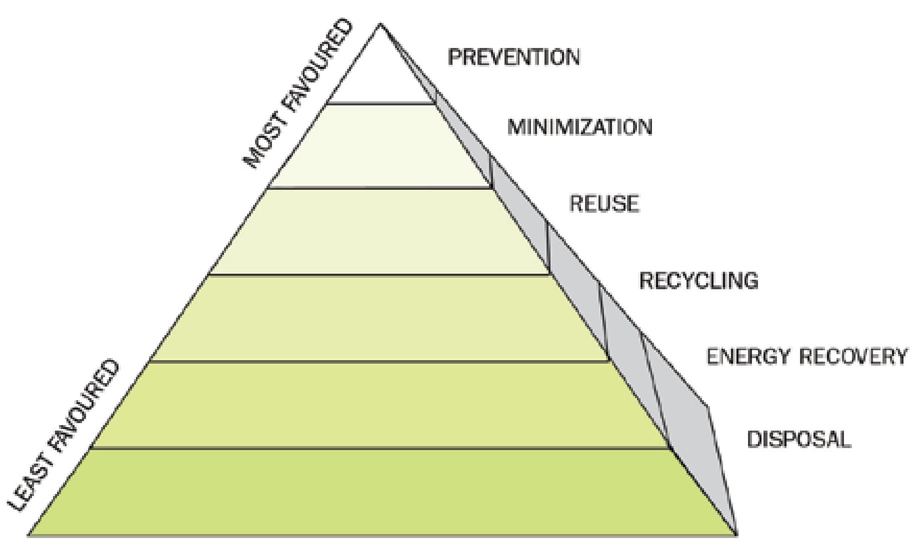


FIgure 2.1 Traditional pyramid scheme.

rationalized if energy recovery is done in tandem; i.e. methane collection for biogas, even though methane is a relatively potent greenhouse gas and contributes to ozone degradation (less so if this is done anaerobically). Tradition prioritizes this scheme simply as *reduce, reuse, recycle,* but this scheme does not allow for the reinterpretation of waste or new ways to dismiss negative connotations associated with this subject matter.

The difference between all these steps is the amount of energy input that goes into each of them as well as the implications of the initial production. Reducing is most desired because it does not involve the use of energy, but rather a change in mindset. Reuse involves little energy; the energy required to transform waste into reuse is renewable, consisting of labour either from repurposing or reconfiguring the material. Reduce and reuse are the only steps in the pyramid scheme that maximize and retain all energy initially invested in the material; recycling dissipates energy when items are down-cycled. Any additional energy added to the recycling process subtracts energy from the initial product, while landfilling happens when most of the usable energy has already been dissipated.

A modern approach rearranges this pyramid scheme first to seek *re-imagination* and next, to *redesign*.[2] Re-imagination takes place when people collectively believe in the same goal. This requires reflection upon society and our place within nature; only then can redesign transpire into something meaningful and productive. While reducing does not always happen, these steps help initiate the following disciplines found in later sections, where each seek their own interpretation for methods of reuse, all with a common aim to maximize the added value of objects.

[2] Daniel C. Esty and Andrew S. Winston. *Green to Gold* (New Haven, CT: Yale University Press, 2006), 197.

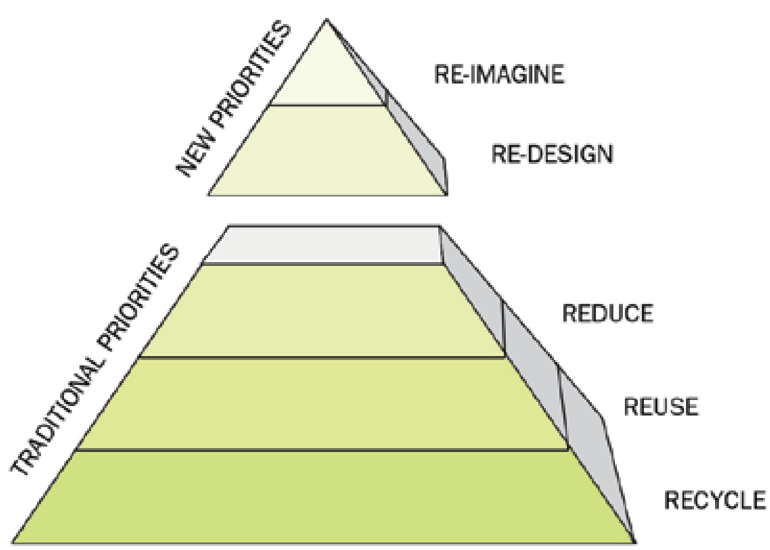
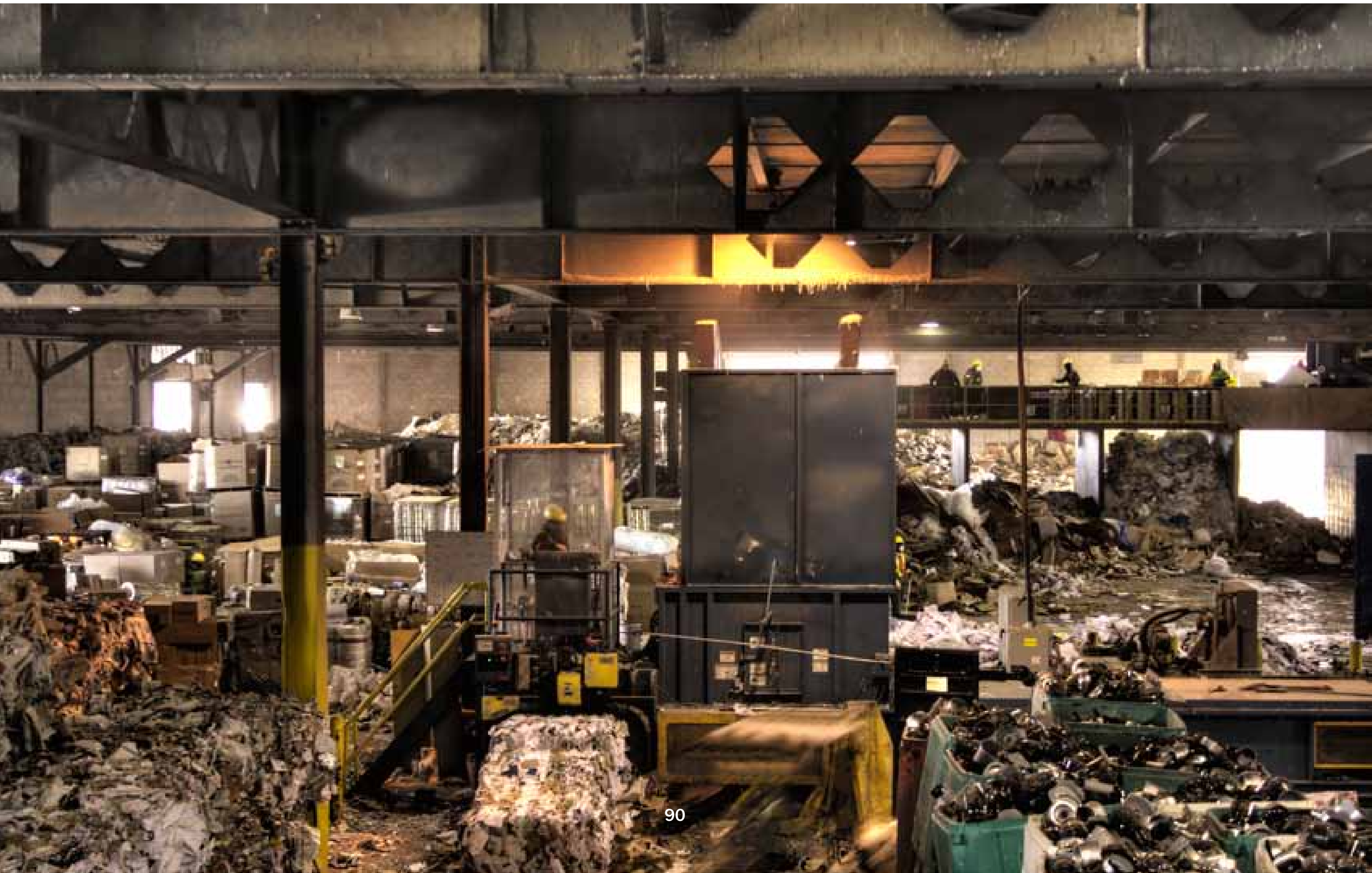


FIgure 2.2 Modern pyramid scheme.



Previous page: Figure 2.3. *Top,* Recycling Centre.

Previous page: Figure 2.4. *Bottom,* Sorting of recycled waste.

Figure 2.5. *Above,* Marcel Duchamp's Bicycle Wheel, 1913.

For many years, the reutilization of garbage as a topic or medium in art has provided a rich reflection into our culture and society. As a theme this has been constantly a taboo subject. One of the earliest examples can be seen when in 1913, Marcel Duchamp presented his first 'ready-made' bicycle wheel as art. Shortly after, he submitted a piece to the *Society of Independent Artists* called the *Fountain*. At the turn of the century this piece became one of the most widely debated pieces in the art world and is now recognized as a milestone in the history of modern art. Often described as blunt, dirty, and unfinished, Duchamp's intention was to promote intellectual interpretation without the distraction of attractive handiwork. Blurring the fine line between art and garbage is what every *adhocist* and *bricoleur* strive to achieve in their works of art, habitually forcing the viewer to acknowledge their complicated dichotomy.

The work of adhocists and bricoleurs is often interchangeable and mistaken for one another, as both exude new ways to layer found objects in unique artistic expressions with the absence of discrimination. *Ad hoc*, a term coined by Charles Jencks, can be applied to almost every discipline. He describes ad hoc as a "method of creation relying particularly on resources which are already at hand...basically involv[ing] available systems or dealing with an existing situation [but] in a new [and efficient] way." [3] The contrast, however, as defined by Claude Levi-Strauss, is that bricolage contains an essence that is more mythical. It asks the bricoleur to engage in "a dialogue with [the material or tool], before choosing between them to index the possible answers," while addressing himself "to a collection of oddments left over from human endeavors, a sort of dialogue with nature." [4] The bricoleur works by means of *signs*; it allows him to incorporate his persona of human culture into reality, where "art lies somewhere halfway between scientific knowledge and mythical thought," [5] thereby saturating the object with knowledge and contemplation.

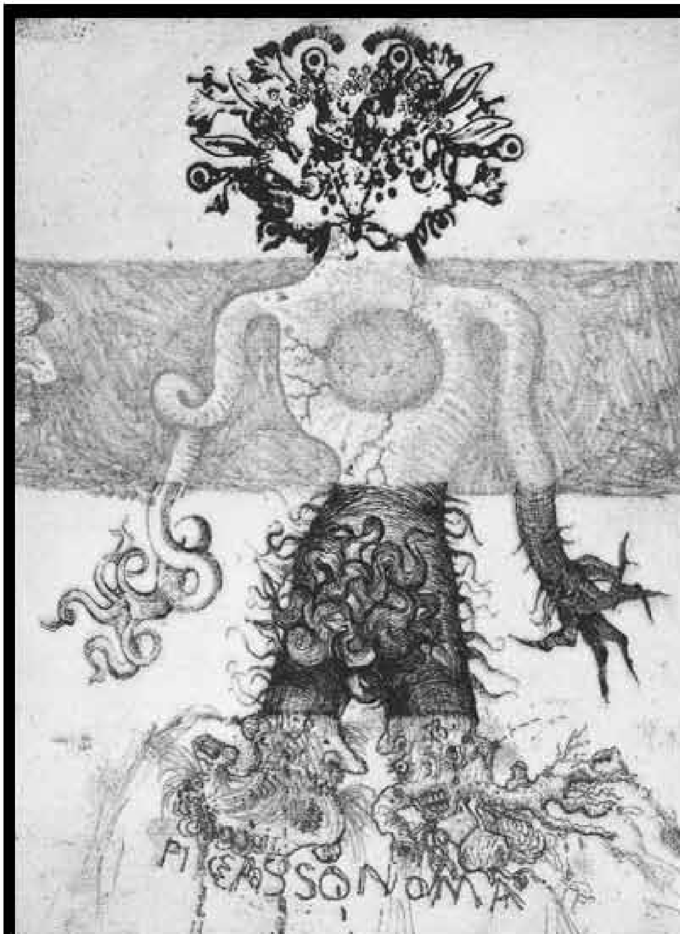
> *Everyone can create his personal environment out of impersonal subsystems, whether they are new or old, modern or antique. By realizing his immediate needs, by combining ad hoc parts, the individual creates, sustains and transcends himself.* [6]

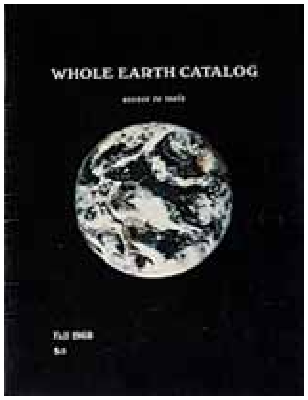
[3] Charles Jencks and Nathan Silver, *Adhocism* (New York: Double Day, 1972), 9.

[4] Claude Levi-Strauss, *The Savage Mind* (Weidenfeld and Nicolson: London, 1972), 19.

[5] Ibid., 20.

[6] Charles Jencks and Nathan Silver, Adhocism (New York: Double Day, 1972), 15.





Previous page: Figure 2.6. Exquisite Corpse, An adhocist game in which a collection of words and images are collectively assembled by adding on to other artists' work without knowledge of previous collection.

Figure 2.7. *Top,* First dome by Steve Baer after attending Buckminster Fuller's lecture. This 18 foot truncated dodecahedron was constructed out of wood scraps, chicken wire, and stucco, then bonded with bottle caps.

Figure 2.8. *Middle,* The Whole Earth Catalog.

Figure 2.9. *Bottom,* Drop City, circa 1970.

During the late 1960s, techniques of bricolage and adhocery were virtually nonexistent in architectural discourse. *The Dome Cookbook* and *The Whole Earth Catalog*, both published in 1968, are amongst the first counterculture treatises formalizing the do-it-yourself pop culture, a tool made to empower autonomous thinking while finding inspiration. Free from the constraints of traditional architectural formalities, these domes engage both nature and science. Obsessed with geometry and mathematics predominately found in nature, mythical thought lies in the idealized world outside the bounds of an established system of rigid and oppressive lifestyle. The *Droppers* (name given to the dome makers) were ultimately driven by a conviction to *rebuild the world* one dome at a time.

The detritus of American consumer culture provided exemplary tools for Droppers. Embracing advanced obsolescence, the dome construction was built with anything from car tops, scrap lumber, railroad ties, damaged insulation, and even bottle tops. The first prototype, however, was not as complex as later designs; trial and error done in situ provided Droppers with valuable tested solutions for future fabrication. This first dome was constructed using 2x4 studs from a local farmhouse; the structure was then wrapped in tarpaper and chicken wire. Bottle tops held the wire together as the whole dome was immersed in stucco and then tarred again before the exterior finish was applied. Lastly, windows were adapted from abandoned cars. [7] "Recycling formed the economic correlate of their aesthetico-political ideals," [8] as well as a new sort of participatory democracy.

However, faced with too much and too soon, "this euphoria soon gave way to a dystopic sense of foreboding," [9] as the second re-evaluating of these domes provided much scrutiny. With the abundance of new materials emerging from the affluent waste society, came environmental and biological implications for its inhabitants. Maintenance proved to be quite a rigorous task when many were faced with problems ranging from water infiltration, air quality, inflexibility of space, and the inability to make additions and change. Nevertheless, this movement continued to inspire innovation. The domes provided a fertile ground for future experimentation using much more refined ad hoc and bricolage techniques, paving the way for secondary use or adaptive reuse of post-consumer materials.

[7] Felicity D. Scott, *Architecture or Techno-Utopia: Politics After Modernism* (Cambridge, Mass: MIT Press, 2007), 161.

[8] Ibid., 163.

[9] Ibid., 167.

2.3 SECONDARY REUSE OF POST-SECONDARY MATERIAL

The traditional building process involves many trades that have perfected methods and practices over many years, some even for hundreds. Most of this can be attributed to:

a) Availability of materials
b) Skill and labour
c) Demand
d) Efficiency
e) Tradition

The rigidity of our trades began with materials being available in certain regions, and not necessarily because it is the 'best' way to build. With future economic inflation, we can begin to see the availability shift from traditional materials to non-traditional materials. The gap that exists between these two stages is closely linked to the stigma of using non-traditional materials such as waste, meaning by-products of production, obsolete objects, and objects with limited and temporary lifespan. We can better narrow this gap if we can perfect the methods of building with waste so that attributes 'a)' to 'e)' will come to be more appealing and consequently help to supersede traditional methods. This discourse deals largely with factors of overproduction of non-renewable and non-biodegradable substances and the urgency to solve resource depletion and scarcity during the modern age of society.

Figure 2.10. *Bottom right*, 3-storey EcoARK pavilion for 2010 Taipei International Expo is made from 1.5 million repurposed PET bottles. This structure is built to withstand earthquakes and hurricanes.

Figure 2.11. *Bottom left,* The wall is completely deconstructable, taken apart and reassembled elsewhere. A small amount of silicone is placed in between each bottle to bond them together.

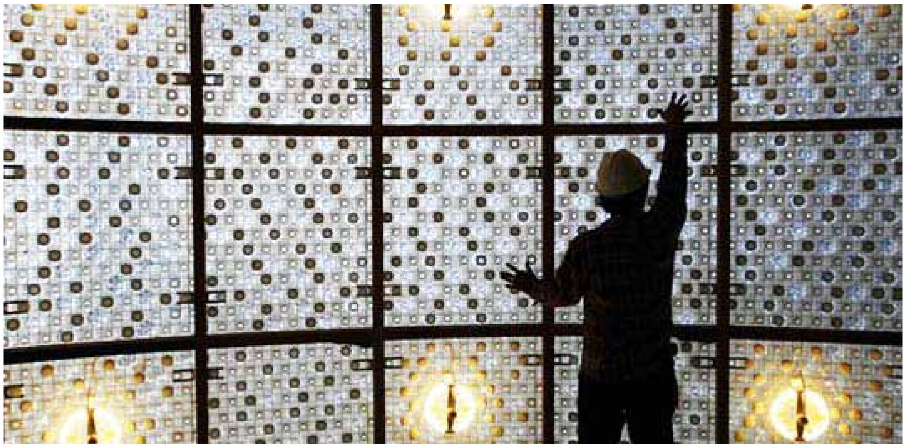


Figure 2.12. *Top*, Demonstration showing the strength of an EcoARK wall.

Figure 2.13. *Middle*, Scrap House phonebook wall.

[10] Martin Pawley, *Building for Tomorrow* (San Francisco: Sierra Club Books, 1982), 136.

There exist many similarities and properties in materials between what we traditionally build with and those that make it into the waste stream. It is no surprise that these also inherit strength and versatility. Since its origins, architecture has used the "waste" of agriculture as a primary material. Inedible parts like wood, hay, reed, and bamboo are often the primary ingredients that make up the core of a building. More recently, bottles and aluminium/tin cans, when stacked vertically, can support a load between 8,800-17,600 pounds, as shown by a performance within engineered bridge construction and which is far more superior to that of a 2-storey house.[10] A wall of books has an R-value of 37, while typical housing construction falls anywhere between 13-21. 2 weaved phonebooks exceed a tensile strength of over 2.5 tons and rejected carpet tiles, when stacked, are good insulators for walls and can be load bearing. These examples are similar to the techniques used in straw bale housing.

Building with reclaimed and unconventional materials often carries notions of poverty. Indeed, the best examples of this type of construction can be seen in Third World countries because they cannot afford to regularly purchase materials processed for construction. With limited laws that prohibit the feasibility of recycling, these Third World countries find their cities littered with debris from imported goods that make their way into becoming ubiquitous inert items in the landscape. The housing crisis, population boom, and poverty force slum inhabitants to find inventive ways to shelter themselves. Since garbage does not require further processing, is readily available, and does not require much skill and labour, often its use proves to be the most ideal construction material.

Contemporary examples of First World nations share the same processes as their poorer

neighbours. However, since their waste is always hidden from view, citizens scavenge materials not in their rubbish bins but largely from manufactured and industry waste. We can already begin to see this type of building practice made popular by Scandinavian countries, as 'eco-friendly'. Stringent codes and regulations influence architects to move in this linear direction. It is just as important, if not more so, to experiment with things that already exist instead of forcefully creating new innovations. The benefits can be seen from architectural firms like 2012 Architecten and Millegomme, in what they call *superuse,* or architects like Samuel Mockbee from Rural Studio, Michael Reynolds, and Martin Pawley. This movement reuses objects that normally would have gone into the waste stream as building materials by mapping projections of potential waste from industries and businesses within close proximity to the building site. This strategy enhances the conspicuous inefficiency of recycling programs. It attempts to address the issue of the functioning markets in relation to image and affluence and the economics of material and labour costs that go with it. In superuse, the aim is to maximize the added value of an object, while stimulating an open mind for materials, products, and an alternate application or use.

Figure 2.14. *Top*, Superuse example with baled soda cans by architects Pugh + Scarpa.

Figure 2.15. *Middle*, Superuse example with surplus flower pot cladding system.

By no means does *superusing* elements include parts or components of derelict buildings, which by definition would be 'reuse' rather than 'adaptive reuse.' The latter suggests an adoption of a new function in not returning to its previous use, and denotes a more *creative* and *imaginative* application to the object.[11] The superuse method does not constrict buildings to be pre-drawn predicting its every outcome and condition; rather the process approaches the planning and design in a more natural and innately primitive manner. Salvaged materials are unpredictable and often come with uncertainty. Their use requires measurements to be verified on site, allowing for tolerances and a chance to discover and adapt to challenges.

[11] Mira Engler, *Designing America's Waste Landscape* (Baltimore, Maryland: Johns Hopkins University Press, 2004), 131.

Sometime during architectural education, we have been taught the principles behind natural and primitive buildings. Brushed aside and yearning for more contemporary examples, we ignore or forget what we have learned. Little did we know that it would become useful one day, and that by looking into primitive examples would help build a foundation and argument for construction. We have grown to be intensely mechanical in our practice. In that, it is difficult to recognize how every 'new' piece of architecture takes elements and principles from primitive building whether we know it or not. The solutions are quite simple. For example, basic shelter is an accumulation of elements placed on top of one another as illustrated by the greatest ancient architectural achievements to this day which are constructed from stacked stones. Much can be learned from the act of making Greek temples or fieldstone walls. Sorting, selecting, putting aside different stones, and choosing at random each stone for placement is necessary because materials in nature are not always perfect and identical. We have an advantage over the primitive as much of the waste we create comes standardized from standardized production. Though still unpredictable, we can trust that it retains a fraction of consistency, whether by weight, size, or shape. Baling waste allows for standardized shape and size, and though weight may vary, it still provides a good material for stacking.

Figure 2.16. *Top,* Traditional stacked field-stone wall.

Figure 2.17. *Middle*, Second Temple of Hera in Paestum, a great ancient achievement using primitive techniques of stacking.

Figure 2.18. *Bottom,* Pallet House, utilizing shipping pallets for cheap affordable, simple to build housing.

When choosing the right material for *superuse*, it is best to look at the proportions and qualities in order to examine the best potential for its function. Shipping pallets make good cladding systems, shipping containers require little modification for inhabitation, baled waste papers are good insulators, and tires can be used for all sorts of applications from wall systems to furniture. The key to finding the best material is by looking at what is readily available and in close proximity to the building site. Rural Studio, headed by the late architect Samuel Mockbee, stumbled upon a surplus of carpet tiles that would have been discarded had he not found a creative use for them. The material was perfect; it was a standard size with the right proportion, aesthetically interesting, high insulating performance, able to withstand harsh climactic conditions, and easy to maneuver and manipulate during construction.

A BRIEF STUDY: *Lucy's House, Rural Studio, 2002*

Donated by InterfaceFLOR, the world's largest manufacturer of carpet tiles, the challenge was to use worn carpet tiles for the construction of a new home. The site of the house is located in Mason's Bend, a backwater of shanties and trailers and along a dirt road about 25 miles northwest of Newbern, Alabama. The house for Anderson and Lucy Harris was built for $32,000. The simple house is composed of a single-storey living area, a sculpture tower containing the master bedroom, 3 children's bedrooms, and a below grade tornado shelter that would double as a family room. All preliminary drawings were done as sketches because predicting its outcome would be impractical, given that there were no prior examples. This was not unusual for Rural Studio, as their designs invariably undergo alteration due to unconventional material choices. Mockbee encouraged his student volunteers to find their own solutions through trial and error and experiment with much iteration before finding the perfect balance.

Obtaining enough carpet to build the project was easy. Carpet manufacturers often face a surplus of carpet when a client's lease contract expires. Often, this becomes a tactic used by manufacturers "as a way to maintain control over their product and to keep the material loop closed for the environment's sake." [12] However, many carpet tiles pose environmental and storage concerns as they can contain up to seven layers of chemicals and materials not suitable for safe disposal or recycling. The concentration of volatile organic compound (VOC) in carpet used as flooring is harmless, but for walls, it requires a larger volume of tiles per unit space. Therefore, the tiles used in Lucy's House were required to be in storage for at least 7 years to ensure that they no longer emitted VOCs and then were treated to prevent microbiological growth before being used.[13]

The super-insulated walls contain 72,000 individual 15x15 inch tiles in bundles of 5 and then were laid one on top of each other like brick coursing. Holes needed to be drilled into the tiles to accommodate pipes and 100mm diameter steel columns used to stabilize the structure at the corners of the building and on either side of the windows. The walls were then capped in compression by a heavy wooden ring beam, and applied pressure to post-tension the tiles (similar to concrete but not as strong) into a dense mass that repels water and fire.[14] Tiles cannot be trusted to carry the roof, but the steel columns can, because the carpet tiles around them help stabilize against wind forces. If the compression strength of the carpet had been known, thinner steel columns might have been possible, and drilling the holes would have been simpler if the diameter was smaller. "Building the wall does require a lot of hard work. Apart from stacking thousands of tiles, many of them have to be cut to shape before application. They were brought in on pallets, each one bearing a different colour. This provided a nice opportunity to play with colour." [15]

[12] Ed van Hinte, et al., *Superuse: Constructing New Architecture by Shortcutting Material Flows* (Rotterdam: OIO, 2007), 34.

[13] Andrea Oppenheimer Dean and Timothy Hursley, *Proceed and Be Bold: Rural Studio After Samuel Mockbee* (New York: Princeton Architectural Press, 2005), 21.

[14] Ibid., 26.

[15] Ed van Hinte, et al., *Superuse: Constructing New Architecture by Shortcutting Material Flows* (Rotterdam: OIO, 2007), 34.

Previous page: Figure 2.19. *Top,* Lucy's House, Rural Studio.

Previous page: Figure 2.20. *Bottom left,* Carpet wall.

Previous page: Figure 2.21. *Bottom right,* Carpet coursing.

The Book Wall is an example of adaptive reuse that can be applied anywhere from First to Third World countries. This installation contains thousands of unwanted books collected from random participants of Toronto and the Toronto Public Library, in addition to hundreds of aluminum soft drink cans scavenged on Monday nights before weekly roadside collection as well as from the generous studios of the University of

Figure 2.22. Soda can collection at UWSA studios.

Waterloo School of Architecture (UWSA). Most of the books were acquired through *freecycle.org*, an Internet based organization that promotes recycling by free gifting of unwanted pre-consumed items with the purpose of diverting waste from landfills. A mapping exercise was conducted within a 5 km radius from the storage site, revealing the quantity and type of waste that could potentially be used for this installation. Since traditional building materials were partly conceived based on availability, it is always best to find the medium for secondary reuse projects from what is easily accessible. In this case, it was discovered that books and magazines are the most plentiful items that society feels guilty about discarding and ends up circulating amongst reluctant individuals. As a result, making this installation out of books would not only help to divert waste paper from landfills, as over 50 per cent of landfill materials are from paper and paper products, but it would also save resources, energy, and chemical processes hazardous to the environment.

Soda cans are rendered useless after a single consumption and therefore become ubiquitous objects in the landscape even though many do get recycled. It is worth noting that even recycling cans are often down-cycled which is not as straight forward as recycling pure aluminum. The body of the can is made up of aluminum, while the top and bottom is made up of an aluminum magnesium alloy. During the recycling process, both the aluminum body and alloy mix together and result in a weaker product.[16] After collecting over 500 cans, I prepared them for implementation as an exterior cladding system made up of shingles. A jig encompassing a Dremel® tool was developed (though it can also be easily done by hand) to slice the top and bottoms off the cans, separating the aluminum from the alloy, thereby retaining the value of the material upon future dismantling. The sheets are then cut and rolled out, the edges bent with a break press (similar tool or sharp edge will do) to resist the sheets from going back to its circular

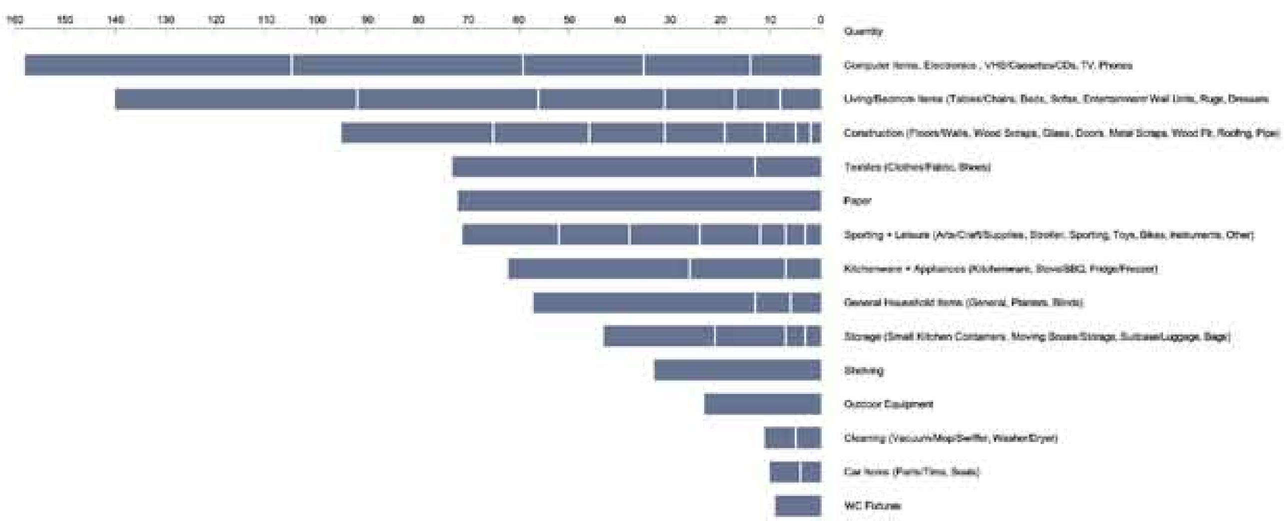
[16] William McDonough and Michael Braungart, Cradle to Cradle (New York: North Point Press, 2002), 57.

Next page, from top to bottom:

Figure 2.23. Manual soda can cutting at a rate of 16 cans per hour.
Figure 2.24. Mechanized can cutting with the help of a fixed jig, at a rate of 36 cans per hour.
Figure 2.25. Break form tool (in this case, my studio desk), to flatten and dull edge.
Figure 2.26. Creation of aluminum shingled wall.

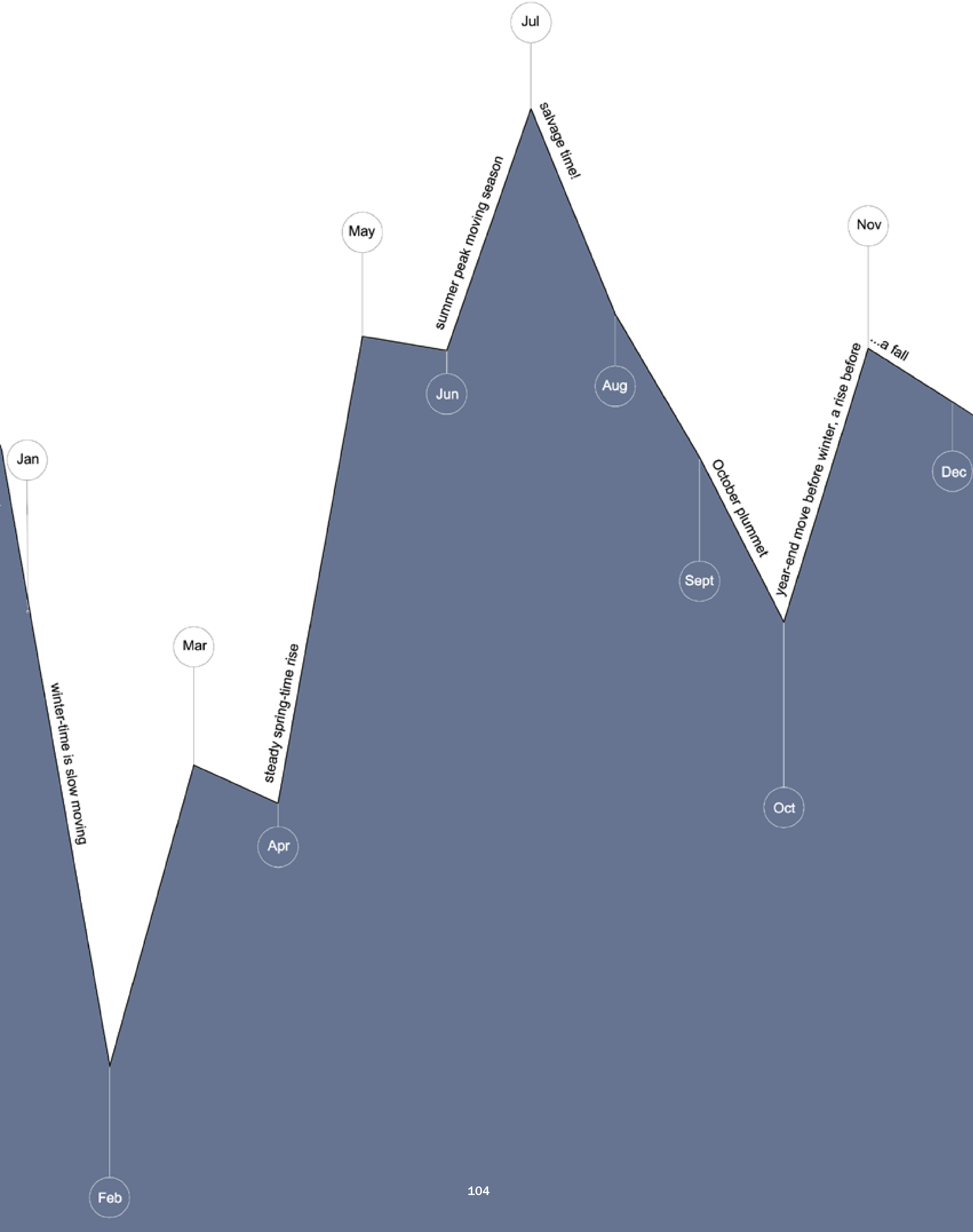

1
2
3
4
5
EDGE OF SHEATHING
TRIM EDGES
FIRST ROW
20
20
CORNER-TO-CORNER
SECOND ROW STARTING SHINGLE
FIRST ROW STARTING SHINGLE
EDGE OF SHEATHING
TRIM EDGES


Quantity
Arts + Craft Supplies
Books, Magazines, Newspaper, Paper
Coffee/Dining Tables, Desks + Chairs
Doors + Screens
Drainage Pipe
Entertainment/Wall Units
Fridge, Freezer
Mattress + Frame, Futons
Metal Scraps
Phone, Fax, Mobiles
Shoes
Sporting Equipment
Suitcase + Luggage
Toys
TVs
Washer/Dryer
Windows, Glass Panes
Wood Scraps

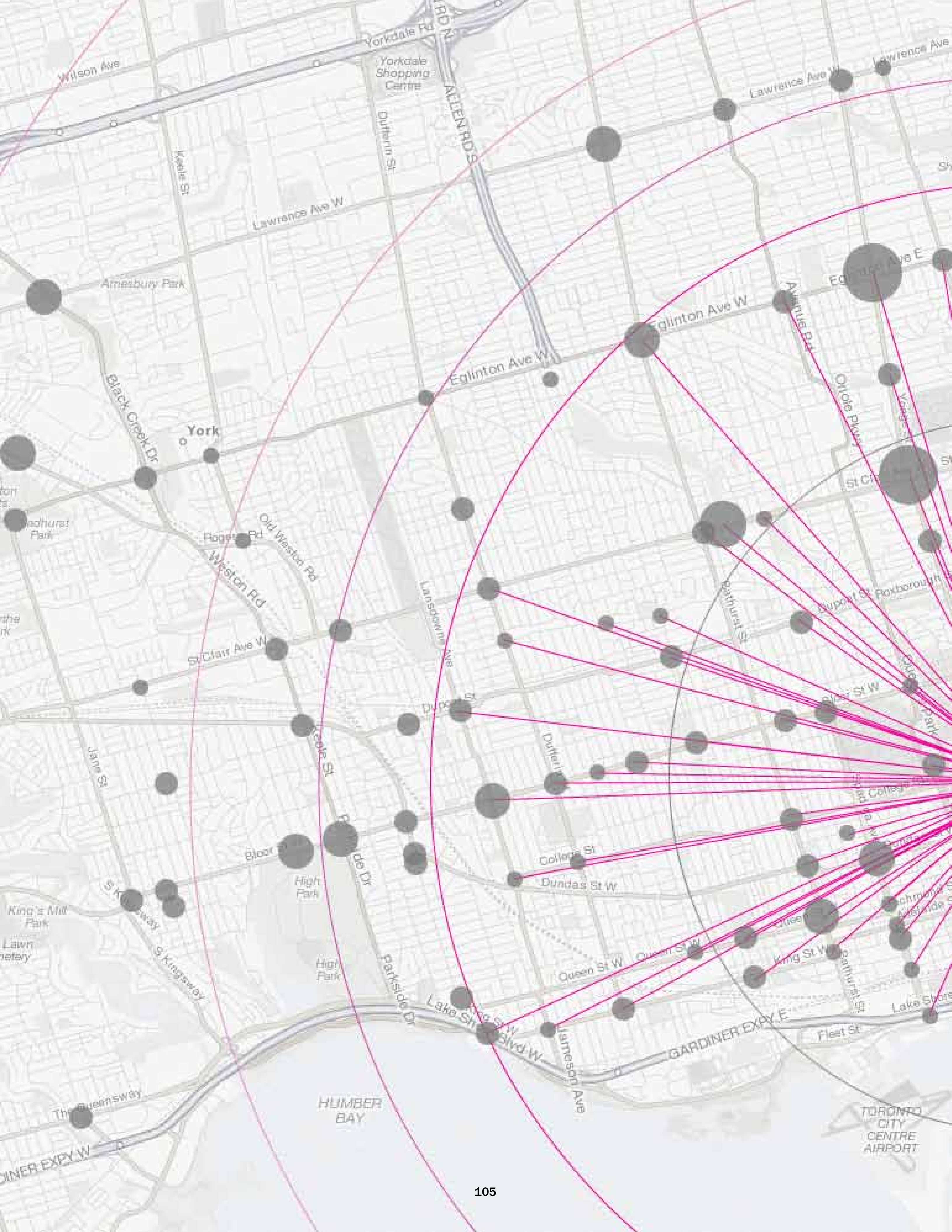


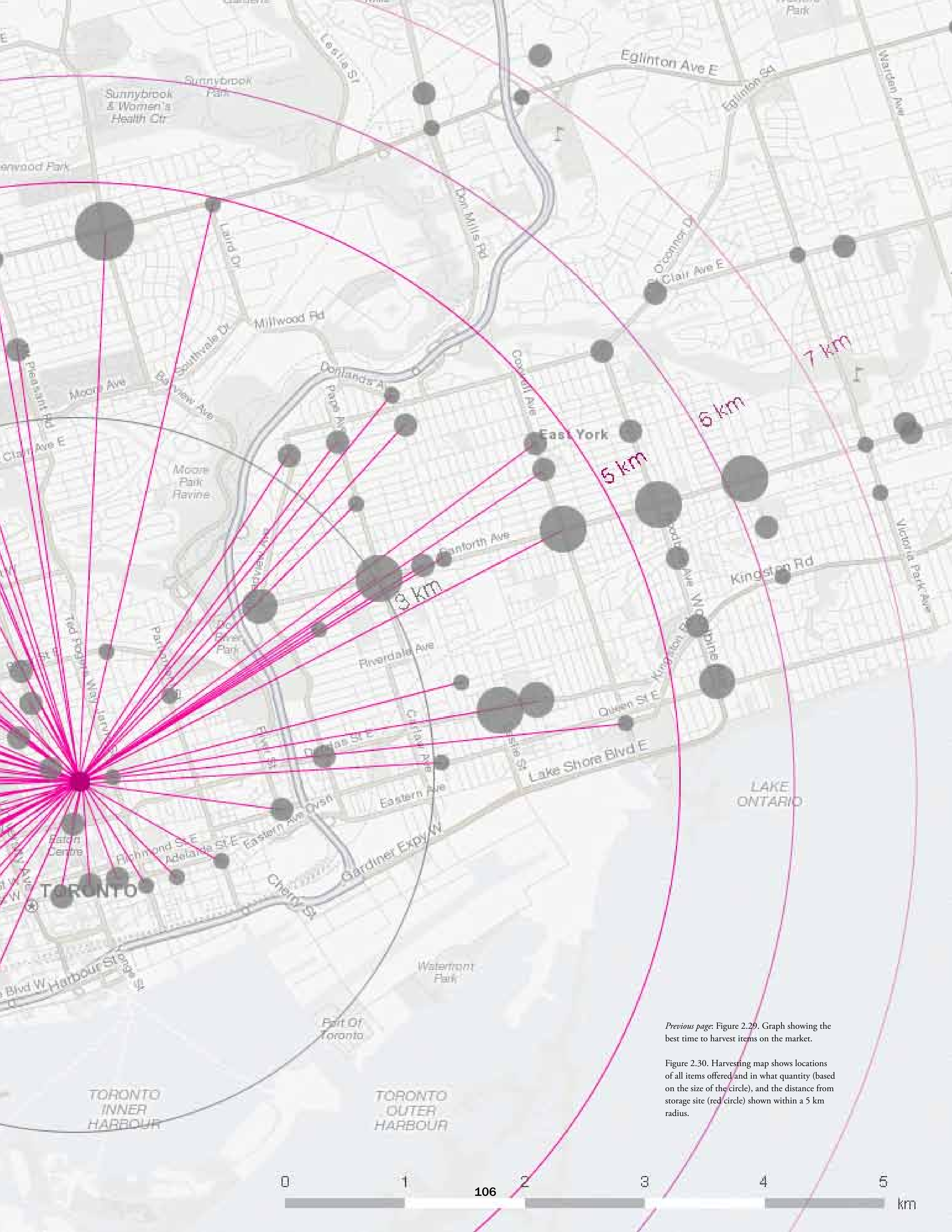
Previous page: Figure 2.27. Items offered on *Freecycle.org* in alphabetical order showing their quantities offered. This shows books and paper products to be the most in quantity offered.

Figure 2.28. List from most offered category to least on *Freecycle.org*., shows e-waste to be a huge problem.



Jul
salvage time!
summer peak moving season
May
Nov
...a fall
year-end move before winter, a rise before
Jun
Aug
Jan
Dec
October plummet
Sept
Mar
steady spring-time rise
winter-time is slow moving
Apr
Oct
Feb


Yorkdale Rd
Yorkdale Shopping Centre
ALLEN RD N
ALLEN RD S
Wilson Ave
Lawrence Ave W
Lawrence Ave
Keele St
Dufferin St
Amesbury Park
Eglinton Ave W
Eglinton Ave E
Avenue Rd
Oriole Pkwy
Black Creek Dr
York
Rogers Rd
Old Weston Rd
Weston Rd
St Clair Ave W
Lansdowne Ave
Bathurst St
Dupont St
Jane St
Keele St
Dufferin St
Bloor St
College St
Dundas St W
High Park
King's Mill Park
S Kingsway
Parkside Dr
Queen St W
King St W
Lake Shore Blvd W
GARDINER EXPY E
Jameson Ave
Fleet St
HUMBER BAY
TORONTO CITY CENTRE AIRPORT
The Queensway
GARDINER EXPY W



Previous page: Figure 2.29. Graph showing the best time to harvest items on the market.

Figure 2.30. Harvesting map shows locations of all items offered and in what quantity (based on the size of the circle), and the distance from storage site (red circle) shown within a 5 km radius.

See a book you like?

Name: +E-mail	Book Title:	Location: (ie. 2B, 4B, Grad Lounge)
[redacted]@yahoo.com	The Glass Coffin	2B
[redacted]@hotmail.com	Fundamentals of Interactive computer graphics Algorithmics - Theory & Practice	2B
[redacted]@hotmail.com	Data Based & Knowledge based systems Foundations of Discrete Mathematics	2B
[redacted]@ Yahoo.com	The Logic Book	2B
[redacted]@hotmail.com	Philosophy of Mathematics Principles of Interactive Computer graphics	2B
[redacted]@gmail	Hebrew Book (w/ elastic)	2B
[redacted]@gmail.com	WAKING UP IN NYC	2B.
[redacted]@gmail.com	BUSTING VEGAS	2B
[redacted]@gmail.com	Cat in the hat comes back The Holistic Cook	2B
[redacted]@hotmail.com	Applied Mathematical Analysis	2B.
[redacted]@	The Time Traveller's Wife	2B
hotmail.com	The Five People You Meet in Heaven	2B
[redacted]@gmail.com	The Silmarillion & C++ for Dummies	2B
[redacted]@gmail.com	Tuesdays with Morrie (1) Eats Shoots + Leaves (2)	2B
[redacted]@gmail.com	England (Lonely Planet)	2B
[redacted]@gmail.com	Confessions of an Ugly Stepsister	2B
[redacted]@gmail.com	JURASSIC PARK ANYTHING ELSE BY MICHAEL CRICHTON!	4B
[redacted]@gmail.com DAVID McMURCHY	REVENGE OF ~~THE~~ BABY SAT DEBT OF HONOUR (CLANCY)	2B
[redacted]@gmail.com	The Night Manager	2B
[redacted]@gmail.com	Petersen's Book of Photo Global Showdown	2B
[redacted]@gmail.com	Biology Family Cooking, Hamlet	2B
Meredith Vega [redacted]	Shakespeare's Bens & Sonnets Anything Agatha Christie	4B

form, while preventing sharp edges. Soda cans prove to be an ideal material choice because aluminum is impermeable, rustproof, and versatile by nature. It is also easy to acquire seeing that an average of 1,500 beverage cans are produced every minute in Canada representing a huge amount of embodied energy being wasted after 5 minutes of consumption.

Taking a cue from primitive stacking techniques, the books were overlapped one on top of the other over the foundation, mimicking the process of building a fieldstone wall. Books were sorted according to size, hardcover or soft cover, thickness, and weight. Other techniques included straw bale housing, which required tension cables to tie down the structure using the top and bottom plate as anchors. The previous case study provided the idea of material simply held together by friction and compression, without the use of a bonding agent.

Initially, in order to retain the visual poetics and memory of each book, the spines were placed facing the interior side of the wall. This proved to be an arduous task as the wall was limited to the width of each book, and because it made the wall imbalanced; magazine strips were placed at the back in order to offset the leaning structure. Magazine fillers were not ideal but necessary to fill minor gaps and unpredictable variances during in situ construction. In the end, the load was unevenly distributed because the glue and binding in the spine caused one side to be denser than the unbound margins, leading the structure to buckle. A second attempt was made after evaluating the mistakes from the first prototype; this time books were orientated any direction that seemed appropriate and hardcovers were reserved at points where vertical tension cables joined. After every 5 or 6 rows, it was imperative to check the balance with a leveler. Working with modular building materials sizes, at every 3-4 feet, a sill plate was placed on top of the wall and then tensioned, also providing a place where the exterior sheathing can be fastened (though not in the original design). The book wall then becomes a structure made up of a series of sub-systems that in the end prove to be quite sturdy and structurally secure.

This second attempt was by far a great improvement from the first, and would have been even more successful if a bonding agent had been used in between the books. However, there are several reasons for not bonding them together. The main reason is to allow the books to be salvaged and reused after the wall has been taken down, continuing the cycle best known as cradle-to-cradle. Moreover, it exploits the maximum efficiency of its embodied energy, creates energy storage, and minimizes waste by designing for disassembly—all of which will be discussed in later sections. One portion of this experiment is devoted to adaptive reuse; the other component investigates the invisible dialogue the wall has with the public. The process of reuse intrigues many students who

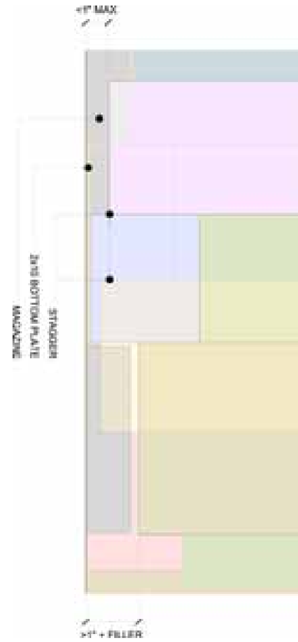


Figure 2.32. Diagram showing stagger placement of books, utilizing magazines as filler to fill gaps between books to further stabilize wall.

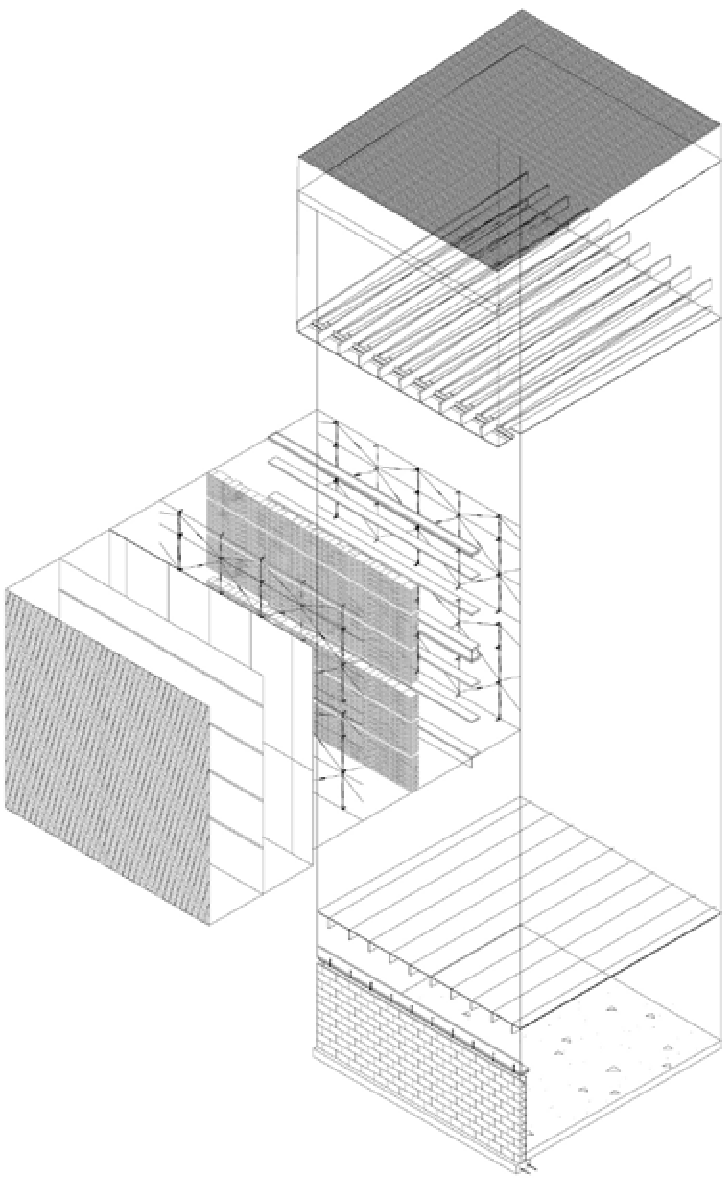
Previous Page: Figure 2.31. Partial list of participants in the cradle-to-cradle processes of the experiment.

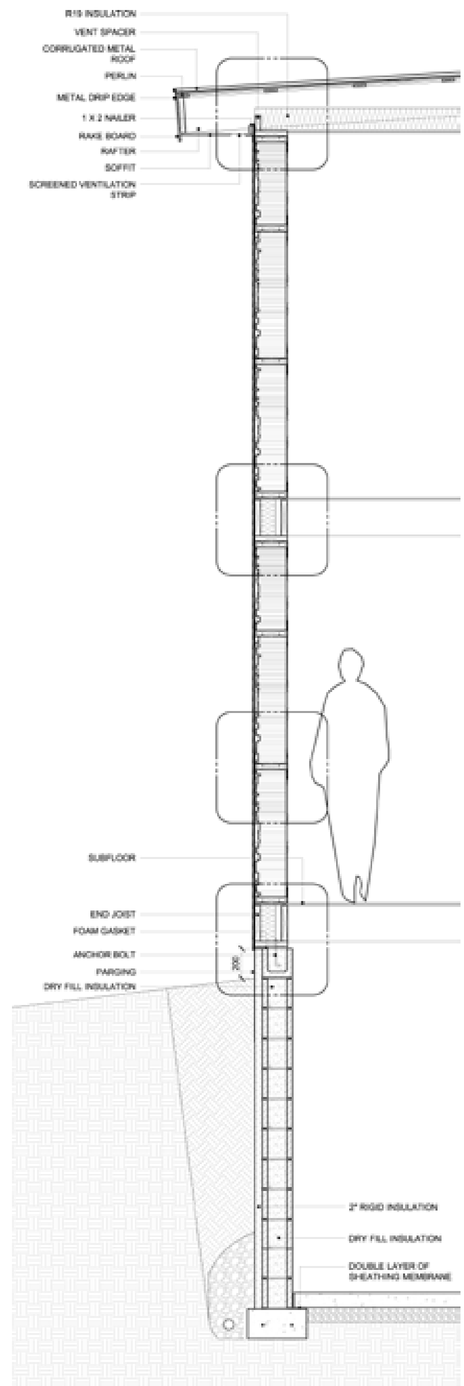
Figure 2.33 Diagram showing implications with placement of books, where the top image is the ideal method.

passed by during the construction, as they are also confronted by the huge quantity of books and soda cans. Often flabbergasted when I tell them that the complete acquisition of this material took less than a week, most simply came to realize how much stuff goes into our landfills. The Book Wall ultimately had an eerie quality and presence that haunted the space. It instigated inquiries and nostalgia and spoke the truth in such a way that was both terrorizing yet calming, displaying that beauty can be found in the most unlikely places.

Figure 2.34. *Left,* Exploded axonometric drawing of the book wall.

Figure 2.35. *Right*, Wall section showing potential construction technique.





In conclusion, there are four basic principles for secondary use of materials:[17]

1. No additional energy should be used in transforming waste materials to usable building products; for example, reusing whole bottles in construction is more preferable than smashing and melting down the bottles to make recycled glass.

2. The nature of the materials used should inspire the architect to employ it in construction based on its properties and not conform to the traditional techniques of building. Therefore the architect must seek out potential uses by evaluating the properties of the materials that make it an ideal building product.

3. If the prospective building product requires steps in transforming waste into usable material, appropriate use of technology should be developed in a ratio of *high: low* where the goal is to maximize the waste material while using the least amount of energy to transform it. This energy should be renewable unless the outcome outweighs the cost. All alterations should be done in initial design stages of planning instead of the processing stage before reuse.

4. Lastly, some waste materials are better to employs than others. Research should be done to evaluate which materials contain higher amounts of embodied energy as well as their availability in proximity to the building site.

[17] Some conclusions are inspired and drawn from: Martin Pawley, *Building for Tomorrow* (San Francisco: Sierra Club Books, 1982), 113.

THE BOOK WALL

Plate 42, *The Build Day 1, Version 1*

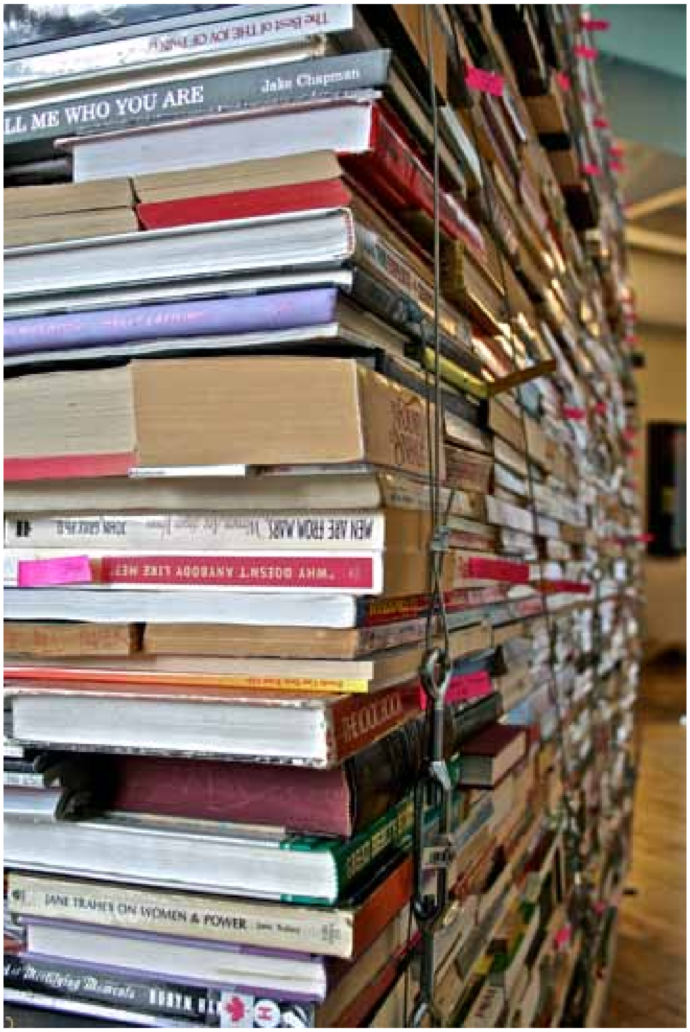
Plate 43, *The Build Day 1 (Back), Version 1*

Plate 44 (left), *Mid Build Tension, Version 1*
Plate 45 (right), *The Build Day 1 (Back), Version 1*

Plate 46 (left), *Magazine filler at the back is a bad idea.*
Plate 47 (right), *The Build Day 2, Before the Disaster, Version 1*

Plate 48, *The Build Day 3, Measuring with Leveler, Version 2*

Plate 49 (left), *Tensioning Cables, Version 2*
Plate 50 (right), *Check for leaning structure with leveler, version 2.*



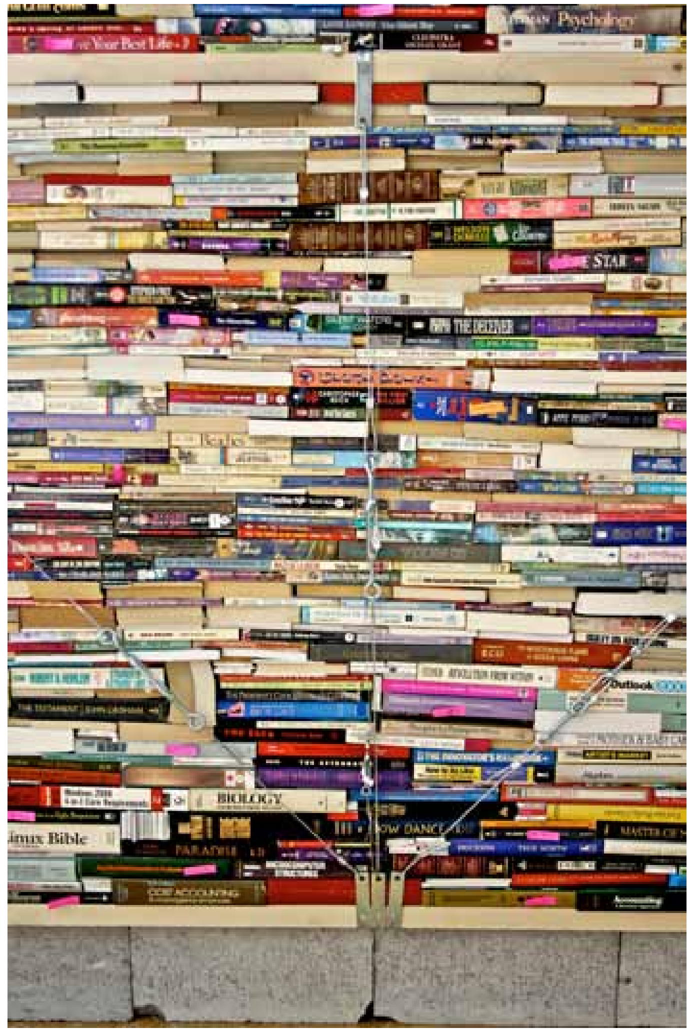


Plate 51 (left), *Student Experiment with Flags no.1 (One Week Later)*
Plate 52 (right), *Student Experiment with Flags no.2 (One Week Later)*

Plate 53, *Student Participation Result*

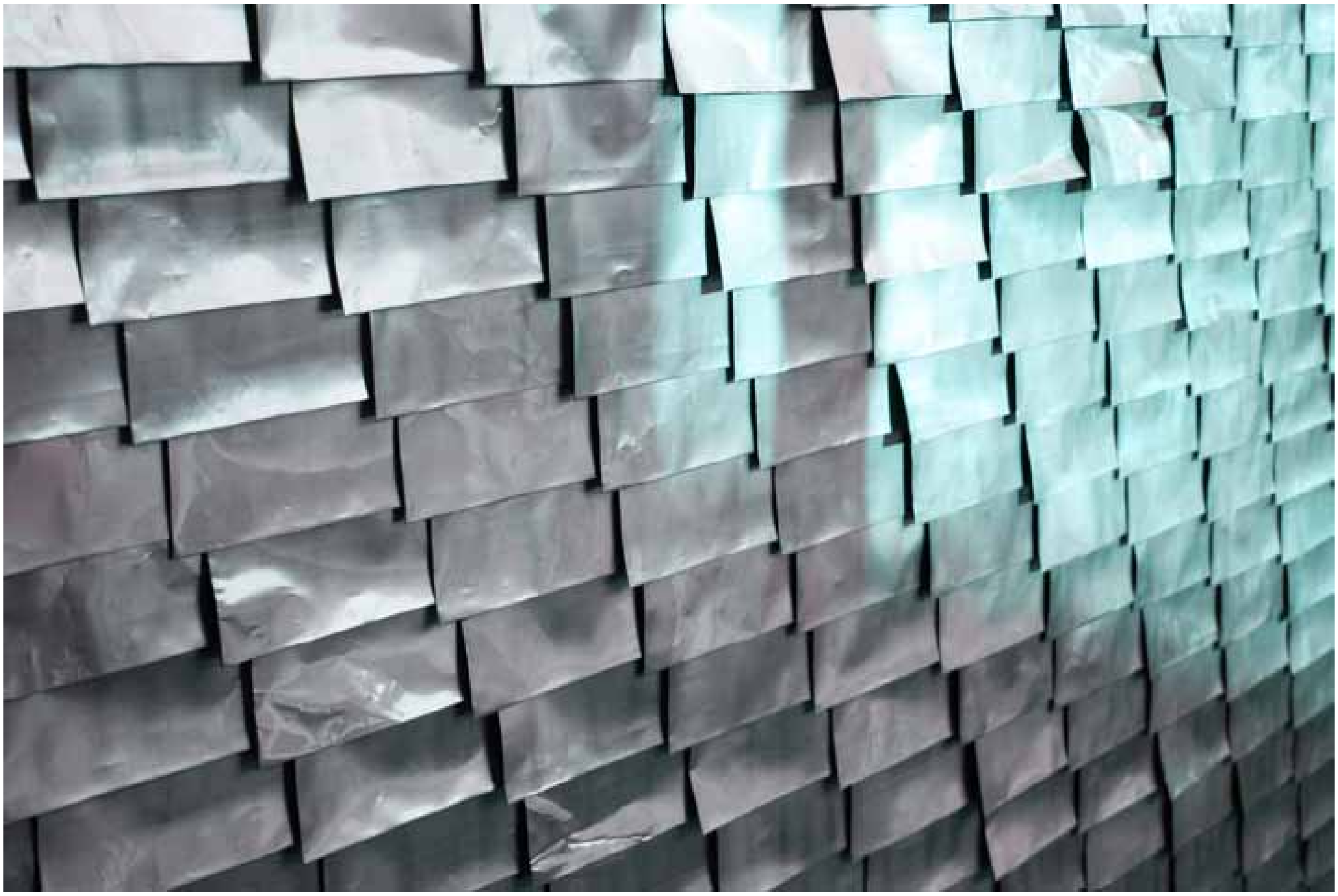


Plate 54, *Soda Can Shingle Wall*

Plate 55, *The Product of Secondary Reuse and Design for Deconstruction*

2.4 CRADLE-TO-CRADLE

From the play-on words *cradle-to-grave*, the phrase cradle-to-cradle has gained recent popularity as a way to describe a 'greener' process of recycling and reuse. While the term is often interchangeable, William McDonough and Michael Braungart looked at cycles in ecosystems as models for changing current recycling and reuse practices largely because there are still environmental implications with both methods. Cradle-to-grave is very much a model of the industrial throwaway society where objects from inception, manufacturing, distribution, and consumption all finally lead to eventual wasting and landfill. Since there is not ever an *away* in *throwaway*, in certain cases it might actually be less dangerous to seal materials in landfill, since chemical and toxic processes during manufacture of the object make it hazardous to sit idle in the landscape. These are called *crude* products, objects that are not designed for the benefit of human and ecological health.[18] Disheartened by current industrial processes and its inability to harness and maximize local natural energy flows, McDonough and Braungart reflected on *eco-effectiveness* searches for a "means [of] working on the right things—on the right products and services and systems—instead of making the wrong things less bad." [19]

[18] William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002), 37.

[19] Ibid., 76.

Regarding reuse, cradle-to-cradle is a term that describes objects that were created with the intention of a second purpose after its initial life. This allows it to essentially jump from one lifecycle to the next compared to secondary reuse of objects where it becomes an afterthought that adapts to any object regardless of its initial intention. Cradle-to-cradle applies principles from the first two stages of the modern pyramid scheme, where it firsts seeks to *re-imagine* existing manufacturing methods. Instead of iterating the shape over and over again by recycling and manufacturing, where materials are often victims of down-cycling, perhaps there is a way to up-cycle material by restructuring its ingredients and process of decomposition. This might be done in such a way that nourishes the environment while simultaneously setting in motion a number of positive effects. The tier after re-imagination seeks to *redesign* an existing ecological situation by designing products or a methodology in which it can return energy and nutrients safely

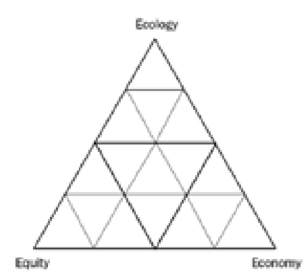


Figure 2.36. Eco-effectivness model. It "celebrates commerce and the commonweal in which it is rooted, where ecology governs all products and secondly in the economy/equity sector, it shifts toward fairness" (McDonough, 150).

[20] William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002), 104.

and naturally back to the environment during decomposition thus halting entropic processes and closing the loop between man and nature.

> *If humans are truly going to prosper, we will have to learn to imitate nature's highly effective cradle-to-cradle system of nutrient flow and metabolism, in which the very concept of waste does not exist….To eliminate the concept of waste means to design things—products, packaging and systems—from the very beginning on this understanding.* [20]

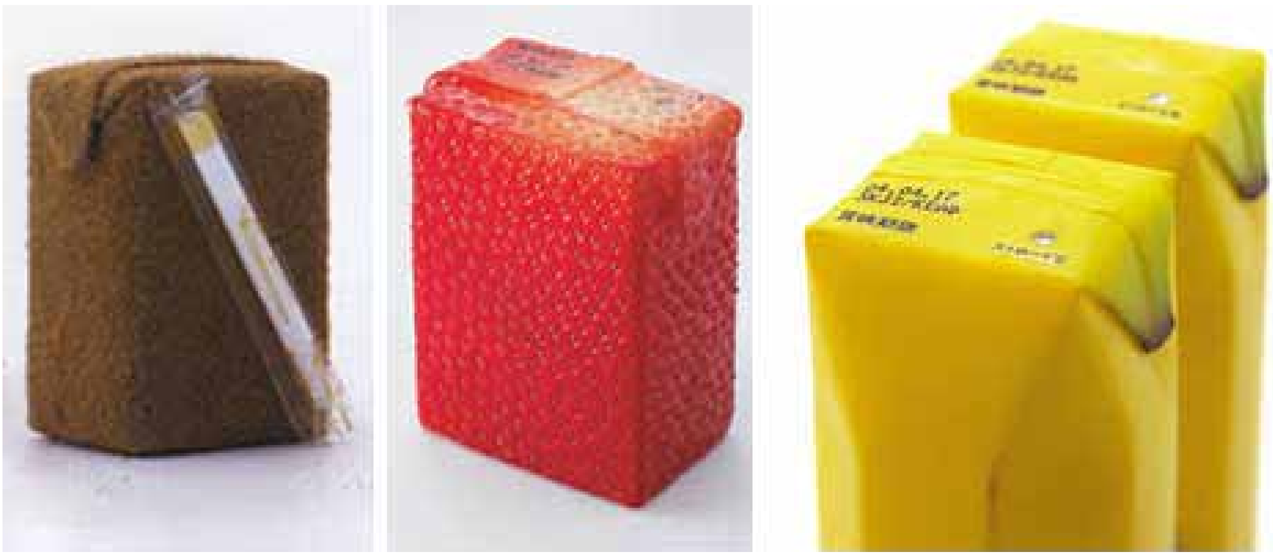


Figure 2.37. A conceptual idea of cradle-to-cradle packaging.

Flexible designs—such as designing products that disassemble to replace, repair, or modify—help to eliminate waste. In the Book Wall a bonding agent in between each book would have been more practical to hold the integrity of the structure. However, it was designed with the concept of reduction and zero-waste, by using the least amount of materials and components, all of which would somehow be reused. From the planning stages it was important to facilitate reclamation so as not to damage any materials during the erection of the wall; any use of bonding agents would have ultimately destroyed the books. After the experiment, every component of the building was given a second life. Components were distributed as follows:

Foundation	Frank, the UWSA security guard
Turn buckles & angles	Resold to Habitat for Humanity's ReStore
Nuts & Screws	Saved for future projects
Bottom/top plate	Donated to the UWSA workshop
Books	"READ," Non-profit organization, aids Rwandian education; various UWSA students
Magazine Strips	For a papier maché dress to support a colleague's thesis
Plywood sheathing	Undergraduate landscape installation project
Aluminum cans	Recycled
Bags of concrete	Undergraduate landscape installation project

Students were encouraged to engage in a sort of dialogue with the installation. Each participant had an opportunity to sit independently, walk around the structure, and reflect on each element, as each and every single component that made up this wall has some sort of history, past, or story that was reclaimed and given a second life. Students were given an opportunity to salvage a piece of the wall at the end of their reflection by placing a claim on the desired object. The result is a chain reaction building upon participation, as one person's claim leads another to ponder (*see* Plates 32-34).

The experiment became a model in which elements in nature (people) fed from the nutrients (books) from all levels (sill plates to foundation), and eventually re-fed back into the same system as fertilizer (unwanted books, reclaimed foundations, post-consumer pop cans), where anticipation of new life forms can begin to take shape (a new construction elsewhere). "Each inhabitant of an ecosystem is therefore interdependent upon each other. Every creature is involved in maintaining system; all of them work in creative and ultimately effective ways for the success of the whole." [21] It is true that the Industrial Revolution brought on phenomenal power over nature in which disconnection takes place. In spite of this, the products and processes of industries can begin to recuperate their relationship with the environment when it respects diversity, and energy flows, with local social, cultural, and economic forces while acknowledging the landscape and its ecosystem.

[21] William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002), 122.

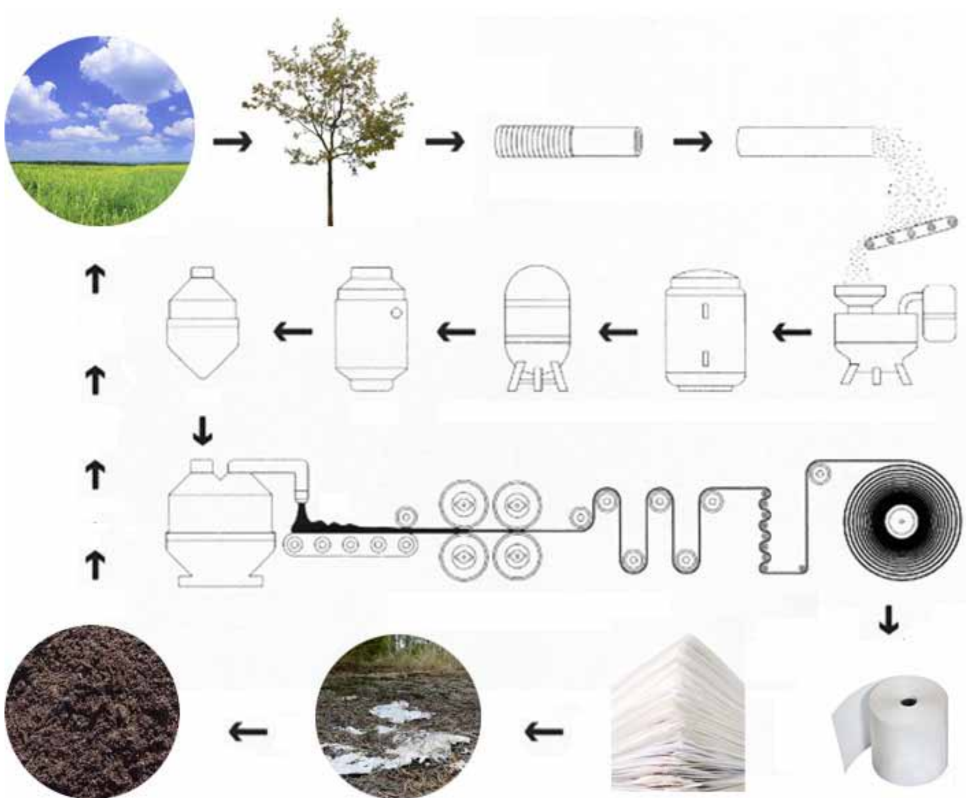


Figure 2.38. Cradle-to-cradle's closed-loop diagram, though similar to the processes of recycling, objects are designed with intentions of giving back to the environment in its final stages (shown here: a simple example of eco-friendly paper products).

Everything that has ever been created is not lost; matter only transforms from one form to another. Waste is a transformation of matter that is simply an untapped energy reserve. In primitive cultures, civilization had little resources but very high levels of utilization efficiency; in present day we are quite the opposite. Government influence behind waste recovery of any form is purely an economic motive, but ultimate utility is an evolutionary idea.[22] "In nature, accumulations of waste create evolutionary opportunities precisely because they are indistinguishable from accumulations of surplus." [23] Utilization of waste material for building presents reduction in the embodied energy content and furthermore transforms buildings into energy reserves from which extraction of resources can be made in the future. According to English Heritage, "the average row house contains enough embodied energy to drive a vehicle around the world five times." [24]

The reuse of waste in buildings has a high reduction rate of embodied energy, saving 95 per cent of what would have been wasted.[25] Buildings inherently possess high levels of embodied energy during the production process. All materials from extraction of raw materials, refining, manufacturing, packaging, transport, and then labour—all add up to the total embodied energy of the building. Often, substantial amounts of 'hidden flows' of waste are not accounted for in this total; these are waste generated during extraction of raw materials. About 68 per cent of waste is in the form of emissions, 22 per cent is released on land and 10 per cent in water. [26] Waste is a by-product generated at all stages of a material's life. The embodied energy content is lower when less waste is produced; therefore it is important not only to look at the embodied energy of the material, but its life-cycle as well, as both are intrinsically linked.

There has been a huge shift in the last 50 years from localized materials to globalized distribution of manufactured materials. The competition between markets has now reached a global scale resulting in the fabrication of cheap materials which encompass

[22] Martin Pawley, *Building for Tomorrow: Putting Waste to Work* (San Francisco: Sierra Club Books, 1982), 48.

[23] Ibid.

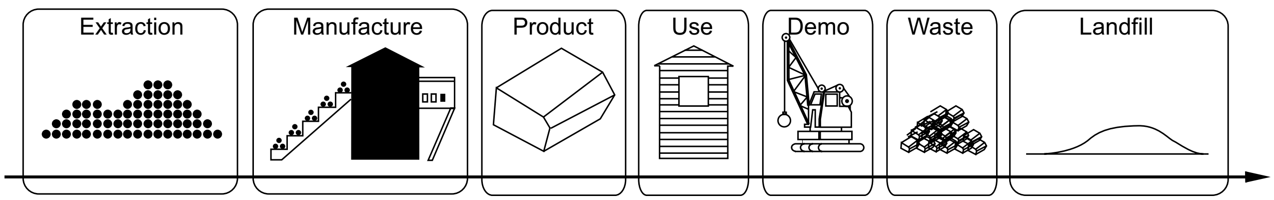
[24] Alana Wilcox, Christina Pallasio, and Jonny Dovercourt, eds. *GreenTOpia: Towards a Sustainable Toronto* (Toronto: Coach House Books, 2007), 48.

[25] CSIRO Material Science and Engineering, "Embodied Energy!" *Superuse* (Sept 2007), http://www.superuse.org/story.php?title=embodied-energy-1 (accessed Sept 30, 2010).

[26] Meg Caulkins, *Materials for Sustainable Sites* (John Wiley & Sons: Hoboken, NJ, 2009), 34.

high-embodied energy that eventually makes its way into the waste stream. It has been estimated by The World Resource Institute that "one-half to three-quarters of annual resource inputs to industrial economies are returned to the environment within a year [in the form of discards]." [27] At present, materials now respond to a completely different category of impact than what it was a century ago. These range from climate change, air pollution, ecological destruction, resource consumption, and energy inefficiency. There needs to be a reevaluation and establishment of a new order of production and construction, where emphasis should be put on the use of materials that come from renewable sources and those that do not come from virgin material.

[27] Meg Caulkins, *Materials for Sustainable Sites* (John Wiley & Sons: Hoboken, NJ, 2009), 33.



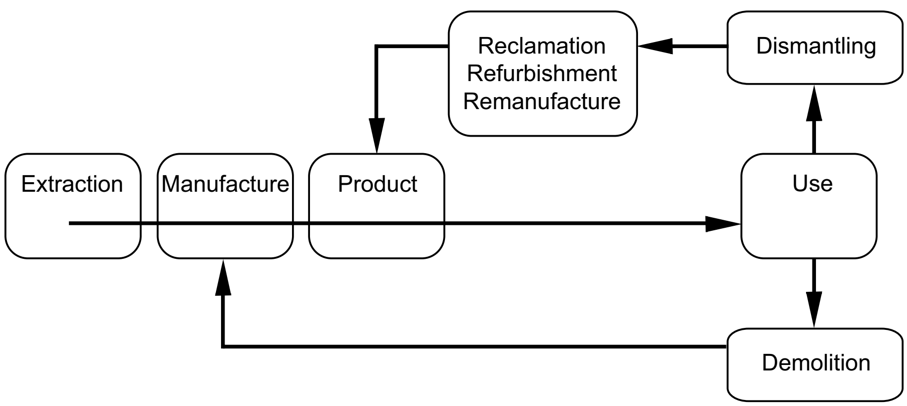


Figure 2.39. *Upper,* Life-cycle diagram of tradition material flow.

Figure 2.40. *Lower,* Life-cycle diagram of proposed and ideal material flow.

Since nearly half of all material and energy extracted are destined for building construction, "architecture now regards the realm of resource flows and effects beyond the contact of its physical site as a primary concern." [28] Since buildings account for over 40 per cent of all greenhouse gas emissions,[29] in the future it is likely that building construction will be an ideal discipline to calibrate new ways to lower the carbon footprint. These may include new forms of resource harvesting, processing, and deployment. Initiatives can already be seen in Ontario, as a growing number of universities and young professionals participate in discussions and competition incentives held by the local government to re-skin buildings and design buildings with a zero footprint. A key to this progress may be the development of materials and their applications. It may contribute as a way of creating "architecture by shortcutting the flow of products and elements from their state

[28] Blaine Brownell, "Testing Ground: Emergent Green Materials and Architectural Effects" in Materials/Treatments, *A+U Architecture and Urbanism*, no. 473 (Feb 2010): 10.

[29] "Zero Footprint Building Re-skinning Competition," *zerofootprint* (Mar 2009), http://www.zerofootprintfoundation.org/ (accessed Sept 27, 2010).

of maximum added value," [30] and garbage as a building material has the potential to do just that, simultaneously creating zero-carbon-footprint construction.

Preference is given to waste that has high investments of energy during manufacturing and the lowest recovery rate, while also in abundance; in other words, the highest embodied energy input and shortest life-cycle. Tires, for example, are among the largest and most problematic sources of waste seeing that approximately one tire is discarded per person per year. The U.S. Environmental Protection Agency reports that an average of 290 million scrap tires were generated in 2003.[31] These tires often cannot be landfilled because of health and environmental risks of stockpiling tires. They also do not bury well.[32] A new use for tires must be found because it constitutes such a high level of energy that potentially could be wasted. If tires were the primary building material, they have the potential to constitute 99 per cent of the embodied energy of the building. Each tires takes approximately 1 million Btu of petroleum to make,[33] therefore a 500 sq. ft. house made out of tires would total an average of 400 million Btu of petroleum, far exceeding the worth of any traditional building material. Examples can be seen in Michael Reynold's *Earthships* of the 1970s, where these autonomous structures consist of rammed earth that maximizes heating and energy efficiency. More recently, structures by Millegomme transform tires and waste into useful objects and architecture, avoiding rules and academic trajectory.

[30] Ed van Hinte, et al., *Superuse: Constructing New Architecture by Shortcutting Material Flows* (Rotterdam: OIO, 2007), 5.

[31] "Management of Scrap Tires", U.S. *Environmental Protection Agency* (Jan 3, 2007) http://www.epa.gov/epaoswer/non-hw/muncpl/tires/index.htm (accessed Nov 29, 2009).

[32] "Even the builders cannot solve the landfills' mysteries—for example, why capped landfills are littered here and there with car tires. Though once buried deep, the tires are somehow ejected to the surface. Scientists are still hypothesizing about this enigma." (Engler, 81).

[33] Martin Pawley, *Building for Tomorrow: Putting Waste to Work* (San Francisco: Sierra Club Books, 1982), 101.

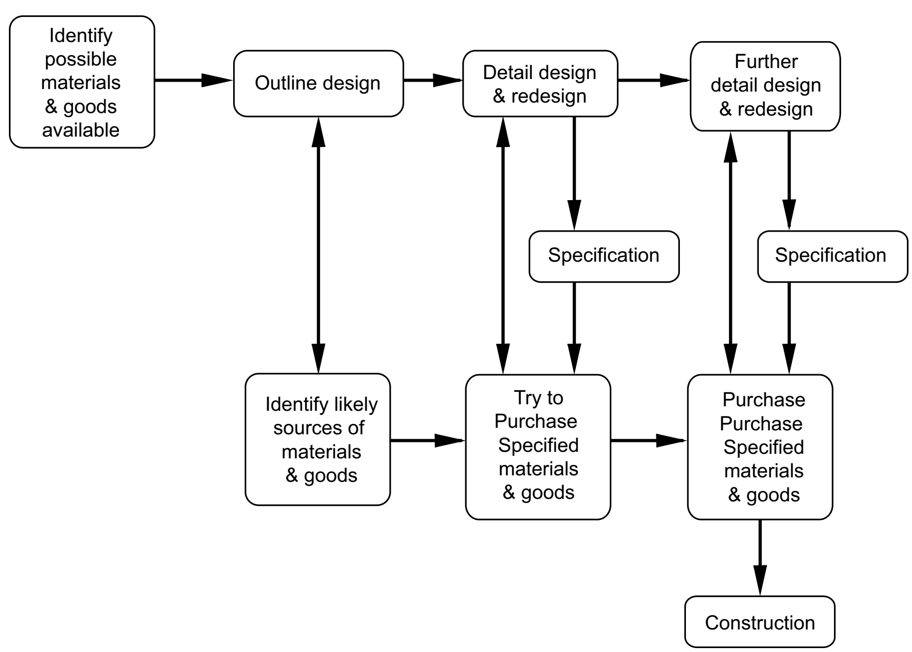


Figure 2.41. Flow diagram and strategy to facilitate good architectural practice for salvage and reclamation design.

2.6 DESIGN FOR DECONSTRUCTION & DISASSEMBLY

Our culture today is built on superficial notions of luxury. Seen only at its surface, the techno-science and design of materials is the epitome of this kind of luxury. With the advent of faux *everything*, it does not matter what it is made of because it will soon be covered up anyway, with materials like veneer, cladding, or other finishes. As a society we are able to fake any material inexpensively. Competitive prices for materials are available because quality is often compromised. The result has been a response to many evolutionary twenty-first-century trends—"the shift from skilled craftsmen to cheap labour in construction." [34] The role of the architect has also changed, as we are no longer the master builder but a subdivision of that. No longer are buildings meant to survive time. Just fifty years ago, we were able to construct buildings that would stand for centuries, and in Europe, much longer. Our goals and ideals of the building craft have shifted so immensely that in academia, students are taught the standards of the 100-year-old-building, as if this is what we should strive for. Albeit, given present circumstances, our volatile nature, and changing environmental predicament, we should build in a way that suits us presently. Yet if it must be done, it should be done in the wisest manner; all the while keeping in mind future possibilities.

Friedrich Nietzsche proposed 3 different types of historical models that are used to describe human development—*monumental, antiquarian, and critical*.[35] For some time, architecture has been about monumental development from the hands of the skilled craftsman and the trade. However, within the last century during the hype of new technological and scientific advances, preoccupied with our liberation from conservatism, we have entered the critical stage in history. The art of the master builder is lost; this is now a role encompassing the trades of the architect, building engineer, and scientist.[36] The lexicon of these trades today forces such trades to disperse into several disciplines. As a result we seem to have lost the ability to understand and piece together projects as a whole. Architects are not required and do not have the knowledge to build bridges without the structural engineer. In most cases, architects do not choose interior finishes and furniture, lighting, or landscaping, let alone minor nuts and bolts that hold up the

[34] Meg Caulkins, *Materials for Sustainable Sites* (John Wiley & Sons: Hoboken, NJ, 2009), 1.

[35] Friedrich Nietzsche, *On the Use and Abuse of History for Life*, trans. Ian C. Johnston (1873), 9.

[36] Stephen Kieran and James Timberlake, *Refabricating Architecture* (New York: McGraw-Hill, 2004), 27.

Next page: Figure 2.42. [*top*] Past versus present. Buildings such as this one (Notre Dame de Paris) was only conceivable by the role of master-builder [*top*].

Next page: Figure 2.43. [*Bottom*] The image is of Don Mills Centre, one of the first malls in Canada within one of the first suburbs in North America. The two images show urban gathering spaces from 2 eras.


Don Mills Centre
CIBC

building. The new view of architecture is not preoccupied with static monoliths, but fast and lightweight assemblies. This comes with implications for buildings that wish to be categorized as *sustainable*. Sustainable buildings were built with the notion that they would last long enough to gain financial and environmental return. To begin to see the rate of return from most of these buildings is not likely for a number of years, at least 10-20 years. It takes perhaps at least 50 years for all initial investments to pay off. Thus sustainability can also be defined by thinking in terms of life span, and so modern building practice must seek to harmonize sustainability and methods of assembly.[37]

In developed countries, buildings and infrastructure account for about 80 per cent of national property.[38] This number will likely rise in the next 30 years from 296 billion square feet to 427 billion square feet. Over a quarter of the buildings will be replaced in the next 20 years and 50 per cent of all buildings built in 2030 will be designated new construction since 2000.[39] It has also been estimated that by that year raw building materials will become quite scarce. The role of the architect will be to play an essential part in deciding the fate of where society stands within nature; architects must seek ways to maximize matter without dipping into our reserves. According to the EPA, over 30 per cent of all waste produced each year in Canada[40] is from the construction industry, of this, 92 per cent results from renovation and demolition.[41] To offset this growing number, tipping fees in landfills have increased, no longer making landfilling a feasible option. Demolition contractors now seek to minimize waste going to landfills because of this cost, making the previous declining salvage markets quite profitable.

To ease the rise in future population growth, an increase in construction can be seen in the future. This will inevitably cause buildings to be designed in quantity, not quality. Design for deconstruction (DfD) as a discipline of designing buildings with the intent to facilitate disassembly in the future will become an important discourse in the practice of architecture. Active reduction in waste is another factor in DfD.

[37] Bradly Guy and Scott Shell, "Design for Deconstruction and Material Reuse," *Center for Construction and Environment*: p. 2, 4, 9. http://www.design4deconstruction.org/literature.html (accessed April 13, 2010).

[38] Asko Sarja, *Integrated Life Cycle Design of Structures* (Spon Press: London, 2002), xi.

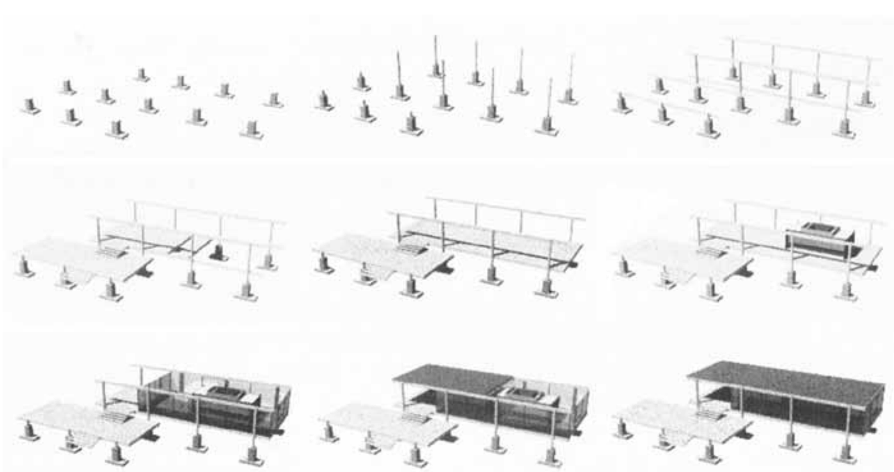
[39] Brad Guy and Nicholas Ciarimboli, *Design for Disassembly in the Built Environment: A Guide to Closed-Loop Design and Building* (2006), http://www.lifecyclebuilding.org/files/DfDseattle.pdf (accessed May 4, 2010): 2.

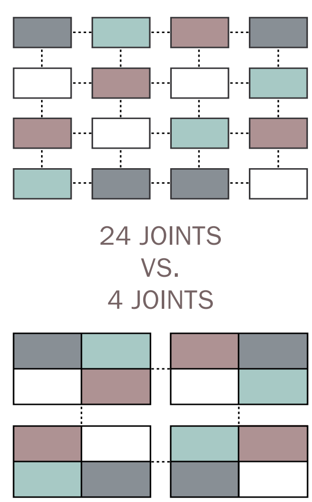
[40] Alana Wilcox, Christina Pallasio, and Jonny Dovercourt, eds. *GreenTOpia: Towards a Sustainable Toronto* (Coach House Books: Toronto, 2007), 48.

[41] Michael Pulaski et al., "Design for Deconstruction," *Modern Steel Construction* (June, 2004), 1.

Figure 2.44. *Bottom Left* , By using modular design and components "construction is simpler, faster, more precise, less expensive," (Kieran, 172) and easier to dismantle.

Figure 2.45. *Bottom Right,* Minimizing joints facilitates ease in construction and dismantling, as well as less human error.





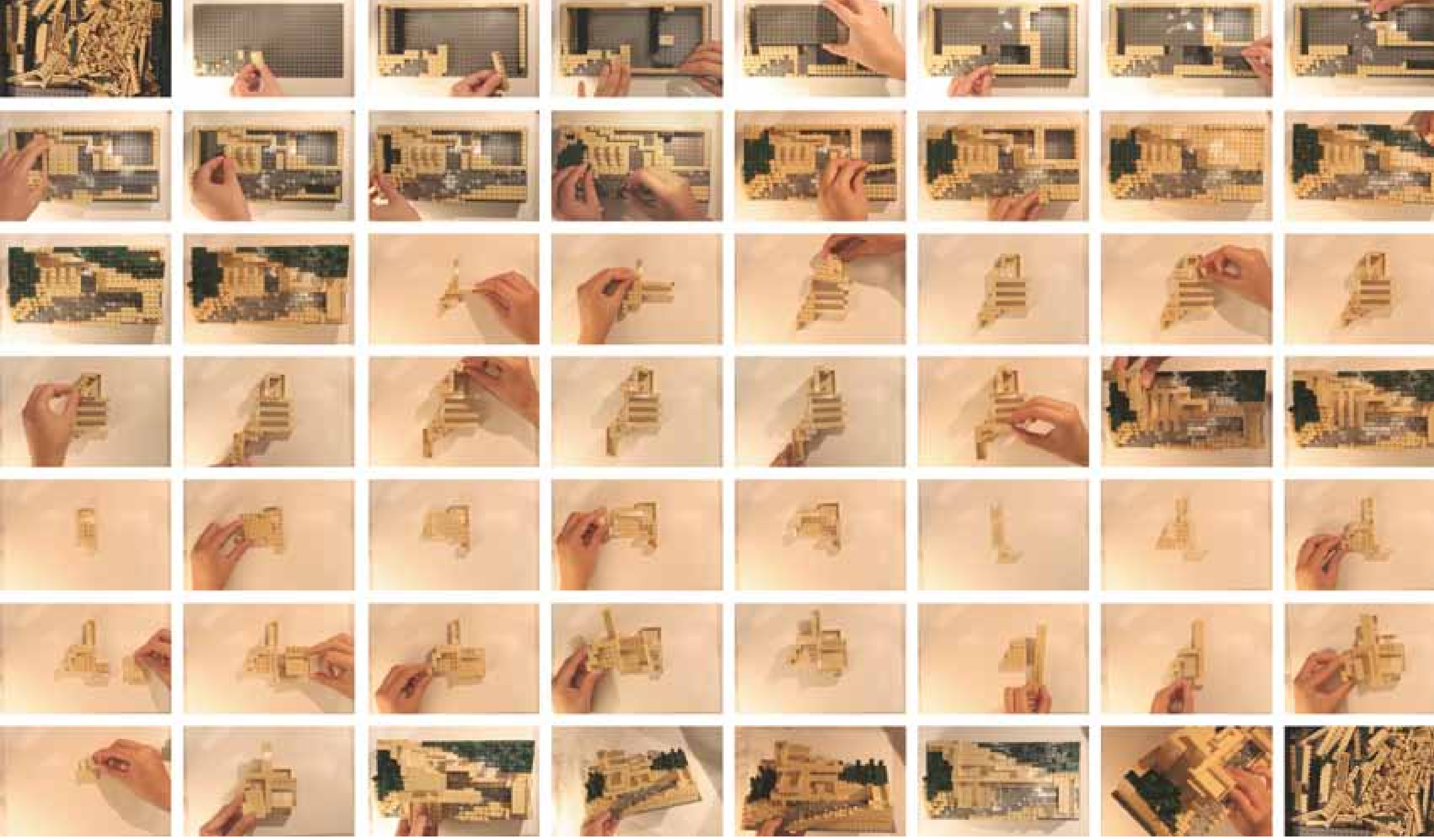


Figure 2.46. Building Frank Lloyd Wright's Falling Water with Lego.

By selective dismantling of structural systems and components by designing them in such a way as to ease disassembly will provide the ability to reuse salvageable parts for future construction. In addition to waste reduction, DfD will inherently increase the life of the building, as the labour for replacement of components and renovation is less challenging. The simple fact is: "if a building can be constructed simply, it probably can be deconstructed simply." [42]

Some of the best examples of DfD can be found in existing prefabricated buildings. In mimicking the automobile industry, prefab construction becomes simpler, faster, more precise, and less expensive.[43] Mass production has also given us mass customization, with the ability to create customized components easily adaptable to current needs of the industry. This has massive potential to minimize waste, especially waste from the construction industry. Aside from prefabricated structures such as autonomous housing, ephemeral dwellings such as tents and pavilions, kiosks, and performance spaces are also good examples because components were used for either ease in construction, dismantling, or both. All of these assemblies avoid the use of adhesives, rivets, and welding; instead they use nuts, bolts, screws, and nails. They are modular components that may come in standardized sizes, which makes them flexible. Additions and renovations also increase the opportunity for future salvage and reuse. However farfetched, children's toys such as Lego®, K'Nex®, or Meccano® [44] are designed with deconstruction in mind, have subtle qualities that are worth considering, and perhaps even applying.

[42] Michael Pulaski et al., "Design for Deconstruction," *Modern Steel Construction* (June, 2004), 1.

[43] Stephen Kieran and James Timberlake, *Refabricating Architecture* (New York: McGraw-Hill, 2004), 172.

[44] Bill Addis, *Building with Reclaimed Components and Materials* (Earthscan: London, U.K., 2006), 20.

Active waste reduction is already a common practice in our everyday lives. The act of sorting rubbish, recycling, reusing, changing light bulbs and appliances to meet Energy Star® performance has already become an established routine. Architecture is beginning to shift their ideas about sustainable practices from not just applying sustainable materials to design but that design should reflect a future reduction in waste as well. Adhocism, secondary reuse of materials, and design for deconstruction are techniques for replenishing depleting resources by reducing the amount of waste going into the waste stream. However future architectural practices should also seek to find a balance between society and waste in order to successfully change negative associations and stigma surrounding this topic.

This balance may be found in topics such as life-cycle analysis of buildings and embodied energies since it has very much to do with society's struggle with the economy, changing markets, and energy affecting daily life. When re-imagining and re-designing current practices, an ad hoc approach to contemporary ideas may aid in the emancipation of traditional ideals into a form of participatory democracy. Cradle-to-cradle practices reinterprets the idea of ecological cycles in product design, this can also be applied to a larger concept whether it is to be in architecture or to an urban plan. We begin to realize that architecture could be a medium in bringing together larger concepts within an urban society, since architecture plays an essential part in deciding the fate of where society stands within nature.

Given that buildings represent approximately 40 per cent of GHG emissions, architects feel the global responsibility to improve future conditions by inheriting the huge task of reducing societal impact on the environment. However, population increase and urbanization has lead to new definitions in the roles of governmental authority. The burdens of the urban society are no longer carried solely by the architect but are also the utmost responsibility of the government as they have the power and means to influence positive changes into a whole population.

Rarely does a resident of any of the world's great metropolitan areas pause to consider the complexity of urban life or the myriad systems that operate round the clock to support it. He or she wakes up in the morning to turn on a tap, switch on a light, flush a toilet or perhaps grab a banana—little knowing how much effort, on the part of how many people, goes into making the simplest morning routine possible....Even the most mundane domestic tasks would be impossible without the far-reaching, complex, and often invisible network of infrastructure that supports them.

- Kate Ascher, *Anatomy of a City,* 2005

PART III | FUTURE

R E S T O R E

Measure twice cut once. Cut once, use twice.

- Jeff Masson

Plate 56, *Demo #1, Toronto,Ontario*

Plate 57, *Demo #2, Toronto, Ontario*

Plate 58, *Old Brick, Toronto,Ontario*

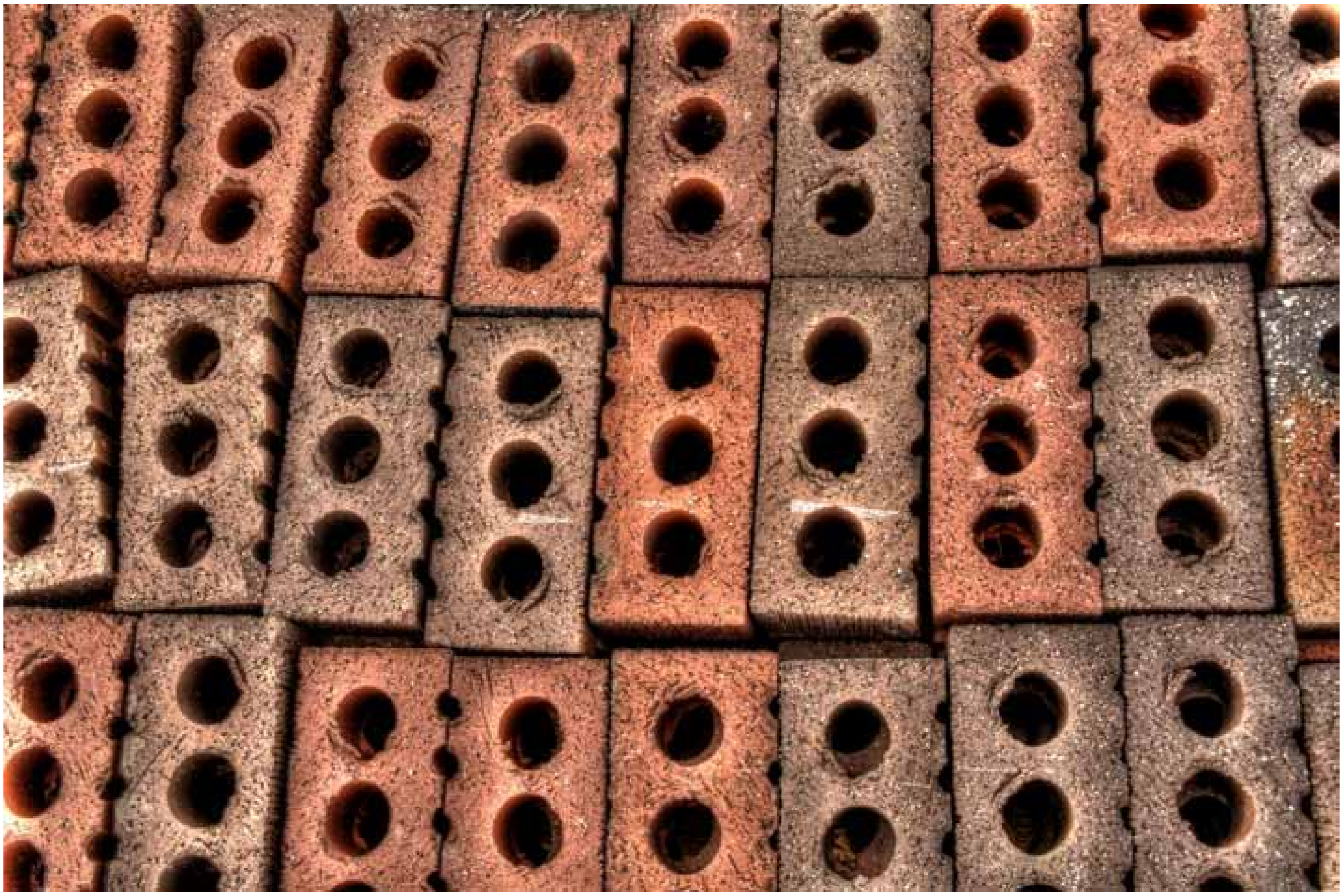


Plate 59, *New Brick, Toronto, Ontario*

Plate 60, *Tiles, Toronto,Ontario*

Plate 61, *Plywood Sheathing, Toronto, Ontario*

Plate 62, *Doors, Toronto, Ontario*

Plate 63, *Wood, Toronto, Ontario*

Plate 64, *Metals, Toronto,Ontario*

Plate 65, *Boiler & Interiors, Toronto, Ontario*

Plate 66, *Sinks, Toronto,Ontario*

Plate 67, Metals 2*, Toronto, Ontario*

Plate 68, *Light Fixtures, Toronto, Ontario*

3.1 CITIES OF THE FUTURE

Niccolò Machiavelli (1527) recognized that situations needed to be unpleasant before prompting relief. A World without Oil in Part I depicts the unpleasant future scenario of Manhattan and other cities with similar topographical elevation that will be concurrent to flooding if no present action is at work. This future scenario, though looking grim, can for the most part be avoided through government initiatives that prepare society mentally for consequential forthcoming events. This entails economic and industrial cooperation to shift consumer habits of spending from disposables to investments, by educating the public on how waste is interconnected with the fundamentals of energy and the environment, by promoting sustainable living, through community involvement by support systems, and by having active groups practicing this principle. Perhaps the most difficult to achieve, yet the most important objective for future change, is to abolish every hint of cultural stigma surrounding waste and reuse because no change can happen without the evolution in social mentality regarding this topic.

Cities should look to experiences that planners, architects, and other governments have had in reshaping their cities into sustainable initiatives that practice similar models of approach. Insight into case studies will provide a pragmatic assessment for the method suitable for the challenges unique to every city. Such examples can be found in Malmoe, Sweden, Murcia, Spain, Songpa, South Korea, Stargard Szczecinski, Poland, Sydney, Australia, and the city of Curitiba, Brazil which is the recipient of the prestigious 2010 Globe Sustainable City award. This award recognizes the city's maturity in the understanding of sustainable integration of developments, both regarding policy and implementation within its city.

The following example represent a city that understands the value of community together with the aid of positive influences, can contribute to the city's diverse method in producing micro scale initiatives. This bottom-up approach provides precedents for architects and planners as leaders in society, using governmental influences to bring about positive changes. Their holistic vision creates unity and diversity, and through education, an awareness and appreciation for the environment becomes evident.

[1] Johan Gorecki, "Globe Award 2010: The Brazilian City Curitiba Awarded," *mynewsdesk* (Apr 7, 2010). http://www.mynewsdesk.com/se/pressroom/globe_forum/pressrelease/view/globe-award-2010-the-brazilian-city-curitiba-awarded-the-globe-sustainable-city-award-2010-392832 (accessed October 10, 2010).

[Curitiba's] holistic approach is well framed and managed in order to create a strong and healthy community, integrating the environmental dimension with other dimensions like intellectual, cultural, economic and social…with a holistic municipal master plan integrating all strategic resources linked to innovation and future sustainability.[1]

A BRIEF STUDY: Curitiba, Brazil, *Jaime Lerner*, est. 1971

The success of Curitiba can be attributed to the work of architect and urban planner, Jaime Lerner, who was a three-time elected mayor of Curitiba (1971-1992) and governor of Paraná since 1994. Lerner, greatly celebrated by his people, overcame many obstacles that were perceived as impossible. His achievements include turning Curitiba from a dirty congested city into an eco-friendly and efficient capital that acknowledges the social responsibilities and challenges of living 'greenly'. The key sustainable challenges identified here are solid waste management, urban growth and sprawl, squatter settlements, and employment. Lerner's mission was to improve environmental conditions for future generations through re-education and removal of social barriers, changing the city's infrastructure.

[2] Tom Phillips, "Quiet Revolution," *The Guardian* (March 26, 2008). http://www.guardian.co.uk/society/2008/mar/26/communities.regeneration (accessed October 12, 2010).

I saw things happening that I thought were wrong. They were destroying the city's history, opening up big roads that wiped out the whole memory of the city, planning the city just for cars.[2]

In the mid-60s, the population had burgeoned to over 500,000 and Curitiba began to see many urban obstacles familiar to any city with a population of that size. Frustrated by the authorities, it was around this time that Lerner felt an urge to confront the realities that his town was facing, resulting in his election as mayor. His first vision included reworking the city through traffic flows. The master plan included mixed affordable transport in parallel with social environmental programs that promoted equality and

Figure 3.1. The city centre of Curitiba and its pedestrian-friendly city centre.

offered relief from social hierarchy, breaking down its divisions by integrating transport within social classes in order to rejuvenate the divided city. It was truly a revolutionary act seeing as Lerner's approach was quite the opposite from other cities at the time. Other cities were preoccupied with paving their cities with asphalt and concrete. Lerner wanted the city to belong to its people, not their cars. He wanted its people to take control over the future predicament of the environment and see the many resulting benefits.

"We built the opera house in two months, the botanical gardens in three months, Niemeyer's museum in five months. We transformed the city's main street into a pedestrian area in 72 hours. It wasn't that we were chasing after records—it was necessity." [3] As the master planner of the Rede Integrada de Transporte (RIT), an above ground subway, Lerner abolished zone tariff systems thus allowing passengers to travel anywhere within the city for an affordable flat fee. A person was able to travel 70 km on one ticket if they wanted to, and this was possible because people travelling shorter distances subsidized the longer commutes. The popularity of this plan resulted in a shift from automobiles to public transport. It is an "estimated reduction of about 27 million auto trips per year, saving about 27 million litres of fuel annually," and using approximately 30 per cent less fuel per capita compared to other Brazilian cities of its size.[4] Around 80 per cent of commuters use the RIT, and yet 28 per cent of them are former automobile owners. The effects of this plan led to the decreasing of pollution and congestion during busy rush hours.

[3] Tom Phillips, "Quiet Revolution," T*he Guardian* (March 26, 2008). http://www.guardian.co.uk/society/2008/mar/26/communities.regeneration (accessed October 12, 2010).

[4] Joseph Goodman, Melissa Laube, and Judith Schwenk, "Curitiba's Bus System is Model for Rapid Transit" *Urban Habitat.* http://www.urbanhabitat.org/node/344 (accessed October 14, 2010).

The bus system travels parallel to roadways, making implementation of various routes feasible by minimizing costs of public infrastructure. This also makes it a preferable choice among commuters as it is well situated in main public arteries and is fast, convenient, reliable, affordable, without delay, and often runs as frequently as every 90 seconds. The bus system allows people to take control over their streets, limiting access within the

Figure 3.2. RIT busses and futuristic shelters.

Figure 3.3. The Green Exchange Program, Curitiba.

city centre to pedestrians and public transport, while at the same time enhancing local businesses and encouraging commercial growth in transit corridors. Bike routes also serve to enhance the pedestrian-friendly environment with approximately 100 km of bike routes and 30,000 bikers a day on its trails. Today, RIT serves more than 1.3 million passengers a day; about 50 times more than it was 20 years ago, and citizens spend only 10 per cent of their income on transportation—much less than the national average.[5]

The RIT hierarchical system uses minibuses to accommodate residential neighbourhoods and brings commuters to the main arteries of the city. These minibuses are operated by private companies who charge per distance rather than per volume of passengers. The RIT subsidize minibus cost by paying the bus company 1 per cent per month of what the vehicle is worth. The outcome benefits both parties because after 10 years the buses are paid for. Private bus companies are able to get rid of their depreciated stock, and the city's citizens take control of the buses and use them for transportation to parks and mobile schools.[6]

In the 1990s, Lerner started a project called "Faróis do Saber" (meaning Lighthouses of Knowledge) that focuses on free education centres that include libraries, free Internet access, and other resources.[7] The education system works in partnership with local schools and cultural centres to diversify access to knowledge, eliminating the barrier between formal education that was limited to upper class and bourgeois citizens. In each ward there is a study centre, a library, and a place to learn and access computers. Other programs initiated by Lighthouses include job training, and social welfare and educational programs that serve to improve the city's service, while at the same time, providing jobs and income to its people. Amongst all of Brazil's capitals, Curitiba has been ranked first in education. "At 96 %, we have the highest literacy rate of any city in Brazil, also hav[ing] the lowest unemployment rate in the country".[8]

[5] Joseph Goodman, Melissa Laube, and Judith Schwenk, "Curitiba's Bus System is Model for Rapid Transit" *Urban Habitat*. http://www.urbanhabitat.org/node/344 (accessed October 14, 2010).

[6] Ibid.

[7] Cesare Pasini, "Curitiba, una Citta' da Fantascienza" *EcoFantascienza*. http://web.archive.org/web/20080501143512/http://www.ecofantascienza.it/articoli/curitiba.html (accessed Oct 13, 2010).

[8] Mayor Carlos Alberto Richa quoted in "Livable Megacities-Curitiba," *Siemens* (Spring 2007), http://www.siemens.com/innovation/en/publikationen/publications_pof/pof_spring_2007/livable_megacities/curitiba.htm (accessed Oct 12, 2010).

Curitiba is the first city in Brazil to implement an 'environmental' university called *Free University of the Environment*, which works with its students to create projects relating to sustainable economy and environmental conservation and education. Focusing their attention on the waste crisis, the *Green Exchange* and *Garbage that is not Garbage* program are just two of many initiatives addressing this discourse. 70 per cent of the population are now participating in both these projects,[9] where residents, schools, and social service groups exchange recyclable materials for food staples and bus tickets. It supports agriculture surrounding the greenbelt of Curitiba and also helps to alleviate the stress of waste on its slums that municipal garbage collection is unable to reach. Since the implementation of the project, fewer sanitary related illnesses and infections are seen, and less waste has been dumped in marginal areas as well as nearby water bodies, and a reduction in waste has led to 13,000 tons of materials being recycled. Its success has led to the growth of another exchange program for students to trade waste for school supplies, books, chocolate, toys, and performance tickets.[10]

Together, the waste projects save approximately 1,200 trees a day by paper recycling alone[11] and help to create a better environment by reducing its burden on virgin materials though recycling and reuse. Money that is raised from salvageable materials and objects funds social programs and helps abolish homelessness and addicts, since the city employs them to work at transfer and sorting stations. The government also saves the money that would have been used to fund private companies to clean up and collect city refuse. Instead, money is given back to taxpayers enabling better living conditions, a cleaner environment, and health and social benefits. This is a perfect example of a symbiotic relationship between the government and its people working towards a common goal of improving the natural environment, while at the same time solving existing infrastructural problems such as waste and collection, health, agriculture, unemployment, education, and transportation. Together, the synergy enables the city to become an entity that sustains the local ecosystem.

[9] Jonas Rabinovitch, "Curitiba: Towards Sustainable Urban Development," *Environment and Urbanization* 4, no. 2 (October 1992): 68.

[10] Ibid.

[11] Ibid.

3.2 WASTE-SCAPES

Waste-scapes are disregarded places that have inconspicuous value. They are, for example, former dumps, markets, landfills, and the abandoned or derelict places that have the potential to embrace the value of economics, social development, and culture. These places are often regarded as marginal by nature, they do perhaps act as heterotopic fertile developments that nurture new ideas, revolutions, and movements that constantly evoke narratives. These narratives are common in themes such as death and elegy of a place or thing, ecological and archaeological history of a derelict place, progressivism of ideas, and entropy, inherent in the natural process of decay. Often waste-scapes yield enjoyment and curiosity, but also contain a hidden wealth of information and potential for education, redevelopment, and community.

> *[They] yield scientific data [that] are laden with myths; [and] are built as monuments to last and host processes of entropy they symbolize death while standing for progress. Their power lies in their contradictions and ambiguity. Probes of the dumps reveal treasures, fears, losses, abnormalities, absences, and enigmas. Their inherent dialects make them a rich subject for intellectual and aesthetic investigation of our everyday lives and places.*[12]

[12] Mira Engler, *Designing America's Waste Landscapes* (Baltimore, Maryland: Johns Hopkins University Press, 2004), 82.

Though waste-scapes presently symbolize marginality, they do in fact display evidence of an urban cultured society. "To an archaeologist, garbage mounds are always among the happiest of finds, they contain concentrated form[s] of artifacts and comestibles and remnants of behavior of the people who used them…far more accurate than [information by the government] Census Bureau." [13] The position of dumps, trading markets, and waste-places did not always signify dirt, poverty, and decay; up until the post-second world war period, society enjoyed these places without aversion. They were places that had potential lucrative possibilities, whether in buying, selling, trading, or real estate following the remediation or redevelopment of the site. Lax surveillance systems and rules allowed these places to flourish as urban armature in the urban periphery. Many designers now regard these places as wasted landscape saturated with potential to rejuvenate and remediate the site. Though these places are acknowledged as necessary, they are viewed as potential places for the introduction of parks, markets, and more

[13] William Rathje and Cullen Murphy, *Rubbish! The Archaeology of Garbage* (New York: Harper Collins, 1992), 10, 24.

Previous Page: Figure 3.4. Manhattan's former waste-scape, the Highline, revamps the city's waterfront bringing in tourists, leisurely pleasure, and a new view of New York's city-scape.

buildings to 'hide' the flaws that may be once there to support public infrastructure, i.e. landfills.

Nevertheless, the instant we disguise waste-scapes is the moment we lose the unique capacity and opportunity for bringing this topic into public consciousness. It should be a primary objective for local government and a responsibility for architects, planners, and designers to initiate spaces created to promote reuse and recycling. These spaces may act as totems in the contemporary landscape, where the "pervasiveness of recycling demonstrate a new sense of connection between consumption and material waste, [where] it promotes new rituals of social-economic exchange with a moral-environmental [awareness]." [14]

[14] Mira Engler, *Designing America's Waste Landscapes* (Baltimore, Maryland: Johns Hopkins University Press, 2004), 125.

Yet change lies in the power of encouragement, whether from government influences that affect bylaws, or the media's power of persuasiveness. This change should be great enough to accommodate the shifting of infrastructure and laws with the lifestyle of city inhabitants that transforms any judgement that would hinder redevelopment. To begin, the design of these spaces should decline gracefully,[15] where resilience plays an important role in the design of structures and the urban fabric. Because in time, all things decay and become abandoned, designers are now more inclined to design things that facilitate reuse. Such thinking prepares us for not only the obstacles in the future, but also practices cradle-to-cradle techniques that may eventually become good habitual instincts.

[15] Kevin Lynch, *Wasting Away* (San Francisco: Sierra Club Books, 1990), 174.

The dump is an essential waste-scape in the city which holds potential for innovative exchange of insurgent ideas. It can work towards bringing together a community that manifests common goals in order to transform the process of consumption into appreciation for the environment. When established properly a dump has the ability to become the urban market place; a place that goods, ideas, and information are exchanged, and a place that acts as a forum where communities, businesses, and local authorities host activities and public events. Perhaps the most significant contribution waste-scapes have is the ability to make connections between people and products in the most unfettered way. Places like *Wellesley Recycling and Disposal Facility* in Massachusetts, USA, *Wastewise* in Georgetown, Ontario, and *BRING Recycling* in Oregon have transformed their facilities into town forums, community centres, and learning facilities. These sociable upscale environments empower communities to participate in sustainable living practices, while being an asset to the city and a commodity for tourism.

Figure 3.5. Wellesley Recycling & Disposal Facility act as public gathering spaces for social interactions and a place to host events, concerts, and performances.

Presently, in a world where resources are becoming increasingly scarcer and the instability of our surroundings bear no results from our perpetual effort, waste-scapes provide appropriate visions for environmental rehabilitation. The bottom-up approach to design and problem solving has become progressively more common over the last few decades. French sociologist and theorist, Bruno Latour, states in his criticism of the scientific world that "soon nothing, absolutely nothing, will be left of a top-down model of influence. The matter of fact of science becomes matters of concern of politics. As a result, contemporary scientific controversies are emerging in what have been called hybrid forums. We used to have two types of representations and two types of forums: one, science…and another politics….A simple way to characterize our times is to say that the two meanings of representation have now merged into one." [16]

[16] Bruno Latour, "The World Wide Lab," *Wired* (June 2003): 147.

A new paradigm suggests that architects and planners should consider designing waste-scapes that work towards a larger framework, where we seek to redefine the meaning of landscape and what it contributes to the discourse of urbanism. This method allows designers to consider the undervalued and overlooked regions of the city to close in on the patchwork, in order to mend and redevelop the existing rather than towards the audacity of new city plans and mega-structures. Working in a bottom-up approach promotes creativity in synthesising struggles with current trends and data that may aid in strategies that integrate multiple networks. The Internet is one of many contemporary tools that can help synthesise this trend and data in order to conduct new grounds for experimentation.

Nearly 80 per cent of the population in North America uses the Internet, by far the fastest growing global community. With an increase of 146 per cent in users from year 2000 to 2010,[17] two-thirds of these users are also connected to social networking and this number is likely to increase seeing that networking site growth is more than three times the rate of Internet growth.[18] Given the current trend, Internet-based social networking systems allow communities to develop internationally, where

[17] *Internet World Stats*, June 30, 2010. http://www.internetworldstats.com/stats.htm (accessed November 16, 2010).

[18] "Global Faces and Networked Places," *A Nelson Report on New Global Footprint* (March 2009): 4.

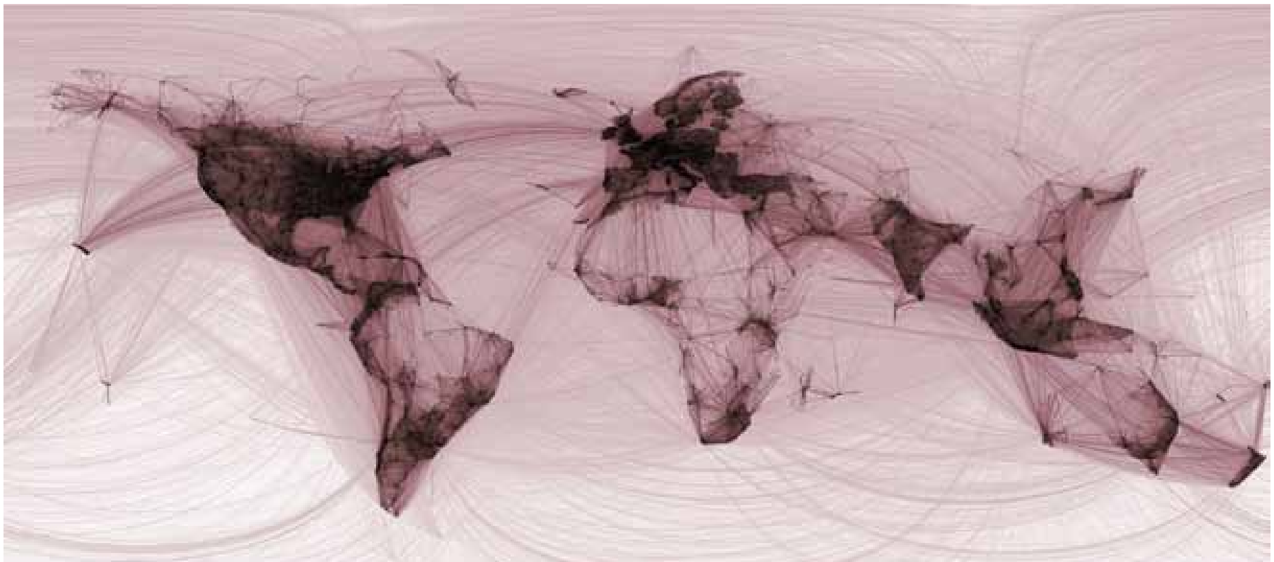


Figure 3.6. Social networking as a medium for global connectivity. This map shows abstracted data for about 20 million people on Facebook, each line represents a human relationship. Areas where social networking is not a priority (Australian Outback and Siberia) is also visible along with areas that seemed 'paired' (Alaska-Hawaii and Brazil-Uruguay). The creator of this map, Paul Butler saw a map of the world emerging:

"The blob had turned into a surprisingly detailed map of the world. Not only were continents visible, certain international borders were apparent as well. The lines didn't represent coasts or rivers or political borders, but real human relationships."

[Josh Rothman, "Visualizing Friendships," *The Boston Globe* (December 20, 2010).]

individual users and groups are able to discuss anything from current events, likes and dislikes, relationships, jobs, to social events. Originally targeted toward youth, the social networking audience is becoming broader and older; this success can be attributed to the phenomena of *Facebook*®, which has been the driving force behind the implementation of social networking into the lives of a wider spectrum of participants.

The rising population in social media provide a fertile ground for opportunities in bringing together target markets of interested participants in creating active green communities. The platforms that make these social networks thrive are based on friendships and interaction with members that share similar interests and values that add to the quality of their lives. Members are both creators and consumers of media content and therefore exude a sense of ownership, which contrasts traditional business models.[19] This new model, for example, allows businesses to use personal data found on networking sites to connect and engage with users on a more personal level, where they work to enhance user value through interaction.[20] In the case of Facebook®, it has given businesses a chance to show user affinity and loyalty over others and use it towards self-promotion. Members can join fan pages and add 'like' and 'fan of' links to their personal profiles; these links connect them to other members who also put those links on their profile. 'Starbucks®' group, for example, has over 17.5 million *like* members, over 820 related links, 6700 pictures uploaded by group members, discussion topics, and close to a million wall posts (average of 1 post every 2 minutes).[21] This offers Starbucks® the opportunity to promote content to a wider population, on and off the web. In September 2006, Facebook® launched the 'News Feed', which tracks the record of members and their *friends*' comments, votes, posts, likes, and status.[22] It was from this moment onwards, that social media went *live* into *real-time* data, changing the configurations of media and broadcasting, and how information is brought to consumers.

[19] Nick V. Flor, *Web Business Engineering: Using Offline Activities to Drive Internet Strategies* (Reading, Mass: Addison-Wesley, 2000).

[20] In the case of online social networking, it has revolutionized the way businesses promote and market themselves. Elements of this successful business model can easily be transformed to non-profit green organizations to promote sustainable ways of living.

[21] As calculated from the Starbucks fan page from Facebook website.

[22] "Global Faces and Networked Places," *A Neilson Report on New Global Footprint* (March 2009): 9.

"It is precisely the intersection of environmental, technological, and design innovation that holds the most promising future for architecture," [23] Internet and social media have the potential to be the interstice connecting those elements. They have dramatically changed the way people behave towards personal values and interactions in the built environment, which poses both challenges and opportunities on a global scale. The increasingly rapid advancement of technology and innovations led to a plethora of new materials and methods for utilizing them in architecture. Hyper-choice, while it seems like a positive thing, can in fact confuse and make it impossible to compare, define, and evaluate new materials against traditional building materials. Opportunities through the use of social media allow users to connect and access, educate, learn, discuss, and sort through the hyper-choices in order to remodel the market for reuse in architecture.

[23] Blaine Brownell, "Materials/Treatments," *A+U,* no. 473 (Feb 2010): 9.

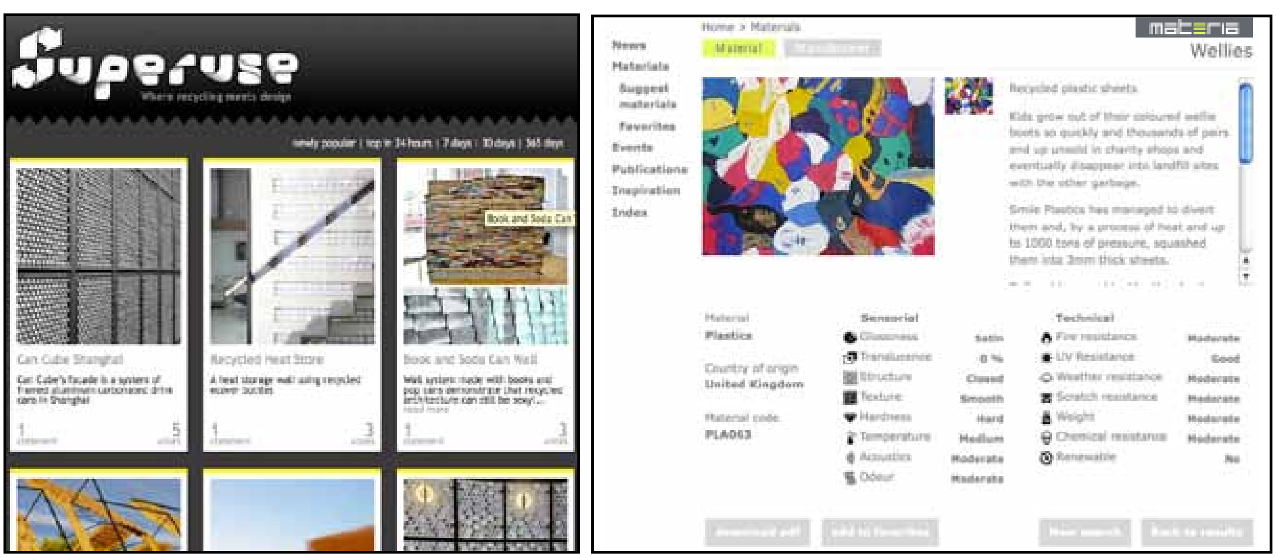
A database of resources may facilitate instant-access reference material to the global public. This database holds a library of materials, their properties, and specifications. There are already great examples of this system at work starting in 2002 when the European Union established recycling programs to be a primary objective. The motives were purely economic and political; they believed that "enormous markets would open up if resources could successfully be exploited with greater efficiency." [24] Since then, the Netherlands has made designing buildings to facilitate secondary reuse a good common practice that is now the norm. Netherland-based *Materia*,[25] is a non-profit web database where users can index materials, their uses, properties, inspiration, and case studies while at the same time plug into publications, events, and news. However, the problem that many of these databases face is the disconnection between systems.

[24] Huber Riess, "Message in an Bottle," *L'Architecture Aujour d'hui,* no. 372 (September/October 2007): 92.

[25] Materia, http://www.material.nl

Materia, though a great tool, faces the challenge of inaccessibility and being limited to materials that are manufactured. 2012 Architecten's database called *Superuse*, focuses mainly on adaptive reuse methods in architecture and industrial design, but does not

Figure 3.7. Existing online databases. *Superuse* is great for ideas and inspiration [left], however it does not provide users and fabricators with technical information, such as specifications, manufacturers, location, and availability--as *Materia* does [right].



provide material information and salvage locations. Lastly, *Freecycle*™ is a community-sustained organization with over 8 million members, which provides salvageable locations to materials in almost 4,900 communities around the globe.[26] The problem with this approach is that materials and objects do not contain information on how to maximize their usage. Perhaps the greatest hindering factor keeping architects from reusing secondary material in their buildings is that there are not very many good examples of built work. Moreover, it is difficult to find alternate uses to maximize the potential of waste and reuse methods are also tough to conceive. "If design is to flourish [amongst the multitude] of architects…then [they] must have the shopping resources of professionals, because design can be decisively influenced by consumption as well as by production." [27] Information between resources, producers, and consumers should be better connected and established properly in a single database that becomes a place where information is readily available to the public along with their specifications, possible uses, existing examples of projects, and where this material is offered and in what quantity. The reason behind the success of Facebook® and its sustained growth as a social networking tool, is that it encompasses all the properties of other networking systems such as Windows Live Messenger™ (MSN), Friendster℠, LinkedIn®, Flickr®, Twitter, Myspace® into one simple package that is accessible, public, free, and convenient.

A hybrid between a database for materials and social networking has the ability to amalgamate into an opportunity for bottom-up design solutions with the aim to permeate and revolutionize architectural and cultural customs. The cybernetics of this hybrid forum work towards the following characteristics:[28]

1. Cataloguing materials and listing their specifications and properties.
2. Listing present examples of the material's distribution and re-use capabilities, and an assessment of its suitability towards construction.
3. Estimate of the gross capability by these resources when factors, such as price, wastage, distribution pattern, and suitability for self-assembly are known.
4. Future assessment of the availability a material, as in the increase or decrease of future production and the amounts of energy put into the materials.
5. Embodied energy breakdown of each material as well as a life-cycle analysis and its effects on the environment.
6. Series of case-studies that are contributed daily as prototypical examples for design solutions.

[26] T*he Freecycle Network* (2010), http://www.freecycle.org/ (accessed Jan 4, 2010).

[27] Charles Jencks, *Adhocism* (New York: Double Day, 1972), 174.

[28] Some points adapted from Martin Pawley's garbage housing assessment in his book *Garbage Housing* and *Building for Tomorrow*.

7. Cost analysis and economic value of the relationships between total cost of modification and reuse, to that of the increased value resulting in secondary reuse and energy savings.

8. Mapping reuse potential, their locations, quantity, and potential for reoccurrences (such as industrial and manufacturing waste).

9. Public storage facility locations with lists of materials stored, vacancies, and timelines, which will also act as a salvage centre for secondary reuse.

10. Discussion boards, event listings, meeting places, workshops, publications, and additional resources all provided in real-time feeds.

11. Social networking component where members join groups, have fan pages, access to live chats, a profile, and a place where salvage, reuse, and eco-friendly companies and organizations can offer advice, product, or service by communicating and connecting with members.

These companies and organizations can provide architects, designers, and the general public with a platform for realizing projects and design challenges. Social media enables publishers to take part in a wider, multi-dimensional conversation rather than the traditional method of bombarding content into public attention. It creates multi-faceted and significant opportunities to change our system of approach when it comes to formulating ways to abolish stigma in reuse. "Publishers can improve the engagement with their own audiences – by tapping into consumers' increasing desire to create content—and can use social media to syndicate their content beyond its traditional confines to a much wider audience." [29]

[29] "Global Faces and Networked Places," *A Nelson Report on New Global Footprint* (March 2009): 15.

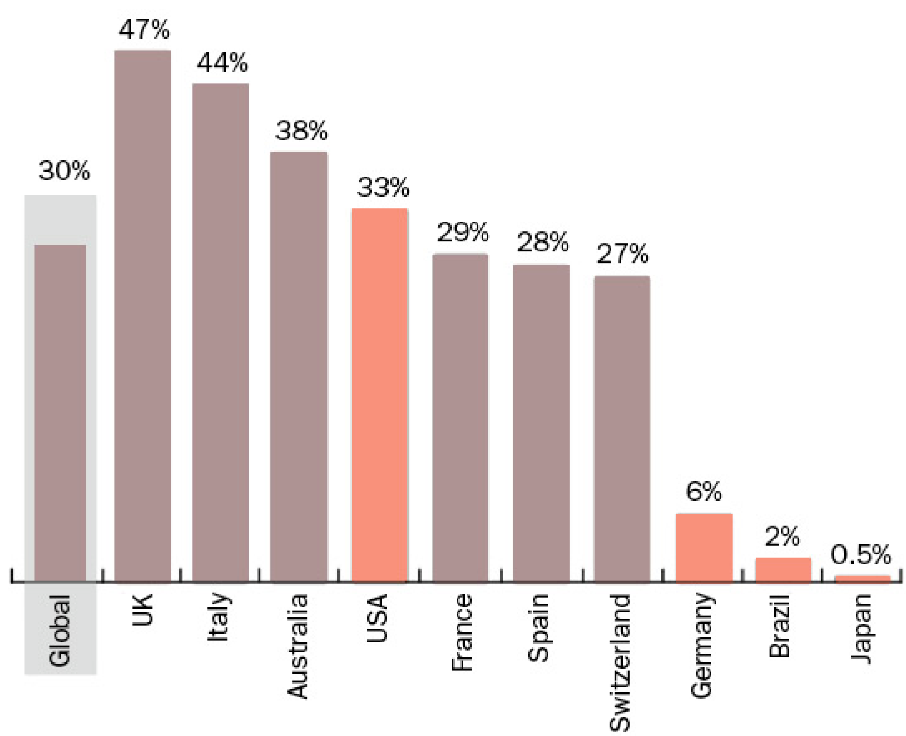


Figure 3.8. This graph shows selected countries and global percentage of world's online population in 2008 who visited Facebook. Among the highest of these, UK is ranked first followed by Italy, and lastly Japan.

3.4 THE NEW LANDSCAPE FOR CHANGE

When waste-scapes are established properly, the potential for these places to contribute to the betterment of society, whether economically, politically, culturally, and/or environmentally, is limitless. The social network and urban marketplaces for salvage and reuse education can be "a civic asset in a physical sense, and a common location for efficient trade, information and inspiration. Its most significant contribution would simply be to help bring about relevant connections between people and all products in an [unrestricted] way." [30] For the insertion of this new visionary landscape to occur, there must be a reorganization of the existing. Of course, these changes do not happen overnight and there will undoubtedly be difficulty in adapting to these new sets of organizational principles.

These principles are reorganized so that short-term (or small scale) improvements can facilitate long-term solutions. Essentially working from a micro to macro scale means tackling issues from a bottom-up approach. The City of Toronto, like most cities, started with recycling bins. Years later shifts to green bins for composting followed; then many years later, the no-plastic-bags bylaw, incentives for water and energy conservation, and more recently the Toronto green roof bylaw—the first city in North America that requires all new construction and additions of institutional, commercial, and residential developments to contain green roofs if the gross floor area exceeds 2,000 square metres.[31] These changes happened in slow progression and only in the last decade or so after the realization that global warming is indeed a real threat.[32]

The top-down approach never had very much success in the province of Ontario and as a result, never gained the momentum needed for long term change—this was seen recently with the merging of GST and PST into HST, and the eco-fee scandal that lead to outraged citizens. "It's not just the eco-fee that has people outraged. It's the sneaky way it was implemented. It's a novel tactic. Introduce a sly eco-fee the same day you introduce a whopping tax grab—and hope no one notices." [33] The 'scandalous' fee disguised as

[30] Charles Jencks, *Adhocism* (New York: Double Day, 1972), 179.

[31] A lot of the new green bylaws include ideas-competitions, government grants, funding, and incentives to instigate social awareness and offset climate change.

[32] Only then did the City accelerate into one of reform and restructuring of priorities that place focus on future oriented environmental goals, until recent Fall 2010 mayoral election—it is also worth noting that during October 2010, Rob Ford was elected mayor of Toronto. His approach to environmental urban strategies took an opposite turn and is not in keeping with former mayor, David Miller's environmental legacy.

[33] Christina Blizzard, "Ontario's Eco-fee Hoax," *The Toronto Sun* (July 13, 2010).

Figure 3.9. Toronto City Hall green roof opened May 2010 as part of the annual *Doors Open* event in Toronto.

an 'eco' fee had consumers feeling uneasy as to where their money was being spent and how it was charged. Eco-fee was a target towards recycling and disposing of hazardous waste materials and was adopted by the government to give Stewards of Ontario a "financial incentive for manufacturers and importers to find more environmentally friendly materials for their products." [34] The failure here was that there was no financial incentive because retailers knew the cost of the fee from manufacturers and simply tacked on this amount in the total price of the item. Upon reflection, Ontario Premier Dalton McGuinty, realized that this plan was implemented poorly and too prematurely, resulting in chaos and confusion. The Environmental Minister, John Garretsen, in order to quell citizen confusion, scrapped the eco-fee only 20 days after it was implemented.[35]

[34] "Ontario Eco Fee Fell Short: McGuinty," *CBC* (July 27, 2010), quote by David Miller, http://www.cbc.ca/canada/torontostory/2010/07/27/ontario-eco-fees.html (accessed November 20, 2010).

[35] Ibid.

One of the major problems with the eco-fee system was the attempt to shift the cost and responsibility of hazardous waste disposal from the producers to the public, which did not tackle the problem at its core, but only transferred its environmental liability. McGuinty acknowledged that "people have to see that it's not something that's going to be dumped on them, and if they don't see that, they are going to be completely distrustful of this process." [36] Political economist and sociologist, Max Weber, indicates that bureaucracy was at one point more democratic and was never a dominant force in the human organization of roles until industrialization. This organization of roles was meant to fulfill objectives, expectations, and obligations. The eco-fee did not work because it created confusion on both ends of the spectrum. Bureaucracy had their say and then it was implemented without first initiating public input or discussion. The rearrangement of governmental campaigns can make progressive shifts without the need to reform entire governments.

[36] Ibid.

For example, the shifting or demolition of walls, as everyone knows, is an efficient and effective way to revamp old spaces and create entirely new ones without having to invest in a completely new building. Working from micro to macro scale may ensure security and trust among the people as accepting small scale changes may prepare masses for larger implementation resulting in significant environmental changes. Citywide compared to provincial-wide changes are easier to accept and adapt to, since citywide improvements are made based on needs and desires expressed locally by its people. The mayor of Curitiba recognized the problems with mobility and social hierarchy in the city and sought to bring both problems together with one solution, the RIT. Since this transit system was so efficient, it was recognized by residents to be the best and fastest way to travel; thus residents of all social classes adopted RIT as a primary mode of transport. This led to larger infrastructural projects such as the restriction of private vehicles in the city centre that led to environmental initiatives using RIT as a financial incentive, which later led to environmental consciousness, re-education, and the birth of new institutions.

This led finally to waste programs and the reduced dependency on local resources that promoted local goods and produce, which in turn, aided Curitiba's economy.

By recognizing co-dependence in systems, one ensures positive results amongst widespread conglomerate issues. Thinking in terms of whole systems in an integrated network of matrices not only allows one to tackle the core issue, but also surrounding challenges and emerging constituents in the future. Rarely are challenges simply black and white; they exude complexity beyond governmental capacity. A contingency plan (an *ad hoc* plan) may offer an alternative model that branches to several, or join several, possibilities that band together and give greater significance. This model may allow future possibilities to remain open, while taking risks and evaluating progress that leads to the on-going success of this plan. This contingency plan may be implemented in the form of several small-scale projects that are independent and do not rely on one another but together may bring greater significance. For example, Curitiba's success is not due to one specific initiative but to many, that when viewed as a whole give greater meaning and significance to the identity and vision of the city. The benefit here is that a city would readily take more risks since one failure does not affect other projects. Contrary to contingency plans that are usually applied to small scale problems, massive planning (province-wide) is a large-scale and long-term plan that isolates from the bottom-up approach and often subjects whole populations to welfare.[37] Information is better received in increments that one can empathize with, and when people can see how it may contribute to the improvement of society and to the environment. The argument may be more compelling when systems work together symbiotically to create environments in eventuality that benefits everyone and everything.

[37] Charles Jencks, *Adhocism* (New York: Double Day, 1972), 182.

The new landscape for change requires several ingredients for progress. A start would be to first facilitate long-term changes that benefit the welfare of the majority, local governments must work from a bottom-up approach to gain public trust and recognize the needs and wants of its residents. One way to do this would be to collect information from a form of global exchange, perhaps using social networking systems that tap into global trends and data. Using this data, local governments can improve public communication by inviting public discussion and by providing more information to re-educate and inform the public about its future predicament, that is, to make better choices, to change consumer habit, and create environmental awareness. In particular focusing on our responsibilities toward depleting sources and the potential for utilizing existing resources, such as waste is critical. Secondly, risks must be taken in creating and utilizing waste-scapes, which inherently have beneficial economic, political, and social potentials. A flexible contingency plan that may provide alternative solutions to risks and render them benign may aid city leaders to make radical leaps and decisions. For example, the next project is about Ontario Place. This project is to be Canada's first autonomous community. It is expected that this project will inherit many uncertainties and risks; however, it also possesses the necessary infrastructure to transform this failed community back into the original intention of a park if necessary.

These developing waste-scapes may ease public uncertainty and stigma towards this topic, and influence the present and future generations towards re-design and re-imagination of this discourse. Social networking is one of many tools that have the possibility to bring about the rearrangement of roles in order to create a new structure of human organization. The key challenge in changing our landscape lies in the micro scale initiatives that benefit all parties. By changing the notion of waste, it is possible to see its prospects as economic stimuli, a positive source for energy, and creative expression that harmonizes multiple systems into free-form kinetic organizations[38] that is ever-changing and adapting to environmental and city desires.

[38] Alvin Toffler, Future Shock (New York: Bantam Books, 1970), 125.

A HYPOTHESIS: Ontario Place, circa 2020

Everyday hundreds of millions of people live in and commute within large cities. Waves of vehicles, stuck in traffic, emit billions of tons of pollution into the air each year. Less noticeable are the inner workings of a city that weaves through underground tunnels and pipes, where people in subways move about and vast volumes of clean water flow through the city's veins. Urbanization furthers the strain on dwindling resources, accelerating climate change and energy and water depletion as inhabitants are forced to consume and rely on infrastructure due to urbanized needs. As migration moves towards the city, so too does food transport. In Canada, the average travel distance before food is available is 8,000 km, not to mention the fuel and raw materials needed to be used in order to produce it. To produce 300 million tons of food, which is enough to feed the urban population of the world, the consumption of 6 billion tons of fuels and raw materials will need to be used. In addition, it will also require a production of 250 million tons of manufactured goods, and 5 trillion kilowatt-hours of electricity.[39] Waste and waste disposal are also prominent features in the urbanized infrastructure, since in America, urbanized areas produce a bulk of the waste generated and 30 per cent of the world's waste. Yet, perhaps the pressing issue that arises from this outcome is the amount of carbon dioxide that is produced in urbanized areas and its effect on climate change. As calculated by the Carbon Dioxide Information Analysis Center (CDIAC) for the United Nations, in 2008, global emission from CO_2 has reached 29 billion metric tons annually.[40] The approach as to how we should live in urbanized areas should seek a new direction, where architects, engineers, and city planners should begin to plan more ambitious communities in the direction of environmental sustainability.

[39] Martin Pawley, *Building For Tomorrow* (San Francisco: Sierra Club Books, 1982), 23.

[40] CDIAC, "Carbon Dioxide Emissions (CO_2), Thousand Metric Tons of CO_2" for *The United Nations* (2008), http://mdgs.un.org/unsdmdg/SeriesDetail.aspx?srid=749&crid= (accessed September 12, 2010).

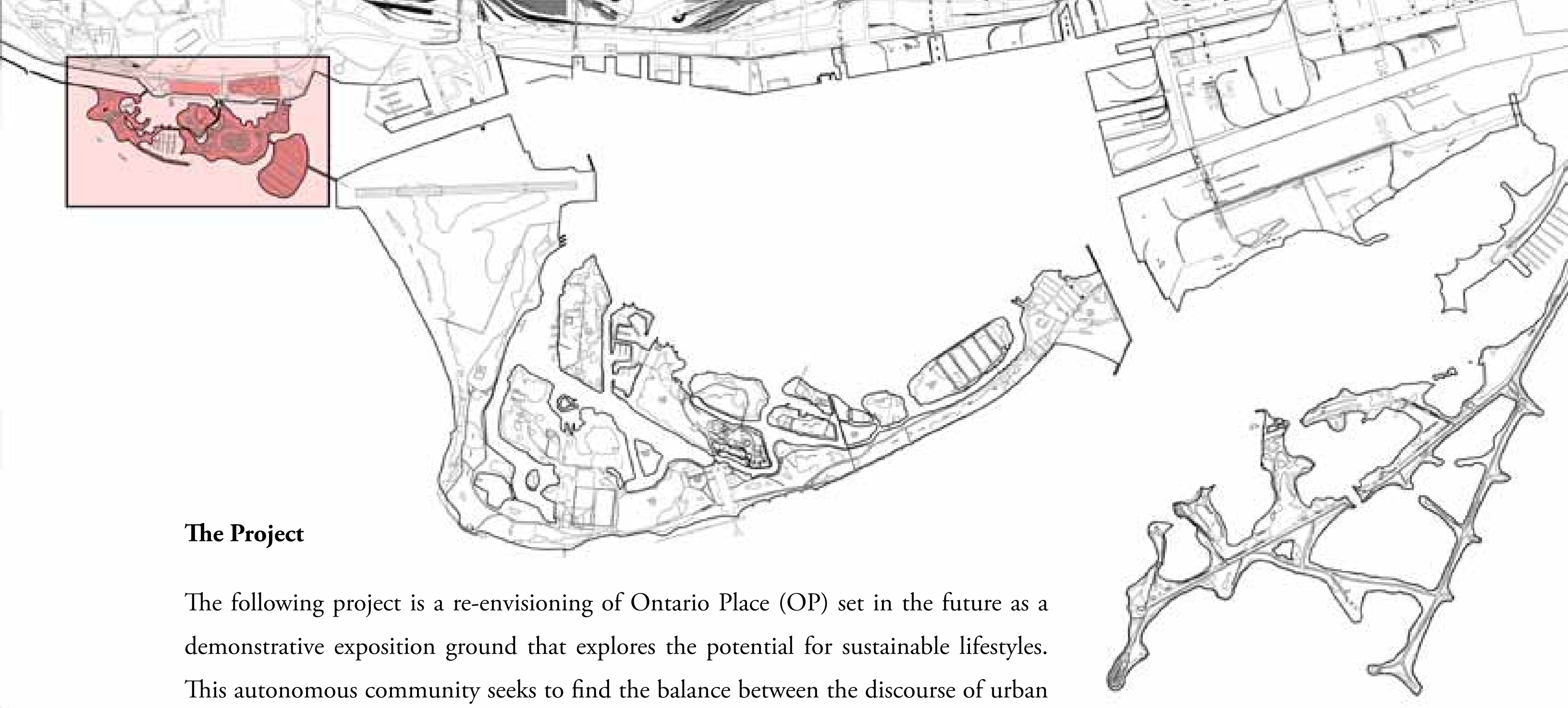


Figure 3.10. Context Plan.

The Project

The following project is a re-envisioning of Ontario Place (OP) set in the future as a demonstrative exposition ground that explores the potential for sustainable lifestyles. This autonomous community seeks to find the balance between the discourse of urban society and community living. The proposal is that this community is to become a seed planted within a larger network that provides surrounding communities with precedents, inspiration, and realization that societies can in fact live wisely, *off-the-grid*, and environmentally. OP would be self-governing. Accountabilities will include the administration of schools and institutions, health, social services, culture, urban development, food production, and their own form of public infrastructure such as roads, waste management and collection, water, and energy. Since this autonomous community is not directly linked to the City of Toronto, the plan may allow increased security and lower the cost of living, including ownership of property, as well as a reduction in environmental impacts through the tenets of green building design practices, which are stringent on efficiency. For the OP community, living off-the-grid would mean living without excess, of only using and consuming what is necessary to sustain oneself or the community.

Calculations and statistics for this project can be found in the *Appendices* (A1). This includes calculations for food consumption, agricultural capabilities, energy harvesting (wind, solar, methane), waste management (municipal, biological, composting), housing, and population. The conclusion drawn from the calculations show OP to produce exceedingly more energy than it will consume, which will allow the excess energy to circulate back into Toronto's energy grid. The island's consumption of energy is 5,495 MW•h at its most inefficient. With wind and biogas together, it will yield 10,452 MW•h of electricity not including energy from PV panels. The island will also be able to account for all its waste produced; these are effluents from solid waste, wastewater, and organic wastes. The limiting factor discovered through this synthesis is that the island can only yield 5 per cent of population needs in food. Therefore OP must seek other alternatives such as, purchasing food on the mainland and through OP's urban market, which will in turn open up opportunities for local farmers.

The following parameters have been used in designing OP as an eco-friendly community of the future. These parameters and design principles are based on the synthesis reached from the body of research in this thesis, specifically from the sections regarding cradle-to-cradle, secondary reuse, design for deconstruction, waste-scapes, and micro scale projects using bottom-up approach influenced by Curitiba; and are ideally applicable to emergent cities as well. However, these parameters also exemplify the principals found in *new urbanism*, a branch of urban design techniques that promotes community function and livability, while at the same time striving for environmental harmony and social integration in a diverse community setting.

Parameters:

1. Reuse of garbage: in creating networks and programs via the Internet on waste awareness; in urban armature, public spaces and housing, creating a zero-waste society.

2. Design for deconstruction & secondary reuse: reuse of old buildings and waste materials, designed to facilitate reuse of components in new design.

3. Cradle-to-cradle: zero waste, organic society.

4. Energy harvesting: clean and renewable energy, i.e. methane harvesting through anaerobic digestion, wind power, solar, and possibly hydroelectricity.

5. Self-sustaining: own government and joint community effort, a symbiotic relationship.

6. Naturally occurring landscape: low maintenance landscape that naturally progresses into an ecosystem for abiotic, biotic, cultural, and energetic growth.

7. Autonomy, founded upon 4 pillars: environmental stewardship, social consciousness, leadership, and fiscal responsibility.

Figure 3.11. Experiential section of Ontario Place. The Cinesphere (centre), surrounded by the natural landscape, is a newly converted biosphere for winter agriculture.

The Proposal: Ontario Place circa 2020…

The placement of the new Ontario Place community within the heart of downtown Toronto would enhance the lakefront as an inverted 'emerald' necklace of green infrastructure, connecting the Toronto Islands and the Leslie Spit. The juxtaposition of the different sites will allow unrestricted dialogue between the metropolitan city, community living, and environmental stewardship as this will allow the communities to have the opportunity to bridge between these gaps.

Initially conceived in the late 1960s, OP was a project that was used to appease the city of Toronto after much government spending was diverted in the creation of Montreal's Expo '67. It officially opened in 1971 as parklands, exposition space, and family oriented gathering spaces. The space was intended to rejuvenate and revitalize an industrial waterfront, while bringing tourist and pedestrian flow towards Lake Ontario. Its original agenda as a cultural centre displaying artefacts and technology from all over the world was lost and over time it became what it is now, an amusement park. However, in the summer of 2010, after many years employed as parklands, this fading Toronto icon called for submissions from architects in the hopes of revamping Ontario Place for 2011 as part of the 40th anniversary redevelopment. OP's General Manager, Tim Casey, told the Toronto Star that "we're open to just about anything".[41] A plan to transform the park from seasonal to a year-round eco-attraction is in place. The serious intention to redevelop the site included the possibility of demolishing the Cinesphere and other iconic attractions, essentially making OP a blank canvas for ideas and experimentation.

[41] San Grewal, "Complete makeover for Ontario Place," *The Toronto Star* (July 15, 2010). http://www.thestar.com/news/gta/article/836552--ontario-place-to-be-torn-down-and-rebuilt?bn=1 (accessed October 30, 2010).

Figure 3.12. Building materials salvage centre & drop-off location, construction & prototyping centre. Spring and summer temporary pavilions set up, working in tandem with urban marketplace.

Figure 3.13. Biodegradable and organic content acceptable in Ontario Place and composting facility.

From left to right: cotton/other organic made clothing, produce, paper bags, yard/gardening waste, books/magazines/newspapers, paper or corn disposable products, meats/other consumable items.

Surrounded by the postcard-like panoramic view of Toronto, OP as a former cultural centre and present amusement park ground evokes great curiosity, fantasy, and potential, perhaps more than any other place in the city. The plausible nature of this vision is attributed to the inherent quality of reverie in the site, its isolation, connectedness to Toronto and neighbouring islands, and the willingness of unprejudiced efforts to move towards a greener Toronto. A new model of the metropolis could indeed be at work. While cities are responsible for the production of greenhouse gases that degrade the environment, the plan to change OP, however, presents a rare opportunity for atonement. OP represents a blank canvas, a chance to tear down the old and lay new foundations. These new foundations are founded upon the principles of ecological systems, where a place is responsible for the production and conservation of its own energy, recycling, waste, food, and water. This community proposal will aim to support a large population that utilizes fewer resources than its mainland counterpart.

While many cities operate through transportation networks of roads, communication lines, sewage, water distribution, and energy, the main concern for these cities is their dependence on distance resources, which contribute to further deterioration of the environment. If the scenario for *A World without Oil* were to come true and there are firm evidence that climate change and oil depletion are to be anticipated, then design of buildings at the very least should move in this proposal's linear approach of designing autonomous elements attached to buildings, i.e. passive energy, solar and wind harvesting, grey water collection, waste management, and food production. Harvesting this renewable source of energy that would otherwise be wasted opportunities would indeed protect communities from most impacts derived from networked sources because autonomy has the ability to avoid inefficiencies in the system (see *A1*). Living in an autonomous community such as OP, requires not only joint efforts in creating an efficient and well-working society, but residents who share similar goals, lifestyles, and convictions.

The OP of 2020 will be the first community in Canada to serve as an example of a close-looped society. It will act as a micro-scale development of Toronto that may result in the redevelopment of values and ideals that work as a device for implementing new models for waste awareness, utilizing and redefining the techniques of reuse and recycling. Innovations to conserve and create energy will work towards a community that strives for a minimum to zero carbon-footprint society, as well as implementing green building and design practices of design for deconstruction, secondary reuse, and embodied energy storage. The production of waste will always be a challenge on any island; cradle-to-cradle practices will be an important factor in sustaining OP. Living in a closed-loop society requires residents to acknowledge the natural cycles of birth and decay, and requires finding inventive ways in keeping materials from their entropic stages to eventual wasting, where the idea of waste does not exist.

The Vision

It is now 2020 and Ontario Place has already established itself as a community in the city of Toronto. During the visit, I was able to investigate how the inner workings of OP had contributed to the similarities of an actual organism, making it an efficient and successful community.

Upon arrival on the island, visitors and residents are greeted by a bustling urban market and salvage centre. It is here perhaps, that the vision of Ontario Place was planted many years ago. What was at one time an empty parking lot is now overgrown with buildings made from the once detritus of Toronto. A plethora of innovations and objects brought over from industries, manufacturers, and the residents of mainland Toronto, line the lot. Inside, the buildings are galleries that exhibit many examples of furniture, cladding materials, innovations like a hot water heater made from PET bottles, and the latest projects from all over the world that utilize waste in many different and creative ways. Adjacent to the salvage centre is an urban market open all year-round, dubbed the new St. Lawrence Market of Lakeshore West, a place where one can find the freshest locally grown and island grown fruits and vegetables. Between the assortments of cheeses, baked goods, and spices is an arts market of jewellery, clothing, household items, appliances, and artwork made from Toronto's former junk. Now, considered one of the trendiest places to spend your afternoons, the visitors park in the public lot adjacent to the markets, rent a bIXI^{SM}, and then bike off to explore Toronto's eco community.

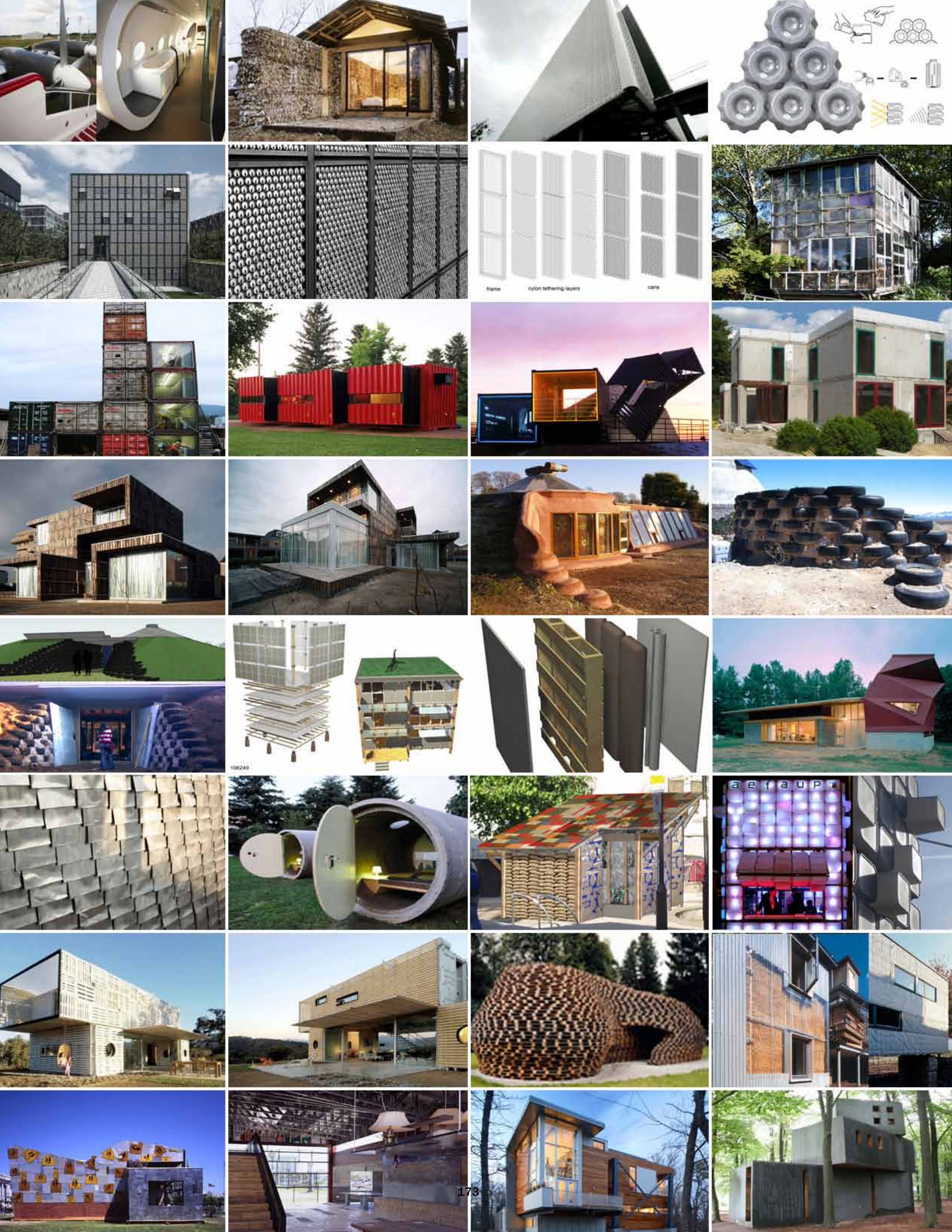
Greeted by four entry corridors, three of which are solely pedestrian, one is surprised to encounter the scale of the community; a scale in which residents can live, work, and play only 10 minutes from Toronto's downtown core. Of course the re-envisioning of how the streets are laid out contributes to their lifestyle and the ease in which people go about their days without their cars in this pedestrian friendly community. There is evidence of this already at work in a neighbouring community, "[on the Toronto Islands, people] live without cars and like it that way. In fact, 52% of 'downtown' households, according to a City of Toronto study, have NO ACCESS to a car." [42] Furthermore, hundreds of

[42] Jason McBride & Alana Wilcox, eds., *uTOpia: Towards A New Toronto* (Toronto: Coach House Books, 2005), 107.

Figure. 3.14. Ontario Site Plan:

1. Residential area
2. Bridge to Toronto Island Community
3. Canada Post drop-off
4. Security and Inspection
5. Zipcar, Bixi, Parking: Public & Private
6. Urban arts market for salvaged items & produce
7. Information kiosk
8. Retail, boutiques, supermarkets
9. Natural wetland
10. Composting facility
11. Methane, biogas harvesting station
12. Site Storage
13. Agricultural lands & natural landscape
14. Medical Centre
15. Restaurant
16. Sculpture garden, outdoor art gallery
17. Community centre, outdoor amphitheatre
18. Community pool
19 Water filtration plant
20. Wind energy station
21. Wind turbines
22. Ontario Place Yacht Club
23. Biosphere
24. Building materials salvage centre & drop-off location, construction, & prototyping centre
25. Environmental College, eco- workshops & research centre for Reuse Design
26. Social networking & materials database HQ, meeting and conference spaces
27. Trust & financial centre, housing office
28. OP Convention Centre
29. Community offices and maintenance operations, Police & fire department, security HQ
30. Emergency vehicles & vessels
31. Public Library
32. Agricultural surplus storage
33. Community School & day-care centre
34. Recreational grounds
35. Public Beach
36. Living Machine, Waste Management

EXHIBITION PLACE
LAKE SHORE BOULEVARD WEST
PUBLIC
5
PRIVATE
ONTARIO BOULEVARD
REMEMBRANCE DRIVE
6
4
3
7
6
7
1
31
14
11
13
10
9
9
12
8
15
35
2
1
36
35


frame
nylon tethering layers
cans

Torontonians are waiting to own property on Toronto Island (a similar island facing similar challenges), forcing them to cap the waiting list at 500 people.[43] Due to the community's isolation from the mainland, one must monitor the island's sustainability closely. Since no public and personal vehicles are allowed on the island, residents must evaluate everything that enters the island. Living in autonomy forces this community to be responsible consumers, where they must only acquire the essentials so as to minimize waste.

The long curving street east of the information kiosk, made from shiny aluminum soda cans, leads into the archetype of an ideal community of residences that bridge between the Toronto Island community and Ontario Place. These residences are built on top of a man-made landfill constructed out of concrete box caissons. Though weathered, one can still make out the lettering of engraved text atop the bronze plaque sitting by the beachfront facing the serenity of Lake Ontario. Stating the history of its construction, it says that 'the first layer of fill in the box caissons was from the demolition waste of new construction and developments near the CN Tower. The second layer was completed upon the closing of Michigan's landfills and Carleton Farms and Pine Tree Acres, where in order to relieve the stress on Toronto's garbage problem, approximately a volume of 1,560,000 m^3 of non-biodegradable and toxic substances were diverted and used as

Previous page: Figure 3.15. Housing typology utilizing techniques of secondary reuse & DfD.

Figure 3.16. *Top*, Experiential section of new landfill with experimental housing typology.

[43] Jason McBride & Alana Wilcox, eds., *uTOpia: Towards A New Toronto* (Toronto: Coach House Books, 2005), 107.

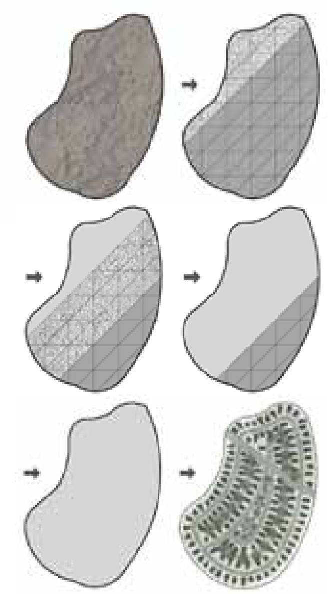


Figure 3.17. Island landfill phasing.

island landfill. Toronto was able to solve 2 crises in 2015, the first, where to divert this waste, and the second, the astronomical cost for shipping this material to the next open landfill.

Dispersed with unconventional housing typology of mixed-use, multi and single-family units, townhouses, and residential towers, the buildings exude a life of their own. Evidently, the nature of these new construction techniques, the reuse of old construction, and design strategies has transformed the island into an experimentation ground and open exhibition of creative city armature. Each building, more unique than the next, the weathered patterns on their facades, the translucency of plastic bottles, their masterful use of ad hoc techniques, mishmashes into a montage that has become a creative playground exhibiting a property reminiscent of its past in which manifests a memory of decay and triumph. Since the completion of the island, it has become a spectacle globally attracting thousands of tourists and locals each year.

With narrow walk able pedestrian friendly streets to amenities and schools, mixed-use buildings, and self-governing neighbourhoods, the OP community takes the idea of being an accessible neighbourhood one step further. After taking a walk through the

Figure 3.18. Section of new landfill. Box caissons are filled with layers of waste and then capped with concrete.

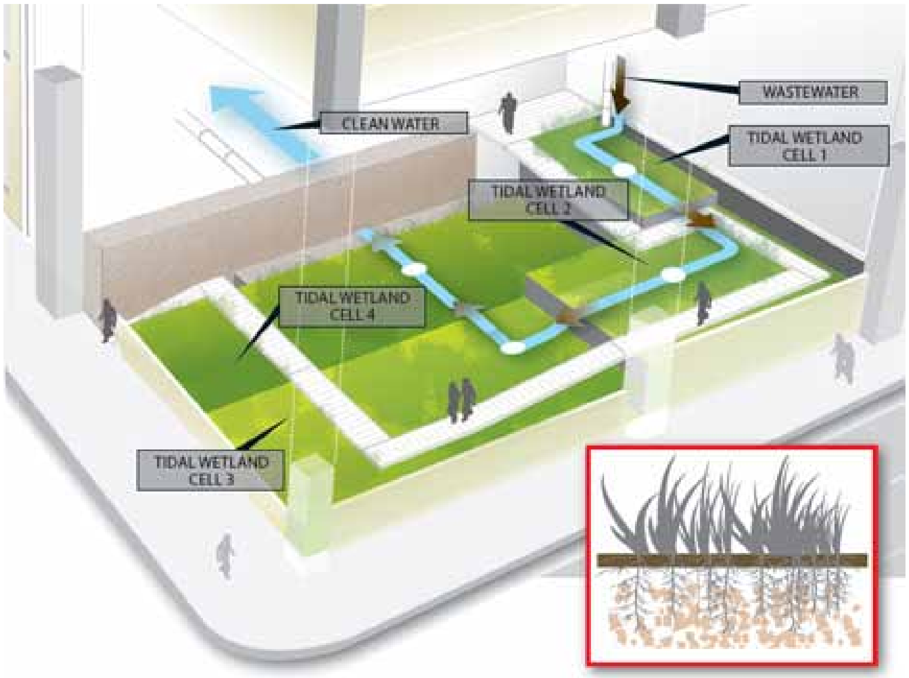


Figure 3.19. *Top,* Living Machine.

residences, one can see that the commotion surrounding OP was not all to do with the creative use of materials and building practices, but that these buildings generate their own source of food, energy and resources as well. Photovoltaic panels and glass in tandem with their own rainwater and grey water collection systems sit on top of each roof, enabling the community to generate about 9.5 MW•h per household and enough water to irrigate crops and flush toilets (see *A1*). The energy produced by PV is more than the needs of a household, which allows this excess energy to export it back into the grid. The output of wastewater from toilets and streets then flows through the island's Living Machine®, an undisturbed and aesthetically pleasing wetland that is working both indoors in a greenhouse and outdoors, allowing it to operated through the colder seasons. (*see* figure 3.19).

Upon closer inspection, this wetland is made up of gravel-like material and different plant species that work together in a complex ecosystem to cleanse it of pathogens and pollutants. The gravel material must contain substantial *cation exchange capacity* (CEC), which allows cations such as ammonium to be absorbed. This absorption rate is the principle mechanism for nitrification, and therefore limits the gravel material to be a mixture of clay, shale, and slate.[44] Within this wetland, one can find aquatic organisms ranging from fish, bacteria, algae, protozoa, plankton, snails, and clams; as well as plants. There are four types of plants typically used in the Living Machine®, they occupy each strata of the wetland, and they are (from top to bottom): floating, oxygenating, marginal, and deep-water plants.[45]

[44] Worrell Water Technologies, "Tidal Wetaland Living Machine System®" for *Living Machine* (2007): 3. http://www.worrellwater.com/images/uploads/resources/tidal_wetland_living_machine_technology_description.pdf (accessed Feb 17, 2011).

[45] Anna Melnik, et al., "A Feasibility Analysis of a Living Machine," *University of Waterloo*, for *Environmental Studies 2* (November 2004): 15.

Instead of relying on chemicals that treat wastewater, which mainland Toronto does, this system lets nature's digestive properties take its course by providing a mixture flora and fauna to specifically cleanse and perform trophic functions. About 240,000 gallons of wastewater is neutralized by sifting through the system one cell at a time; incoming air helps bacteria to oxidize ammonia, forming a nitrate that is then turned into carbon. The water can then be pumped back into the buildings and used for toilet flushing, irrigation, cleaning, or directly returned back into the lake.[46]

[46] "How it Works," *Living Machine*, http://www.livingmachines.com/about/how_it_works/ (accessed December 20, 2010).

The Ontario Place community believes in the natural process of ecological systems where nothing in nature is wasted and can be returned back to the environment in some form. The Living Machine® is the island's way of dealing with human waste, though their solution in dealing with consumer waste takes on a regime that is much more rigorous since it relies heavily on joint community effort. To ensure that minimum waste enters and exits the community, the island has limited the access to garbage pickup and collection. OP allows only biodegradable and organic substances onto the island through strict regulations and inspections upon entering the premises. Any non-biodegradable waste must be brought off the island and onto the mainland where it can be disposed of in authorized areas. The remaining waste is then collected and digested in a central composting facility where it does two things; the first is to produce high quality fertilizer for island agriculture, and the second is to harvest methane for energy. This composting facility has the capacity to hold over 88,000 tons of organic waste, it can also produce 374,000m^3 of methane generating 3,852 MW·h of electricity. Methane harvesting by anaerobic digestion is recognized by the United Nations Development Program to be the most useful decentralized renewable sources of clean energy supply that are less capital intensive than other methods.[47] Biogas is recognized to be a potential renewable replacement of fossil fuels for small communities. In fact, these facilities also help to reduce energy and the carbon footprint of waste treatment plants. Passing by this facility, it was hardly noticeable that the 'park' was in fact built on top of a mound of garbage. Children continue to play unfettered by the smell or lack of smell thereof. Since the landfill is kept capped for anaerobic activity and only opened briefly once every few

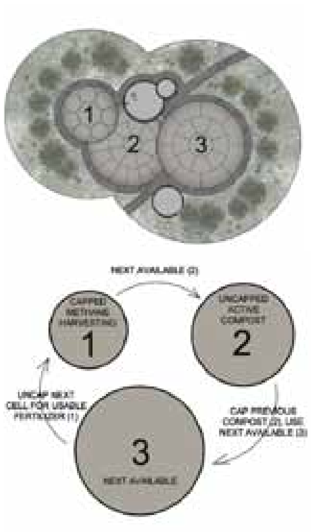


Figure 3.20. Composting facility [top] and biogas harvesting stages [bottom].

[47] Dr. Mae-Wan Ho, "Biogas Bonanza for Third World Development," *Institute of Science in Society* (June 20, 2005), http://www.i-sis.org.uk/BiogasBonanza.php (accessed November 8, 2010).

Figure 3.21. *Bottom*, Experiential section of composting facility and agricultural lands.

days for deposit, virtually no odours escape to nearby residential areas.

Figure 3.22. Urban Armature. Ontario Place's public sculptural garden and turbine field acts as a source for inspiration.

Surrounding the biogas and composting facility is an unruly agrarian landscape, abundant in open space that helps to decrease the city's greenhouse gas emissions by offsetting its carbon dioxide production into the atmosphere. Over the years a naturally occurring ecosystem of plants, animals, wetlands, and agriculture has formed an untamed landscape that exhibits considerable charm considering its low maintenance upkeep. A friendly onlooker captures the rare species of plants, reptiles, butterflies, and birds on his camera. He has spoken about how the island has brought back the natural biota of southern Ontario. However unintentional, it does provide the natural habitat for ecological development in the urban wilderness that is constantly changing and evolving, making the island an ideal place to take a break away from the city, yet still be in the city.

Nearing the west-central side of OP, it was a relief to see that the iconic buildings were still kept intact; however, something about them had changed. As a child playing at OP, I remembered these buildings to be somewhat desolate with nothing interesting happening in or outside the pods. Now, they have become the heart of the island; its arteries work to bring a new vision to OP through education by establishing their environmental college, its eco-workshops, and research centre. The OP convention centre, the Networking & Materials Database Headquarters, Trust & Financial Centre, police and fire department, as well as housing and community offices are all located in these complexes contributing to the bustling atmosphere of business executives, young professionals, and students. Sitting in on a lecture, the professor had spoken about how education on recycling and the environment is one of the key factors in determining whether or not Canadians recycle. He noted that many factors influence "the willingness to recycle, including social norms, promotional and information campaigns, and barriers to recycling such as collection method, distance to drop-off location and required sorting of materials. Having access to recycling programs is [also another] key factor that determines whether [one] recycles." [48]

Amid the pods is an even more important icon that has been the epitome of its former glory. Reusing its skeleton, what was once the Cinesphere is now re-clad in glass, creating a new function for this relic. Efficiently positioned to maximize the full potential of solar gain, 1.5 levels of year-round farmlands provide organic, locally grown produce for the community while minimizing imported produce hauled from thousands of kilometres away. The new biosphere enables crops to grow year-round in soil, as well as hydroponic and aeroponically. Together, the biosphere, residential, and public spaces produce approximately 37,850kg of food.

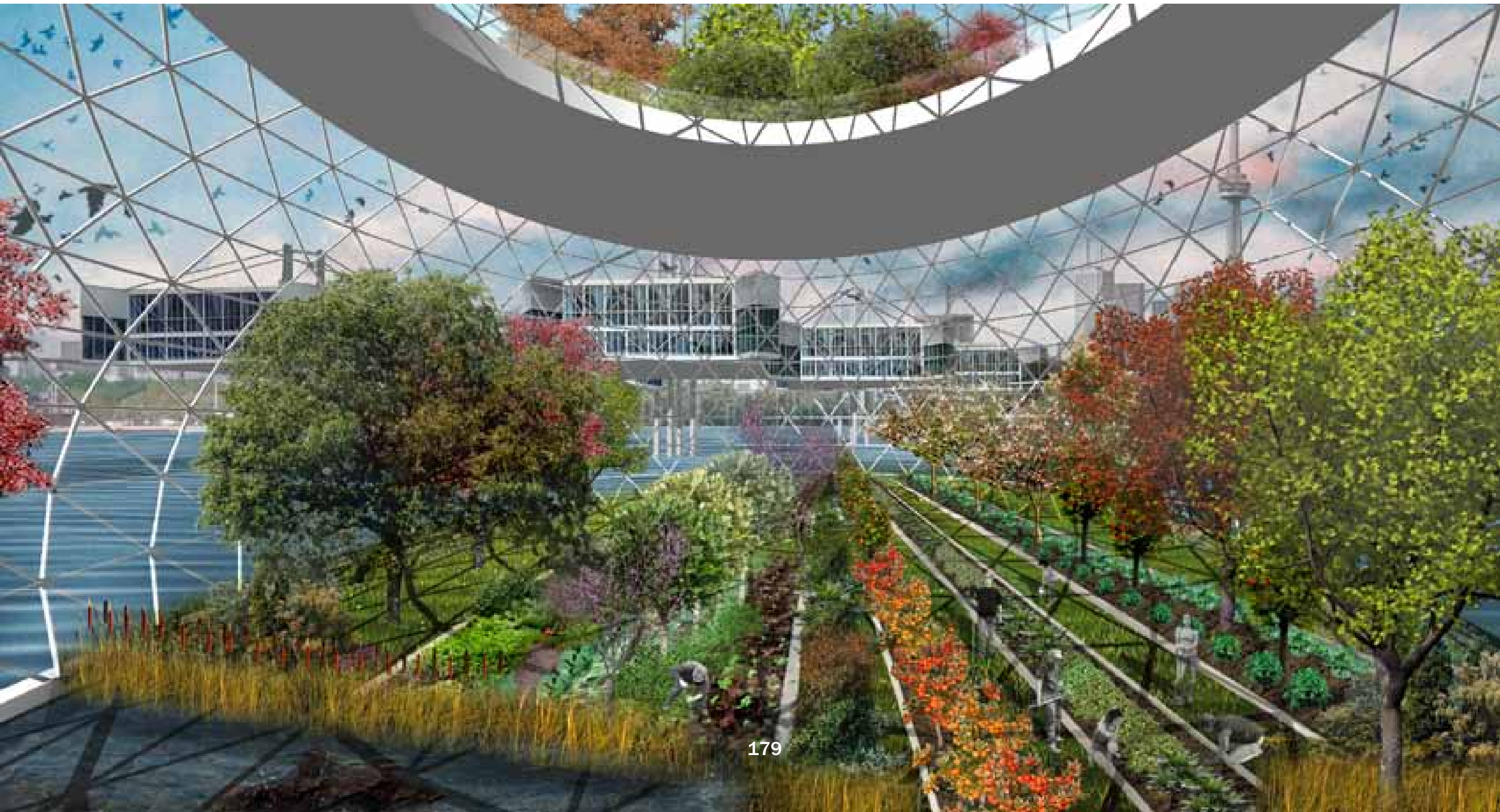
Behind the backdrop of the biosphere stand 3 wind turbines, rotating constantly even on light wind days. There is great potential in Lake Ontario to produce enough clean energy from wind to power whole cities.[49] Each of these 750 kilowatt wind turbines can generate between 1,400-2,200 megawatt hours of electricity per year, enough to power 250-400 homes.[50] With 3 wind turbines on OP, the capacity exists to generate approximately 6,600 megawatt hours of clean energy per year; enough for 1,886 homes and far exceeding the need of the island. Though no one alternative energy source can

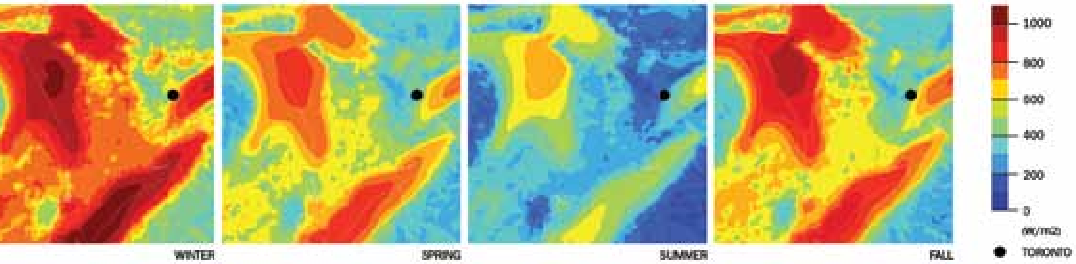
[48] Avani Babooram and Jennie Wang, "Recycling in Canada," *Statistics Canada* (2007). http://www.statcan.gc.ca/pub/16-002-x/2007001/article/10174-eng.htm#chart3 (accessed Feb 17, 2011).

[49] Interactive maps and web tools allow Ontarians to create and view maps of wind and water renewable energy resources in the province. Using this tool, a conclusion can be drawn that there is indeed great potential to harvest wind power from Lake Ontario. http://www.lio.ontario.ca/imf-ows/imf.jsp?site=renew_en (accessed November 8, 2010).

[50] Environmental Portal, *City of Toronto* http://www.toronto.ca/environment/energy.htm#wind_ex (accesses November 9, 2010).

Figure 3.23. Inside the Biosphere





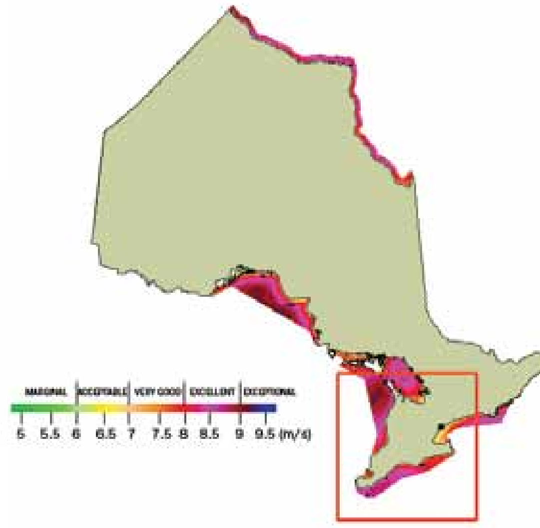


Figure 3.24. *Top left*, Southern Ontario average seasonal watt per square metre, shows Toronto to generate the least amount of energy by wind power in the summer months and the most in the winter months. Solar power can be used to offset inefficiencies in the summer.

Figure 3.25. *Top right*, Ontario average wind speeds, where Toronto falls under the *acceptable* to *very good* range.

take the place of the grid, the key to having a clean and reliable source is to have multiple systems working in tandem. Wind power, coupled with solar power and biogas, will have enough power and stamina to sustain a community even larger than Ontario Place (see *A1*).

Upon returning to the parking lot where I rented the bIXI[SM], I continued along Lakeshore Boulevard taking a last look at OP and how it had transformed since my days as a child. Its success is due to the unwavering optimism and endeavours from the people of Toronto that has allowed OP to grow from a potential waste-scape to a place that is truly sustainable, nurturing fertile developments of new ideas and revolutions. Ontario Place has been a source of positive inspiration, illustrating that the possibility of a micro scale project within a metropolitan city can have the success that in fact bears huge environmental impacts beyond Toronto itself. It has thus since been seen globally as a community that has closed the loop between man and nature, a model society that more *cities of the future* can be seen to emulate.

CONCLUSION

Architects, more efficiently than any other professionals, have always had a vocation that supports the inherent ability to visualize and materialize a project in its entirety. It is from our creative free flowing ideas and knowledge of the built environment and its culture that allows us to see the emerging problems as an integrated framework of systems. These systems contribute to a greater dialogue that can mitigate between human intrusion and ecological progress. Though waste is the main topic in this thesis, it is better understood in the context of industrialized urban societies. It is also important to look at the waste crisis not only that the throw-away society is a symptom of consumerism, but also that external factors such as economic and political motives play an inconspicuous role in it as well. While it was believed that the government stimulated the economy through consumerism after WWII, which ultimately had a negative effect on the way we regard waste today, they can also be the influence that changes our habits and perceptions into one of environmental responsibility.

Sociologist, Walter Benjamin, claimed that architecture too plays a subconscious role in influencing our habits of perception. He stated that, "Architecture has always represented the prototype of a work of art the recognition of which is consummated by a collectivity in a state of distraction." [1] His argument involved the contrast between those who let the work of art consume them and those who are "distracted" merely absorb the work of art, and that this is the most obvious in regards to buildings since they become everyday experiences, allowing architecture to penetrate into our lives unknowingly. Much the same as the framework of designed spaces and the networked flow of infrastructure within cities, they influence our daily routines, behaviours, and social interactions by weaving together the inner workings and rhythms of a complex city—traffic, their lights and signals, water input and output, electricity, communication lines—many of them

[1] Walter Benjamin, *The Work of Art in the Age of Mechanical Reproduction* (essay, part 15, 1968): 23.

function invisibly.

Though the discourse between contemporary architecture and the maximization of existing resources has been occurring for several decades in the form of counterculture, the assessment of past endeavours of the 1970s have bequeathed a significant legacy of theories and strategies[2] relating to the dilemma between the artificial and natural—or humans and the environment—that have shaped the content of this research. The dual relationship between natural and artificial is reconciled by mimicking ecological cycles found in nature and by employing cradle-to-cradle principles of design. The objective behind this principle is to minimize waste by planning wisely so that at the end of a material's life-cycle it safely degrades as nutrients in the environment. A position from this strategy is taken and applied to this research, where the goal is to find ways in which one can maximize to the best of their ability, the added value in an object (such as garbage) by keeping this energy cycling and not dissipating. Garbage is wasted energy, and while it is not the only solution, it can be the catalyst between human and environmental reconciliation since it has the ability to act as the source that relieves part of the strain on energy and depleting resources.

[2] Alessandra Ponte, "Garbage art and garbage housing," *Log*, no.8 (Summer, 2006): 99.

This critical node in time calls for development in the discipline of architecture to advance secondary reuse of postconsumer materials as an alternative, as well as to establish new strategies to replenish resources and diminish scarcity without further compromising the environment. This thesis seeks not to create entirely new knowledge, but to generate new dialogues between a set of existing ideas and problems. Evaluating the different methods presently employed in the topic of waste, recycling, and reuse in conjunction with architectural practice nurtures and expands those ideas beyond present limits. This increases the possibilities of opening markets for secondary resource exploitations to achieve solutions for future problems.

Garbage is a resource that is renewable, ubiquitous, readily available, and exhibits properties that are similar to what we build with today. Since waste is considered valueless, there can only be gain from the exploitation and utilization of garbage as a form of resource. The difficulty in doing so is based on our inability to see its value and profitability and our inability to invent creative solutions by re-imagining and re-designing new potentials. Recognizing the similarities between waste and building material may mimic waste found in nature, where waste and surplus are virtually indistinguishable. If architects can satisfy these factors in garbage that affect traditional building construction practices—material availability, people with knowledge to provide skill and labour, garbage efficiency, population demand, and ability to accept modification to traditional norms—it will create vast potential for innovations. These innovations in waste and construction will unequivocally aid in creating attainable targets for progress in order to successfully abolish the cultural stigma surrounding this topic.

The three projects titled *The Book Wall, A World without Oil,* and *Ontario Place*, work on different scales to build upon the ideas discussed. The Book Wall is a modest size project that seeks to reconcile the issues between waste and usefulness. This project is very much about its materials, availability, labour, and constructability. Its aim is to place a value on waste to help make a transition between cultural stigma and acceptance, while at the same time it evaluates our current struggles with the waste crisis and scarcity. This experiment prevents the wasting of high-embodied energy content of materials by finding inventive ways to retain its value. There is something poetic about the reutilization of waste, slightly ironic but indicative to the current contemporary era.

Based on this research, it is my belief that the next step for architects and the students of architecture is to investigate ways to not only develop buildings that operate sustainably, but to reutilize materials that are high in embodied-energy and have short life cycles. It is important to acknowledge that buildings contribute to over 70 per cent of some cities' environmental footprints.[3] Thus architecture should be used as a tool that can control a city's carbon footprint by selecting environmentally responsible materials either by utilizing waste or recycled materials, by practicing sustainability, creating environments that use less energy, and by using these buildings as precedents in changing city perceptions, providing goals for the city and its people. In turn, this may also assist in persuading industries to use materials that are manufactured with less energy, harmful products, and waste output. "Massive changes are occurring environmentally. Materials need to address that. Changes in materials can transform society, how we live, what our environmental impact is," says Blaine Brownell. "This current downturn in the building industry is an opportunity for architects to reconsider materials and their impact," [4]

[3] Ron Dembo, "What the Environmental World Needs is Universal Benchmarking in the Fight Against Global Warming" *Zerofootprint* (Aug. 2010): 2.

[4] Blaine Brownell, "Smart Materials, Intelligent Futures," *Fabric Architecture* (July/August 2009), under *Transstudio*, http://transstudio.com/smart-materials-intelligent-futures/ (accessed April 1, 2010).

The hyper-choice of new materials and techno-utopic innovations in clean energy from other disciplines only masks the potential for secondary resource markets by layering them onto existing construction techniques. These are energy replacements (i.e. hydrogen fuel with fossil fuels) or chemical and material substitutes (i.e. recycling) often found during the depletion of material reservoirs, inducing temporary relief to problems. This relief is often followed by an intensified crisis of some form of consequence, and whether large or small, there is no denying that entropic processes are at work. The future will afford challenges that surround the topic of deconstruction and production of waste-scapes that catalyze epochal shifts in our notion of community and the environment. Rather, we should begin to assert techniques in maximizing the potentials of waste in order to reconstruct itself in the urban cityscape. Thus "architect[s] must find ways to transform, to metamorphose the material and intellectual detritus of destruction into the genuinely new. The technique most essential to this process is a conceptual one: see the old as if it had never before been seen." [5]

[5] Lebbeus Woods, *Radical Reconstruction* (New York: Princeton Architectural Press, 1997), 30.

A World without Oil takes the Book Wall one step further by moving towards a more extreme reconciliation. Like the Book Wall, it exudes principles of *adhocism*—of using what is readily available but in a more severe scenario as a way to provide quick solutions to an accelerating problem. While A World without Oil is about climate change and oil depletion, this project begins to fuse together elements of community involvement, environmental stewardship, and crises that help to develop the third project, Ontario Place. Though the proposition of A World without Oil is highly mythical, the creative process of untraditional thinking provides a strategy in which designers should work in order to create more convincing solutions for the future.

Since the government, city regulations and codes influence architecture; the solution does not rest solely on the architects' ability to convey this environmental message, but reflects a responsibility that is also political as well. Throughout history architecture has often acted as a mediator between the general public and governmental authorities. Their buildings assert authority and provide a clear vision of the city that helps in bringing cultural identity and unity between its people. Studying the general framework of the city will help to focus the attention on micro scale changes that prompt macro scale improvements. By looking at the city as a whole will allow us to see relationships between each area and how each change may affect one another.

Waste-scapes are heterotopic places that exhibit potential for redevelopment and progress. They are the microcosm of urban environments such as city dumps, abandoned buildings/land/landmarks, contaminated sites, and marginal or peripheral land surrounding cities—all containing some sort of microenvironment or ecosystem away from the confines of the city. Waste-scapes present opportunities for micro scale projects and are fertile in development as they represent a blank canvas for experimentation. There is much to gain from the redevelopment of waste-scapes, these are mostly to do with its inherent connectedness to sustainability—increasing the life-cycle of wasted space, sites are adaptively reused; there are reductions in consumption, especially with the ability to lower consumption due to the choice of limited networked infrastructure; and the ability to promote awareness and reeducation.

The lessons of the Book Wall and A World without Oil unite into a firmer approach that is *Ontario Place*—a potential future waste-scape. This is a more rational and subdued advancement into the previous project that may ease acceptance into this topic, since it seeks to provide solutions that communities can understand and together empathize.

It considers whole scenarios that often contain a framework of systems that work together in creating a more habitable and sustainable environment during a time of environmental sensitivity. This is a testament that radical solutions are in fact attainable under consideration of how elements coalesce. The synthesis here is that by creating a multitude of micro-scale insertions, the fruition of these projects will result in a macro-scale development.

Research on how micro scale changes affect larger surroundings works to help reevaluate current and future predicaments. More effort should be made in collecting information and data of individuals in their connection, general awareness, knowledge, and reactions to the environment, economy, and industries in order to juxtapose this data with designing more suitable operations and assertions for waste-scapes as places of economic stimulus, progress, and creativity. The bottom-up approach to micro scale projects is a convincing way to produce large changes within a city and society. Working in this manner can move the topic of waste into new grounds for experimentation and acceptance. A place where the public can participate and access a well-documented body of work could act to transition a change in mindset surrounding this subject into one of acceptance. The challenges are, however, guided by new sets of contemporary design principles and strategies.

The Internet is a contemporary tool that can advance and transition global acceptance on this discourse, as well as a place for people to understand the creative and useful potential in utilizing waste as a renewable material. In addition to the traditional habits of building construction, cultural stigma surrounding waste, and the unpredictability of these materials due to lack of information; there are many reasons why this topic has never fully matured or come to fruition. One of many reasons is to do with the poor documentation of examples that demonstrate this body of work as well as the lack of research on this topic. When in due course, there is a place where one may be able to browse examples, techniques and ideas, locations and quantity of materials, and their properties, we may be able to collectively and freely participate as a society to seize considerable opportunities in transforming our lifestyle, consumption, industries, our surroundings, and the environment.

Architect and theorist, Lebbeus Woods, claims, "Architecture is, first and foremost, a process of creating knowledge. Because of this, the making of architecture is a major coalescing activity in society, [fusing] together many flows into a single complex strain. In classical terms, architecture is a socially significant synthesis of the old antithesis: public/private, art/science, capital/labor." [6] This thesis attempts to create provocations through a series of photographic essays, narratives, and experimental projects in order to

[6] Lebbeus Woods, *Radical Reconstruction* (New York: Princeton Architectural Press, 1997), 14.

examine more closely the role that architects play in society. Curitiba is one of the cities that recognized the importance of this role, particularly in education. This education goes beyond the pros of sorting garbage and is more about the significance of individuals and their connectedness to the environment. Lerner saw his role as an architect, city planner, and mayor as an important starting point for educating not only architects but a community as well. It is important for future architects to see where their vocation is leading, since it is no longer solely the act of creating buildings, but also the fusing together of community and environmental wellbeing.

Whether the initiatives of architects start with micro or macro changes, redevelopment of waste-scapes, or from the cybernetics of global communication, they must seek to find the connections between systems in order to create a meaningful ecosystem of global connectivity between man and nature. The importance of re-imagination and re-designing is to construct open-ended dialogues that nurture evolution and that constantly adapts to bringing solutions to current ecological conditions.

APPENDIX_1 ONTARIO PLACE CALCULATIONS

Numbers are approximate and produced for ideal scenarios or maximum capacity.
Statistics of OP:

[Statistics]

Population:
8444 total: 6720 high rises, 270 mixed-use, 864 townhouses, 420 multiple family units, 170 single family

Usable Land Area:
34.5 hectares total site
0.3117 hectares are landfill disposal
2.3 hectares indoor agricultural land (biosphere, greenhouses, residential)
3.42 hectares outdoor agricultural land (public, not including residential)

Housing:
185 units: 28 high rises (5+ storeys), 30 mixed-use, 18 townhouse complexes, 60 multiple family units, 49 single family

Food consumption:

8444 pop. x (95kg[produce] + 30kg[meats]) = 1,055,500 kg annually
(Therefore: 95kg x 8444 people = **802,180 kg** of produce needs to be produced)

Based on Statistic Canada's most recent survey.[1] Some numbers are modified to suit the needs of the island. For example, islanders may consume larger amounts of produce than survey suggests, and consume lesser amounts of meats.

[1] "Food Available for Consumption in Canada," *Statistics Canada* (2008). http://www.statcan.gc.ca/ads-annonces/23f0001x/hl-fs-eng.htm (accessed Feb 18 2011).

Solid Waste production:

350kg/person x 8444 people = **2955 tons**

(information from Statistic Canada 2004 survey calculated an average of 418kg of waste per person in Canada.[2] Since OP has no garbage collection, this number is estimated to be significantly less, therefore a value of 350kg was used).

Energy consumption:

29.7 MW•h/household x 185 units = **5,495 MW•h**

The number 29.7 MW•h is taken from National Resources Canada.[3] However this information is limited to single-family dwellings in Ontario. Perhaps a more accurate picture can be taken from the City of Toronto who estimated that each family consumes from *5.6-8.8 MW•h*.[4] Since Toronto has a greater congregation of high rises and multi-family units, there will be a lowering per capita consumption of energy. For OP, using 185 units may balance out the lower consumption of energy usage of Toronto (Since the number of single houses will balance the number of high rises).

[Synthesis]

Food production on island:

The following calculation is based on the average weight of *18 types* of crops per acre of land (for a variety of yield) and assuming that there is only one growing season.[5] To offset growing season, assume that agricultural land for summer is maximized for indoor/outdoor area, and winter for indoor areas only. This *coefficient* is 12,855 lbs/acre/season = *2,360 kg/ha.*

Summer:

2.3ha + 3.42ha = 5.72ha

5.72ha x 2,360 kg/ha = 13,500 kg

Spring/Fall:

2[2.3ha + ½(3.42ha)] = 8.02ha

8.02ha x 2,360 kg/ha = 18,927 kg

Winter

2.3ha x 2,360 = 5,428 kg

Total: **37,855 kg**

37,855 kg/802,180 kg (need) = **5%**

Therefore, OP can only meet 5 per cent of food consumption on the island within designated growing areas. Ways in which OP can generate more yield would be to maximize winter harvesting through residential and public gardens[6] and the storage of fruits and vegetables in agricultural storage locations, west of the island. The input values

[2] Avani Babooram and Jennie Wang, "Recycling in Canada," *Statistics Canada* (2007). http://www.statcan.gc.ca/pub/16-002-x/2007001/article/10174-eng.htm#chart3 (accessed Feb 17, 2011).

[3] ecoENERGY, "Survey of Household Energy Use 2007," *Natural Resources Canada* (2010): 13.

[4] Environmental Portal, Renewable Energy in *City of Toronto*. http://www.toronto.ca/environment/energy.htm#wind_ex (accessed November 9, 2010).

[5] "Crop Yield Verification," *The Garden of Eden.* http://www.gardensofeden.org/04%20Crop%20Yield%20Verification.htm (accessed Feb 18, 2011).
**Note: The information on this webpage has not been peer reviewed. Numbers are to be used in calculating estimates, only. The 18 types of crops are chosen based on possible Canadian yield, i.e. avocados were exempted since it is not typically produced in Canada.

[6] A variety of winter crops include: parsnips, beets, turnips, leeks and carrots, through the fall and into December. Red Russian kale, Dutch green curled kale, perpetual spinach, Swiss chard, turnips, beets, arugula and broadleaf cress through the winter until April. In the early spring, cauliflower, cabbage and broccoli. While broccoli, alfalfa, mustard, cress, and wheatgrass, all these are nutrient-packed greens can be grown on a windowsill. Many types of squash will last through until late spring.

for summer and spring/fall agricultural land area are minimum and can be expanded to meet island capacity. This may meet standards of production. However, the actual annual amount of OP's food consumption is lower, due to its proximity to Toronto and the amount of time residents of OP may spend on the mainland. In addition, Ontario farmers are invited to participate in OP's open market 7 days a week, allowing residents to purchase fresh and locally grown produce on the island.

Waste Management:

Composting facility for organic waste:

In Keele Valley's operational lifetime, it disposed of 28 million tons of waste.[7]

28,000,000 tons waste/99 hectares = 282,828 tons waste/1 hectare

282,828 tons waste x 0.3117 hectares OP landfill = **88,158 tons** capacity

Therefore using Keele Valley as a reference point we are able to deduce the following information. OP composting facility has the capacity of 88,158 tons of organic waste, allowing a capacity of ¼ million mainland Torontonians to divert their organic waste here. The potential for a composting facility in Toronto can be a great asset, seeing as though 66 per cent of household waste is biodegradable (26 per cent paper, 40 per cent organics), while plastics is only 9 per cent.[8] In addition to this, composting practices has been steadily increasing with an average rise of 25 per cent per year.[9]

[7] "City intensifies waste diversion efforts as Keele Valley Landfill closes". *Toronto Works and Emergency Services, City of Toronto*. (27 December 2002). http://wx.toronto.ca/inter/it/newsrel.nsf/11476e3d3711f56e85256616006b891f/65b63ef988a3391b85256df60045ca0e?OpenDocument&Highlight=0,*station* (accessed Feb 17, 2011).

[8] "Human Activity and the Environment: Annual Statistics 2005," *Statistics Canada,* Cat. no.16-201-XIE (2005), p. 3.

[9] Ibid, 13.

Waste:

In Ontario, demolition waste amount to 1,158,701 tons; and the total weight of waste from residential, demolition, and industrial is 12,061,131 tons.[10] A great number of demolition waste can be diverted into the construction of OP buildings, in addition to residential and industrial waste.

[10] ecoENERGY, "Survey of Household Energy Use 2007," *Natural Resources Canada* (2010): 3.

Biological waste:

There exists many precedents of Living Machines® handling municipal flows at a rate up to **80,000 gallons/day** (GPD).[11] An average person in Toronto uses *253 L/day* (66 Gallons/day), *31 per cent* of which is wastewater flow.[12]

66 GPD x 0.31 = 20.5 GPD wastewater

20.5 GPD x 8444 people = **172,764 GPD**

3(80,000 GPD living machine) = **240,000 GPD capacity**

Though the living machine has the capacity to process wastewater on the island, dual chamber dry composting toilets in residential areas may help to offset the amount of wastewater going into living machines, including a reduction in water consumption.

[11] "Waste Water Technology Fact Sheet: Living Machine," *The Environmental Protection Agency,* EPA 832-F-02-025 (Oct 2002): 1.

[12] "Toronto's Water Efficiency Plan," *The City of Toronto*, http://www.toronto.ca/watereff/plan.htm (accessed Feb 18, 2011).

Energy on the Island:

Wind Harvesting:

A 750 kW turbine can generate 1,400-2,200 MW hours of electricity, enough to power 250-400 homes at 3.5-8.8 MW•h per household (A City of Toronto Estimate).[13] Since there are 3 turbines on OP, this can generate up to 6,600 MW•h, enough for 750-1886 homes (or Provincial estimate: 222 homes at 29.7MW•h /household). There is great opportunity to harvest wind along Lake Ontario. Figure 3.28 and 3.29 suggests that Toronto would generate the least amount of energy by wind power in the summer months and the most in the winter months. It also puts Toronto under the range of acceptable to very good in terms of average wind speeds.[14]

[13] Environmental Portal, *City of Toronto* http://www.toronto.ca/environment/energy.htm#wind_ex (accesses November 9, 2010)

[14] "Wind Resource," *Ontario Ministry of Natural Resources.* http://www.lio.ontario.ca/imf-ows/imf.jsp?site=renew_en (accessed Nov 5, 2010).

Solar Harvesting:

The following information is an estimate only and show calculations for one single-family dwelling in order to determine the feasibility of PV panels.

Average single-family household (max.): 75 m^3 of PV = 807 sq.ft
Average PV[15]: 8-10 watts/sq.ft

807 sq.ft x 8 watts = 6.5 kW
6.5 kW x 5 hours/day = 32.5 kW/day
32.5 kW/day x 365 days/year = 11.9 MW•h
assume 80% efficiency of direct sunlight hours:
11.9MW•h x 0.8 = **9.5 MW•h**

Thus, using the City of Toronto estimates (5.6-8.8 MW•h), solar harvesting is feasible for single-family dwellings as an alternative to other methods of renewable energy.

[15] "Solar and Wind Calculations," *Solar Estimate.* http://www.solar-estimate.org/?page=solar-calculations (accessed Feb 18, 2011).

Composting Facility:

Based on the information collected from Keele Valley's 99 hectare Landfill Site: In 2001, 119 million m^3 of methane was produced, which was sufficient to power 20,000 homes.[16] From this, the following information is deduced:

119,000,000 m^3 methane/ 99 hectares = 1,200,000 m^3 methane/1 hectare of land

1,200,000 m^3 methane x 0.3117 hectares (OP) = 374,000 m^3 methane

conversion: 1 m^3 methane = 37 MJ = 10.3 kW•h

374,000 m^3 methane x 10.3 kWh = **3,852 MW•h of electricity**

3,852 MW•h total by methane / 29.7 MW•h/household = Powering at least 130 households

[16] Human Activity and the Environment: Annual Statistics 2005, *Statistics Canada,* Cat.no.16-201-XIE (2005), p. 9.

The production of landfill gas is dependant on waste composition. The greater the amount of organic waste present in landfill, the greater the volume of gas is produced by bacterial decomposition. Since Keele Valley collected all categories of waste and OP collects only biodegradable waste, the amount of methane produced (1,200,000 m^3 methane/ 1 hectare of land) is increased at OP. Therefore a sustained capacity to power 130 households is the minimum since the value of 29.7 MW•h/household was used, which was a provincial-wide estimate and not a local estimate, as well as accounting for the increase in methane due to it being a composting facility. The actual number of households capable to be powered could reach at least 300.

In conclusion, OP will produce exceedingly more energy than it will consume. With wind and biogas together, it will yield 10,452 MW•h of electricity not including PV panels. The island consumption is 5,495 MW•h at its most inefficient. The island will also be able to account for all its waste produced, effluents from solid waste and wastewater. The limiting factor discovered through this synthesis is that the island can only yield 5 per cent of population needs in food. Therefore OP must seek other alternatives such as, purchasing food on the mainland and through OP's urban market.

The capital cost of this project may not be feasible, however, more responsibility on the government's part should be made in allocating subsidies/funds toward these types of environmental visions in the future. OP would be a long-term investment. Monetary profits and gains may not be seen for a number of years; yet, other gains may be evident immediately.

APPENDIX_2 **ADDITIONAL RESOURCES & REFERENCES**

ORGANIZATIONS & WEBSITES

www.salvo.co.uk
www.recyclingbydesign.org.uk
www.bouwcarrousel.nl

Bouwcarrousel provides reclamation service that ranges from salvaging goods and buildings being demo, to selling goods refurbished to desired level

www.reuze.co.uk/frn_directory.shtml

The furniture recycling network

www.frn.org.uk

Furniture reuse network

www.century-office-equipment.co.uk/recon.htm

Reconditioned office furniture

MATERIALS EXCHANGE

www.salvomie.co.uk/

Materials information exchange

www.ciria.org/recycle/

Construction recycling sites

SUPPLIERS OF RECYCLED-CONTENT BUILDING PRODUCTS

www.ciwmb.ca.gov/RecycleStore
www.oaklandpw.com/oakrecycles/construction/products.htm
www.state.nj.us/dep/dshw/recyclenj/building.htm
www.GreenBuildingStore.co.uk
www.recycledproducts.org.uk
www.ecoconstruction.org/

EcoConstructionDatabase

www.wrap.org.uk

UK, Waste and resource action programme provides guidance on using some recycled materials, as raw materials or in products.

www.aggregain.org.uk

www.recyclewood.org.uk

MATERIALS & PRODUCT SPECIFICATION

www.greenspec.co.uk

Large range of info to help designers and specifiers of reclaimed and recycled materials

www.ci.seattle.wa.us/dclu/Publications/cam/cam336.pdf

Department of planning and development has published guide to sustainable building and reuse of building materials

www.recyclingbydesign.org.uk/sites/content/specifying.asp

List of guides to specs for recycling is available

TRADE & PROFESSIONAL ORGANIZATIONS (PROMOTING RECLAMATION, REUSE & RECYCLING GUIDANCE)

www.recycle-it.org

Timber recycling information

www.recoup.org

Plastics

www.icer.org.uk

Industry council for electronic equipment recycling/e-waste

www.bsria.org.uk

Building services research and information association

www.steel-sci.org/

Steel construction institute

RESEARCH ORGANIZATIONS

www.cibworld.nl

International Counsel of Buildings

www.cce.ufl.edu/affiliations/cib/index.html

Flexible demountable buildings (Design for Deconstruction)

www.sev.nl/ifd

www.bre.co.uk

www.recyhouse.be/index.cfm?lang=eng

www.recyclingbydesign.org/site/content/home.asp

Guidance for designers

www.inspirerecycle.org

Inspiring product manufacture with recycling

GLOSSARY OF TERMS

Ad Hoc. A "method of creation relying particularly on resources which are already at hand…basically involv[ing] available systems or dealing with an existing situation [but] in a new [and efficient] way" (Jencks, 9). Adhocism can be applied to almost every discipline.

Bricolage. Similar to Ad Hoc, bricolage can be applied to a variety of disciplines, most commonly visual arts and literature. However, bricolage works by means of signs; which allows the work to incorporate the persona of human culture into reality, while saturating the object with knowledge and contemplation.

Consumption Economics. This field of study introduced product obsolescence to the world of fabrication. It was believed that the means to the success of a healthy growing society was either by changing the physical appearance of an object or by creating a mindset that was quintessential for antiquation.

Cradle-to-cradle. This idea looks at cycles in ecosystems as models for changing current recycling and reuse practices. Often this idea includes fabrication of new products, where from inception these products are conceived with benign materials that safely degrade back to the environment.

Death-Dating. This term refers to products that are meant to break down or wear out before anticipated.

Down-Cycle. This is the process, often in recycling, in which waste materials convert into new materials or products of lesser quality and reduced functionality.

E-waste. This term describes loosely discarded, surplus, obsolete, or broken electrical or electronic devices.

Future-Shock. A term Alvin Toffler uses to describe a premature state of society that has undergone "too much change in too short a time," (Toffler, 2) where we are left to cope with suffering from stress and disorientation.

Hyper-choice. A term that states that customization and technology leads to an overwhelming choice of products, where more choice is not necessarily better and often hinders ones good judgment leading to confusion, frustration, u unnecessary purchases and consumerism, and promoting unsustainability.

New Urbanism. A urban design movement that arose in the early 1980s as a way to break the conventional mould of suburban malls and highways. Instead, it promotes walk able neighbourhoods, diverse housing typology, mixed-use buildings, and strategic but conveniently situated neighbourhoods and amenities. New urbanism also promotes community function and livability, and at the same time also strives for environmental harmony and social integration in a diverse community setting.

Obsolescence of Desirability. This term is also called psychological obsolescence. The essence of this principle is founded upon wasting and acquisition: for example, relying on the volatile nature of trends and fashion. From an economical and consumer standpoint, the principle is socially justifiable because it redistributes wealth.

Obsolescence of Function. This is the process that involves the previous product becoming outmoded because the current product performs better or more efficiently.

Obsolescence of Quality. This process is one that involves death-dating where products are meant to break down or wear out before anticipated. Sometimes this renders reparation obsolete, as it is much cheaper to buy a new one, leading the consumer into a continual cycle of purchases.

Re-Skin. This term is often used with the term zero carbon-footprint (see glossary term) as a way to describe projects that update older buildings, often through re-cladding the exterior face of the building to bring their carbon, energy, and water performance to sustainable levels. Consequently, re-skinning buildings also improves their aesthetics and at the same time are smarter in performance.

Superuse. This term is used to describe "architectural design [that had] shift[ed] from [its original] definition towards creating the right conditions for a plan to be executed. It involves rough estimates of measures rather than narrow tolerances, and crude material descriptions rather than an exact determination of properties. Since a project may involve materials, elements, components and parts that have been used already and are to be used again in an application that differs from what they were supposed to do, their properties need to be re-established to be able to abide by regulations." (van Hinte, 6)

Techno-utopia. This term describes a hypothetical ideal society, where government and social conditions are solely operating for the profit and well-being of its citizens. The usual circumstances set techno-utopia in the near or distant future, when advanced science and technology allow ideal living standards to exist. This often hinges upon two assumptions: the first suggests that it is presently too late to change our environmental predicament, that technology can hinder the entropic effects of global warming and other disastrous outcomes by advancing current techniques to limit our carbon footprint. The second branches off from the delusions that science and technology will free us from environmental responsibilities by creating new or perfecting known forms of energy.

Up-Cycle. Opposite to the process of down-cycling, up-cycle converts waste materials into new materials or products of better quality or a higher environmental value. This process is often used in tandem with cradle-to-cradle practices.

Waste. The definition used in this dissertation is that waste is subjective to the user, who once took value in the object, place, or material, and henceforth has no value or usefulness to the user. Waste can be a person, place, object, material/element, landscape, and interstitial space.

Waste-Scapes. This term is used to describe places that understand the value of economics, social development, and culture. They are the public dumps, markets, landfills, and abandoned or derelict places. Often regarded as marginal by nature, they do perhaps act as heterotopic fertile developments that nurture new ideas, revolutions, and movements that constantly evoke narratives such as death and elegy, ecological and archaeological history, progressivism, and entropy. Often waste-scapes yield enjoyment and curiosity, but also contain a wealth of information and potential for education, redevelopment, and community.

Zero Carbon-Footprint. This term describes buildings that have low environmental impact and do not exude greenhouse gases produced directly and indirectly by building operations, maintenance, and functions. Zero carbon-footprint is usually calculated or expressed in equivalent tons of carbon dioxide produced per year.

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