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Substantial interest in promoting healthier and low impact, environmentally “green” residential developments is growing to facilitate significant changes in living situations of residents and reduce material consumption. Current research remains focused on technological efficiencies of high performance, “green” residential developments. While an important first step, there is a dearth of research analyzing post-occupancy consumption levels within residential developments to determine the relationship between household consumption, quality of life, and residential design. This report aims to address how residential dwellings and user feedback can influence household consumption levels and behaviours in different building types.

Moving toward Sustainable Consumption and Production (SCP) is one of the most challenging issues of the sustainable development agenda, since sustainability discourse often overlooks demand and distribution issues. An analysis of eight multi-unit, residential household settings in Metro Vancouver, BC is conducted on high performance residential development, cohousing development, and typical multi-residential development. While environmental costs and human health benefits in commercial environments are receiving considerable attention, there is a gap in research applied to different residential multi-unit housing types in North America.

Specifically, this study applies quantitative and qualitative approaches using building performance and user feedback. A review first examines pertinent literature in planning, SCP, and post occupancy assessment that helps formulate a conceptual framework. A cross-sectional approach then analyzes household spending data from Statistics Canada and identifies socio-economic and geographic characteristics of households within three consumption categories.

An analysis of eight multi-unit, residential household settings in Metro Vancouver, Canada is then conducted on high performance residential development, cohousing development, and typical multi-residential development. A residential POA mail survey (n=433) to heads of households assesses living space satisfaction and household consumption behaviour. A multi-regression analysis correlates relationships between residential building classifications, socio-demographic data, living space satisfaction, and household consumption levels. Household consumption levels, housing satisfaction, and user feedback is then qualitatively investigated with occupant interviews and site observations.

Findings
Findings from this investigation analyze household consumption in seven areas: housing, mobility, food, solid waste, social capital, consumption behaviours, and livability. Indicators in these areas are viewed through a Driving Force-Pressure-State-Impact-Response (DPSIR) framework. The analysis indicates that cohousing occupants generally consume differently and in some instances more sustainably than green or typical occupants within the cases studied. Occupants in green and typical developments consume comparable amounts of resources, but green occupants may attempt to “buy” sustainable lifestyles. Green building advocates and policy makers are missing key opportunities because efficiency gains are being overrun by increases in absolute consumption levels. Energy efficiency policies emphasizing absolute energy demand (rather than energy intensities) would encourage downsizing and could reverse present trends towards more energy consuming appliances and equipment.

Key responses toward sustainable livelihoods focus on the way households are organized rather than how green technology in buildings is marketed. These approaches predicate financial implications for consumers and producers that have yet to be fully addressed through legislation to mitigate current material consumption levels. They provide critical insights for assisting policy makers, academics, planners, architect, designers, and households may ascertain how residential dwellings affect household consumption levels.

Roles and responsibilities for SCP actors are consolidated into four general conclusions:

1. Until economic models are realigned, SCP has little chance of reaching the transformational shifts to adequately address climate change and over consumption.

2. Additional land tenure mechanisms are required to promote access and secure rights to land and other natural resources.

3. Governance and management structures and approaches require rethinking how to organize households more effectively.

4. Community indicators for SCP require conscious and concerted effort particularly within housing, mobility, and food.

Within the general conclusions, an expert policy focus group reviewed the draft policy implications and arrived at priority items requiring immediate attention. When combined and integrated with behaviour change strategies at the local, regional, provincial, and federal level, the policies have potential to influence and shift consumption patterns.

Top policy implications include:

- Putting a price on carbon through entering into a cap-and-trade system with a stringent emissions cap set each year;
- Establishing a federal carbon tax;
- Curbing dispersed development through the more efficient planning and design of communities;
- Reprioritizing support for sufficient public transit;
- Establishing urban containment boundaries when backed with affordable
housing strategies;
- Spearheading sustainable home procurement programs that publish building product performance measures and lifecycle costs;
- Scaling up cohousing developments; and
- Using indicators to monitor resource consumption, such as real-time smart meters for energy use.

The report concludes that sustainability discourse has failed to deal adequately with the demand side of the ecological, political, and cultural crisis. The social context must interact more aptly with efficiency measures to rethink labour and productivity while decreasing aggregate material consumption levels. Until sustainable options become easier, cheaper, and more convenient, behavioral change will remain reticent in efficacy and uptake. Appropriate solutions should adopt a suite of holistic and local approaches that are based on financial implications for consumers’ and producers’ choices. Ultimately, humanity and all living creatures are short-changed when consumption and technology are not integrated with behavioural considerations.
Substantial interest in promoting healthier and low impact, environmentally “green” residential developments is growing to facilitate significant changes in living situations of residents and reduce material consumption. Current research remains focused on technological efficiencies of high performance, “green” residential developments. While an important first step, there is a dearth of research analyzing post-occupancy consumption levels within residential developments to determine the relationship between household consumption, urban form, and occupant behaviours.

This report examines the impact residential dwellings have on household consumption and user satisfaction. It focuses on the need to examine consumption as the major challenge in moving households toward Sustainable Consumption and Production (SCP).

A theoretical framework of unsustainable consumption and production acknowledges unsustainable consumption is everyone’s problem and ultimately reprioritizes activities based on personal experiences rather than disposable commodities (see Appendix 1). It is contrasted with a SCP framework that seeks to mobilize communities toward reduced material resource use, clean production and ethical investment strategies, localized distribution, efficient utilization, minimal waste disposal, and responsible consumption. These elements can mitigate the process, rate, and pattern of irreversible damage to ecosystems that currently deprive future generations of using these resources.

The framework helps conceptualize and articulate SCP to describe the use and procurement of products processed with strong environmental and social accountability. It offers a vantage point for analyzing sustainable development through four distinct elements:

1) Behavioral, distributional, and ethical considerations with ecological technology adaptations;
2) Absolute consumption levels are of primary concern, rather than an emphasis on intensity levels;
3) Resource use is collectively maximized and leveraged, rather than on an individual basis, when possible; and
4) Consumer activities shift from commodities and materials to products, services, and finally experiences focusing on intrinsic values for greater fulfilment.
A cross-sectional approach analyzes 2004 Survey of Household data from Statistics Canada. The socio-economic data provides a general overview of resource consumption in Canada. Benchmarks are established for the following categories: housing, energy, mobility, food, and goods. Spending data is analyzed to determine patterns of where low, mid, and high consumption groups fall in each category with particular reference to household composition, community sizes, regional locations, fuel types, and price points.

Consumption’s diverging contours accentuate inequalities of single parents and children, the working poor, and affordable housing. A polarizing trend between high and low consumption levels points to an increasing disparity of income that is not democratically distributed. This finding suggests that policies designed to reduce the impact of material consumption need to focus on those with higher incomes, whereas in many instances they currently fall disproportionately on those in the lowest income brackets. Of the consumption categories that provide thumbnail representations, adequate and affordable housing is a reoccurring theme that is insufficiently addressed within sustainable design and green building dialogue (see Appendix 2). These policies exasperate environmental, economic and social conditions for the majority of Canadians rather than level the playing field.

Innovative approaches using qualitative and quantitative findings are therefore sought to provide a rationale for using different kinds of indicators to address SCP linkages between causes, effects, and policy recommendations. The Driving Force-Pressure-State-Impact-Response (DPSIR) framework adapted from the OECD is one such approach, which focuses on household consumption (and production) and quality of life issues by using natural resources efficiently, promoting more equitable social development, fostering economic competitiveness, and applying technological innovation.

Applying DPSIR to measure SCP attempts to connect global trends and responsibilities to households through considering the cause and effect relationships to draw appropriate conclusions (see Appendix 4). The DPSIR framework also identifies socio-economic and cultural factors that increase pressures on the system through the unsustainable consumption and production framework introduced earlier (refer to Appendix 1). The DPSIR framework is particularly helpful for policy makers or decision-makers and balances causes with results. It measures programs and activities designed to alter driving forces representing human activities, processes, and patterns that impact with the goal of improving the condition or state at a particular point in time.

Specifically, the study applies quantitative and qualitative approaches to investigate household consumption in seven areas: housing, mobility, food, solid waste, social capital, ecological behaviours, and livability. If the principles of DPSIR can inform municipal infrastructures, they will provide communities with better mobility choices, encourage different building styles and management practices, and offer economic incentives to households to consume differently and in a more sustainable direction.

A review of SCP, planning, and Post Occupancy Assessment (POA) literature helps frame the study. A residential mail survey (n=433) to heads of households assesses living space satisfaction, and household consumption and production behaviour. 108 owner occupants responded for a response rate of 25%. A multi-regression analysis correlated relationships between residential building types, socio-demographic data, living space satisfaction, and household consumption levels and behaviours. Household consumption levels and perspectives are then qualitatively investigated.
through 42 household interviews that are transcribed, coded, and triangulated with quantitative findings. While environmental costs and human health benefits in commercial environments are receiving considerable attention, there is a gap in research applied to different residential multi-unit housing types.

Currently, standard of living translates into measures of material and economic well-being that emphasize expenditures measured by economic value. SCP’s contribution to well-being attempts to integrate intrinsic qualities, such as social and ecological characteristics, in addition to economic aspects. While concepts of SCP and well-being continue to evolve, supplemental conditions of well-being should augment definitions and uses of standard of living as demonstrated in Figure 15 in Appendix 4.

The report then consolidated an analysis of findings for members of a peer review focus group consisting of leading public policy and planning practitioners in BC to “ground-truth” the process, enhance validity, offer practical policy applications, and assist in dissemination. The analysis examined household behaviour and routines that often become locked into habitual consumption patterns influenced by building infrastructure and urban form. It also examined how municipal, provincial, and federal jurisdictions can target consumption policies. When socio-cultural factors are integrated into building design and resource usage, household boundaries extend beyond the front door to the basic structure and governance of communities.

Three categories of field sites in three different communities were investigated for the study in Metro Vancouver,

1. High performance “green” developments eligible for LEED® certification or comparable high performance building designation: Silva (67 units) and Clements Green (55 units);
2. Cohousing developments: Quayside Village (22 units), and Cranberry Commons (21 units); and
3. Typical (non-green and non-Cohousing) developments: Reflections (79 units), Journey (77 units), Symphony (51 units), and Carlton Terrace (74 units) (see Appendix 3).

Cohousing is an intentional community, where members own private living space, but also share common space. (Hereafter Greens refer to households from the two high performance buildings; Cohousing refers to those living in the two cohousing sites; andTypicals refer to households from non-green and non-cohousing buildings.) Cohousing is also referred to as collaborative housing, intentional community living, and eco-housing. Some meals or social activities are often planned in Cohousing that potentially lower environmental impacts. The model is based on strata-ownership and is more prevalent in Denmark than in North America.

Table 1 - Site Descriptions

<table>
<thead>
<tr>
<th>Development</th>
<th>Location</th>
<th>Number of Units</th>
<th>Site Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silva</td>
<td>North Vancouver</td>
<td>67</td>
<td>Green</td>
</tr>
<tr>
<td>Quayside Village</td>
<td>North Vancouver</td>
<td>21</td>
<td>Cohousing</td>
</tr>
<tr>
<td>Cranberry Commons</td>
<td>Burnaby</td>
<td>22</td>
<td>Cohousing</td>
</tr>
<tr>
<td>Clements Green</td>
<td>UBC Endowment Lands</td>
<td>55</td>
<td>Green</td>
</tr>
<tr>
<td>Journey</td>
<td>UBC Endowment Lands</td>
<td>80</td>
<td>Typical</td>
</tr>
<tr>
<td>Reflections</td>
<td>UBC Endowment Lands</td>
<td>77</td>
<td>Typical</td>
</tr>
<tr>
<td>Carleton Terrace</td>
<td>Burnaby</td>
<td>75</td>
<td>Typical</td>
</tr>
<tr>
<td>Symphony</td>
<td>North Vancouver</td>
<td>51</td>
<td>Typical</td>
</tr>
</tbody>
</table>
The eight sites are located within three distinct neighbourhoods. Silva, Symphony, and Quayside Village are located within an eight-block radius in the City of North Vancouver; Clements Green, Reflections, and Journey are located within a one-block radius on the University Endowment Lands at UBC; and Cranberry Commons and Carleton Terrace are located within a one-block radius in Northwest Burnaby (see Table 1 and Appendix 3). Each development contains owner-occupied residents that have lived in their dwellings for a minimum of six months. Designated rental units in the various developments, when known to researchers, were omitted from the study.
Households encompass socio-cultural structures that determine needs and wants that are influenced by family, friends, neighbours, and co-workers. Household size, dwelling type and location, dietary preferences, commuting patterns, personal and household hygiene, and waste disposal habits all make up daily routines that are often constrained by structural elements that limit options for busy families. More multi-unit residential housing within walking distance of services and public transportation is needed, as are changes in the types of food consumption.

The survey data demonstrates that there are many ways for households to shift mobility choices and driving patterns. For example, cohousing households report they are less likely to drive than Typicals and more likely to drive shorter distances to shop. In addition, results indicate marked differences in preferences concerning food priorities and dwelling types. Household food is operationalized by ranking how frequently food is prepared at home as opposed to previously, and ranking preferences of price, brand/appearance, grown in BC, and whether organic (see Table 2). Greens and Cohousing are less likely to list price or brand/appearance as first priority, and are more likely to rank organic first. Gaps between Cohousing and Typicals are particularly large.

In a country of climate extremes, the amount of energy to heat and cool homes consumes a significant portion of a household budget. Residential housing consumes one-quarter of the nation’s energy, yet few feedback mechanisms are in place to monitor, evaluate, or intervene when the energy grid nears capacity or becomes more expensive to use. Energy’s invisible nature is one reason why electricity use goes unnoticed.

Table 2 – Predicted Probabilities for Food Type

<table>
<thead>
<tr>
<th>Site Type</th>
<th>Price</th>
<th>Brand/Appearance</th>
<th>BC Grown</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>-17.7%</td>
<td>-1.4%</td>
<td>0.5%</td>
<td>18.7%</td>
</tr>
<tr>
<td>Cohousing</td>
<td>-38.0%</td>
<td>-10.0%</td>
<td>4.3%</td>
<td>43.7%</td>
</tr>
<tr>
<td>Typical (Base group)</td>
<td>61.5%</td>
<td>19.2%</td>
<td>15.4%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>
A proliferation of smart meters and digital home dashboards that display energy consumption through real-time tracking have entered the market. Installing a monitor can convert kilowatts and kilojoules into more readily comprehensible dollars and cents, suggesting ways to reduce heating, cooling, and water consumption. The Google PowerMeter, for example, can indicate how much it costs when a television or computer is left on, but requires logging onto a computer. Much more effective would be the placement of electronic monitors in high traffic areas, such as a main entrance or near the kitchen fridge. Profiling consumption in this manner is an important advancement from a utility meter that is traditionally installed in obscure corners of basements, boiler rooms, or building exteriors.

Smart meters can provide information, but do they actually change behaviour, and if so under what circumstances, and how much? A more intuitive approach using ambient information may be used to monitor energy consumption. One study provided utility customers in California with a glass orb programmed to change colours as the price of electricity increased during peak periods. Households so equipped reduced peak-period energy use by 40%, suggesting user feedback is more susceptible to subtle but continuous messaging.10

Internal combustion engines release pollution, causing greenhouse gas emissions that affect urban surroundings, air quality, and community well-being.11 Once a travel decision is made based on time, cost, and convenience, it becomes part of a household’s routine, as evidenced by the majority of households (58%) that commute up to 20,000 kilometres annually.12 Driving behaviour is reinforced by advertisements equating the automobile with personal freedom and sex appeal. Single-occupancy vehicle travel is indirectly rewarded for its convenience and relative cheap cost, but little attention is directed at fuel, road, and parking subsidies, or environmental impact.

California has started to redirect this message. It ranks vehicles on their rate of carbon emissions rather than curb appeal. The state labels all new personal vehicles with a carbon impact score beside the license plate. A quick glance instantaneously assesses the vehicle’s carbon footprint from a scale of 1-10.13

A SCP approach to healthy living involves eating less meat, more unprocessed and local foods, and participating in active lifestyles. Canadians are moving in the opposite direction however, eating more red meat (13 kilograms per person in 2007), exercising less, spending more time in their cars, and ballooning in size.14 Eating locally contributes to a healthier economic base and more resilient communities. British Columbia produces 48% of its food, yet citizens are more likely to buy produce from the US than north of the border.15 While obesity rates in children have tripled in the past 20 years in Canada, one out of three children in the US are overweight.16

Some groups are initiating new interventions. A Portland, Oregon study tested whether elementary children accustomed to mass-produced institutional lunches would tolerate local fare. Since cost was the major consideration driving school food purchasing, local farmers missed out from Oregon’s $70 million school lunch market. A grant provided seven cents per meal subsidy but generated 84 cents of economic activity per dollar, compared to 50-60 cents per dollar on a typical product or service. Children also reported they liked the food better.17 Other groups promote a “Meatless Monday” or another meatless day each week.
Besides eating lower on the food chain, children are more sedentary than previous generations. A study indicated that 75% of parents living less than three kilometres from school drove their children for convenience and to save time. Walking School Buses that organize children to walk to school with a supervising adult are overcoming parental inconvenience and time constraints, while inserting more physical activity into children’s routines.  

Over $9 billion is spent annually on treating respiratory disease, cardiovascular illness, congenital affliction and cancer linked to environmental exposures in the home. When the Executive Director of Environmental Defense purposely exposed himself to suspect chemicals in everyday products by restricting his diet to canned food heated in polycarbonate plastic storage containers, levels of bisphenol-A in his body, a hormone-disrupter linked to breast and prostate cancer, jumped 7.5 times.

Outside the home, lawn care providers apply higher quantities of chemicals than their agricultural counterparts. The array of lawn care products that line the shelves at home improvement stores represents a treadmill requiring more chemical inputs over time to supplement impoverished soil and plant ecosystems. What remains unknown about chemicals is their long-term effects from continual exposure, intentional or accidental chemical mixing, and the high variability of impacts on diverse human populations such as children. Downstream runoff and secondary effects also remain unclear and unknown.

Consumer and socio-cultural factors contribute to notions of homogeneity and natural orderliness outside. Some municipalities restrict or ban lawn-chemical use due to health concerns. Halifax has taken the lead in passing a municipal bylaw limiting cosmetic pesticides through education and fines. New housing construction areas require greater soil depth, residents receive information about non-toxic regiments they can follow to solve lawn pest problems, preventative education is available early in the season before pest problems occur, a web portal helps facilitate communication and resources, and bylaw violations similar to traffic ticketing procedures are complaint-driven to keep costs down.

Behaviour pertains to the ways in which we use our homes and how we think of their design, construction, use, and of consumer goods generally. Information campaigns have shown limited capacity to change behaviour due to the complex and multi-faceted nature of addressing SCP. Households often notice how institutions and corporations say one thing, but do another. This implies ineffective communication in conveying public policy, and creates cynicism and conjures resentment and rejection.

For instance, behaviour change in the UK encompasses a SCP cycle that enables, encourages, engages, and exemplifies as a catalyst for actualizing personal transformation. Behaviour change begins by enabling people to make responsible choices by providing education and skills, along with easily accessible alternatives and suitable infrastructure. Encouraging transformative results through providing (dis) incentives to personal actions produces appropriate price signals, peer pressure, and regulation. Engaging people through face-to-face interaction empowers others to accept personal responsibility for their actions. Finally, by exemplifying more sustainable alternatives, households and their institutions advocate sustainable development by modelling examples. The behaviour process catalyzes how human responses break habits.
Making informed decisions about consumption often requires understanding lifecycle assessments for the most ordinary commodity to determine ecological and ethical implications. These factors are rarely contemplated in daily consumer decisions, yet point toward an effective way forward. Assigning a checklist of actions is tempting, but difficult to do, given the temperamental nature of human behaviour and lack of empirical data.

Behavioural change requires developing comprehensive approaches towards living, working, and consuming. Trade-offs between needs and wants, daily household routines, and purchasing decisions may require replicating consumer marketing strategies used in “necessity” products such as disinfecting wipes, air fresheners, and fabric softeners to shift norms about food, health, waste, and convenience. Changing consumer messages is an important aspect of lowering consumptive lifestyles, which may contradict current notions of success and happiness by linking personal responsibility to consumer actions.

Shifting consumption patterns is not an issue that can be resolved by merely disposing empty milk jugs into a curbside recycling program. SCP’s behavioural dimensions involve dissecting human nature’s hypocrisy and self-denial, factors not usually informing discussions about retrofitting green roofs or converting to electric cars. These dimensions side-skirt hard questions about humanity’s insatiable demand for dwindling resources, even when coupled with greater technological capacity and knowledge.

The following implications are offered for developing SCP policies:

1. Focus on housing, mobility, and food choices since these consumption clusters comprise of the largest impacts. Nevertheless, small and incremental changes, such as turning off lights when leaving a room and washing laundry in cold water, do make incremental differences and contribute toward a comprehensive delivery approach.

2. Develop a sustainable home procurement tool kit to offer to households. The tool kit could serve as one-stop shop aimed at highlighting environmentally friendly and ethical home products and resources, home renovation techniques and materials, personal care and hygiene products, nontoxic lawn care, energy-efficient electronics and appliances, and local services such as DVD rentals, libraries, ride-sharing services, grocery delivery, and used goods.

3. Organize metropolitan buying clubs by which a group of households gets together to place orders for fresh meat and produce once or twice per month from a local farmer. The size of the order usually makes it worthwhile for the farmer to deliver it, and the person who organizes the order may receive a personal discount.

4. Investigate the use of ambient feedback mechanisms in homes or neighbourhoods to display energy consumption. Locally significant indicators can also help households increase awareness about consumption. For example, Vancouver is consolidating plans to use its community energy utility stack as “an iconic reference with animated qualities” to display neighbourhood energy consumption. By installing LED lights that glow red when using maximum energy and blue when functioning at a reduced state, neighbours can quickly assess their energy supply with a glance out a window.
Usually the architect and client agree on a design concept and basic materials before the mechanical and electrical engineers have an opportunity to suggest appropriate alternate systems. Opportunities to optimize synergies are limited and problematic if new technology is introduced at a subsequent stage. Examples include energy-efficient housing, using passive energy in site orientation (e.g., south facing, the use of trees for shade, and wind breaks), setting differential permit pricing by rewarding retrofits instead of demolition and rebuilding new infrastructure.

Changing the building design process is required, which conventionally follows a linear trajectory with successive contributions from each design member. User feedback interfaces in the initial design phase, when viewed as an interdependent and living system, in contrast to operating with distinct site, structure, systems, and use components. Complementary design principles and decision-making protocols are agreed upon early in order to involve stakeholders sufficiently in monitoring the building process from conception to completion.

Ongoing performance evaluation requires integration with political and governance structures. Once a strata building receives an occupancy permit, strata lot owners form a strata corporation and elect a council to manage the development. Strata councils often hire a professional manager to perform tasks under the Strata Property Act in BC. The strata council prepares an annual budget, which must be approved by a majority vote by the strata lot owners. The degree of a voluntary strata council’s level of engagement and sophistication can influence management practices and household policies, yet there is little education or incentives offered to households.

Since strata councils are at the nexus of information exchange and communication for Multi-Unit Residential Building (MURB) organization, different management and decision-making structures and strategies can help communicate and affect resource consumption. Governance structures within residential buildings will remain crucial towards determining more equitable social development, economic competitiveness, and technological innovation.

The survey data reveals that there are many ways for households to interact more frequently with building management as demonstrated in Appendix 5. For example, cohousing communities practice consensus decision-making; in contrast most strata councils practice majority-rule voting. In addition, hours spent volunteering...
may suggest stronger altruistic characteristics by cohousing respondents (refer to Figure 18 in Appendix 5). Greens may be more interested in trying to “buy” their way toward a more sustainable lifestyle rather than to model sustainability behaviour (see Table 14 in Appendix 5). Findings from the interview responses and site observations demonstrate that designing cohousing sites differ from other residential models by structuring space in ways that maximize social interaction and integrate shared common facilities like meeting rooms, laundry rooms, and kitchens, which is also supported in the review of literature.

Buildings constructed in an ecological manner can apply for certification such as LEED® or another standard. The numerous green building standards complicate awareness and compliance (as many as ten standards are used in Canada). To date, few market-based rating certifications include performance verification after occupancy, a shortfalls implying green building certification as an end in itself rather than a means to an end.32 Ongoing performance verification is the next critical step in the evolution of high-performance green buildings.

Buildings should be certified for energy performance (e.g. every five years) and upgraded when undergoing renovations or upon purchase or resale. Heating and cooling performance should be inspected regularly and energy-efficient upgrades and products should be promoted to facilitate best management practices to standardize baseline comparisons.33 These types of initiatives can stimulate the economy with employment in building retrofits, energy-efficiency specialists, and draft proofing. The Canadian Green Building Council (CaGBS) has recently taken a preliminary step by initiating performance assessments in 400 buildings across Canada.

Post-occupancy assessments of LEED®-New Construction (LEED-NC) document a 25-30% improvement above national performance ratings, but residential buildings are omitted from the analysis.34 Effective behavioural change strategies should incorporate lifecycle assessments into how suppliers and consumers evaluate products, materials, and service options, rather than select bids solely based on lowest cost.

Current home financing schemes do not reward the long-term value of renewable energy or energy-efficient investments. Low-income earners are far more likely to rent than become homeowners. Renters have little influence over the capital investments required to upgrade energy efficiencies and are less likely to control internal temperature settings. Energy-efficient investments are often seen as a luxury for rental housing stock, and funding is often allocated, first for short term cosmetic retrofits of older units, and second for additional new affordable units, rather than energy-efficiency upgrades to existing units.35

Capital is needed to invest in upfront building expenditures that consume fewer resources and generate lower operational costs over the long run. To calculate the current value of something that will exist in the future, a “discount rate” is used. Discounting is used to compare the value of costs and benefits occurring at different time periods. Green buildings are often calculated using Net Present Value (NPV) with higher discount rates due to the uncertainty of future impacts. A discount rate expresses the degree to which a new building (or other cost or service) is preferred today, for example, over a new building (or other cost or service) sometime in the future. We tend to place more value on immediate costs or benefits, than when the same costs or benefits are available in the future.
Giving future generations less of an emphasis than the current generation becomes an ethical dilemma within climate change and SCP issues. One challenge is what value to put on life now compared to in the future. Establishing a low social discount rate implies preserving more equitable options of well-being for future generations, while a high social discount rate tends to prioritize the well-being of people today over future generations. Applying Internal Rates of Return (IRR) for infrastructure can extend to energy-efficient or renewable technology investments that use lower social discount rates that reward lower operating costs, but have higher upfront capital costs. IRR is used to identify and value risks explicitly, such as the efficiency or quality of a development. IRR is a more appropriate tool than NPV for analyzing the feasibility of renewable energy and green design. There is a need to establish revolving loans for infrastructure investments for developers to access capital for additional upfront costs that can be recouped by future operational savings.

If green buildings are to be affordable for the majority of residents, they require additional social criteria integrated into point allocation checklists. LEED®-New Developments (ND) is a case in point, where only 4 out of 106 points are awarded for affordable housing. While the cost of building green is declining, green housing will only become sustainable when the majority of residents are able to purchase them. Mission-based nonprofits have been at the forefront of affordable and energy-efficient housing initiatives. Bethel New Life in Chicago, IL, for example, which has built 1,000 units of environmentally friendly buildings, offers quality, affordable, energy-efficient housing, opportunities for ownership, development without displacement, and transit-oriented housing.

Typical development practices ensure parking is abundant and cheap and each residential unit has a stall (or two). Flexible parking standards, on the other hand, can increase efficiencies and save costs when residents are encouraged to leave their cars at home and take transit. Incentives for developers can reduce the cost and need for parking stalls or strata councils can charge higher fees. Some municipalities in Metro Vancouver introduced a bylaw enabling developers to reduce parking ratios by three parking spaces for every rideshare vehicle and associated stall. Not to be outdone, Toronto just approved its first car-free condominium rising 42 stories along with 315 bicycle stalls. Changing public perception about parking and growing pushback from real estate marketers is a greater challenge than modifying regulations.

North Americans are accustomed to comingling their discarded materials rather than separating materials at point of disposal. Comingling adds convenience, but limits recovery rates because of additional labour costs. Infrastructure often physically limits a participants’ ability to separate materials within a building or unit. Many residents in MURBS lack collection space, fear odours and rodent issues, and thus avoid collecting materials outside of glass, mixed paper, cardboard, and plastics #2, #4, and #5. Recycling facilities also compete with marketable floor areas that create false dichotomies between exhibiting responsible stewardship and chasing profit margins.

Local groups have demonstrated it is possible to exceed average resource recovery rates. Quayside Village’s extensive resource recovery program results in weekly diversion rates that exceed the national average by a factor of three. Residents view waste as a resource rather than something to be thrown away.
The World Wide Web and electronic communication offer strata councils powerful means to heighten awareness about building operations. Ecological building features help educate and reinforce expected practices. Green buildings should highlight ecological attributes with signage in common areas and around main entrances.

In real estate markets such as Vancouver, MURBS are financed through pre-selling units before construction commences. Pre-selling units limit a consumer’s ability to choose more sustainable materials and products. Buyers often feel pressure to close the deal, rather than devote due process to building materials and technologies. For instance, economically, it is cheaper for a developer to install a single-monitor gas fireplace system than provide individual monitoring inserts. Households ultimately keep fireplaces lit out of self-interest because they view the heat as a shared but limited resource. No incentive or penalty for turning off the fireplace results in overuse and waste as the “tragedy of the commons” gets played out in living rooms across the region.

Strata councils play major roles in managing household consumption, becoming pivotal actors navigating between the building environment and its occupants. Stratas seek supplemental information to assess how long building products will last in relation to the total lifecycle costs of building technologies. A lack of reliable information to undertake standardized comparisons results in “addressing structural problems with Band-Aids™.” Strata corporations require standard guidelines and mandatory reserve fund studies to ensure sufficient financing is available for repairs and upgrades that may result in longer payback periods, but lower operating costs.

Cohousing has the most sophisticated strata council of the three housing types investigated due largely to its holistic approach toward decision-making and management issues (see below). Even though strata council bylaws do not address cohousing per se, cohousing developments can operate within BC provincial strata laws.

Cohousing achievements include effectively organizing and having residents abide by a set of principles that can serve as design guidelines and organizing principles. Cohousing principles include:

1. Providing resident-managed homes “at cost” by using additional profit that would normally go to a developer to purchase better quality finishing, common areas for shared use and environmentally sensitive design.
2. Reducing individual home size needs and decreasing material possessions without impacting quality of life by providing access to shared space and other household resources (e.g., faxes, computers, cars, washer and dryers, etc.).
3. Promoting social diversity by including people of different ages, backgrounds, family types, racial heritage, and religious and political affiliations.
4. Supporting democratic self-determination by striving to make decisions by consensus.
5. Reducing the need for external human resources and infrastructures by providing services such as daycare, and day-to-day support for neighbours.
6. Encouraging the bartering of talents that do not necessarily differentiate between conventional concepts of paid labour.
7. Generating economies of scale that individual households do not possess.
8. Providing good use of common space, such as a shared guest suite available to members for out of town guests.
A major barrier toward cohousing is stereotypes. Often when people hear about cohousing, they envision a “hippy commune,” cooperative, or government subsidized housing. This perception is wrong, yet difficult to change, and may require additional marketing and branding. A cohousing occupant owns a private unit, usually pays market prices (some developments may offset market units with a few subsidized units), and is open to all. Cohousing forms a rationale as a housing prototype because socio-cultural synergies are mobilized with the physical environment, the people, and building community. The current generation of green buildings has failed to embrace the ability for buildings to create a user-centred awareness for its occupants. Instead some green building accolades border on deceit and “greenwashing.”

The Statistics Canada household data highlight key findings that portray resource consumption in broad strokes, while highlighting some possible surprises or irregularities that help formulate new understandings or policy initiatives about Canadian consumption (see Table 10 in Appendix 2). In addition, the qualitative data in the household interviews indicate that there are many ways for municipalities to influence households, dwelling types, and neighbourhood infrastructure (see Figure 16 in Appendix 4). For example municipalities can promote urban agriculture practices by changing bylaws. Urban agriculture promotes fruit trees in parks, vegetables grown on balconies, raising backyard chickens, and community gardens.

Stratas and municipalities should consider the following implications for developing SCP building policies:

1. Consolidate green building certification systems into a unified system.

2. Advocate for incentives that recognize and reward developers for risk-taking within green design, technology, and affordability.

3. Establish ongoing energy assessment requirements for buildings and display signage and labelling to highlight ecological features. Target the poorest performing government owned buildings for upgrades.

4. Develop design guidelines for Cohousing or adapt cohousing principles to conventional developments to: reduce the length and quantity of hallways, increase common area space, limit total unit numbers to <50, establish transit oriented developments, improve and diversify waste diversion areas within units and developments, and separate residential unit titles from parking stall titles.

5. Develop tool kits for strata councils that encourage target strategies for housing, mobility, food, waste, and community building.

6. Develop flexible unit layouts that allow for the reconfiguration of household sizes and flexibility to adapt units, such as adding secondary mortgage-helper suites to facilitate aging in place.

7. Profile cohousing developments using local examples when possible and consider rebranding cohousing to appeal to changing residential demographics and housing needs.
MUNICIPALITIES

Municipal SCP programs target greenhouse gas emissions, land use (to protect local agriculture), infrastructure, and municipal waste. Municipal governments have devoted little attention to highlighting consumption issues, but as the magnitude of climate change increases, SCP programs will grow in prominence with initiatives like carbon offsets, pollution mitigation, transportation demand management, sustainable purchasing policies, and property tax reform. Because mobility accounts for 35% of a city’s ecological footprint (residential housing uses 15%), the single most important action for municipalities is to minimize fossil fuel consumption.45

Most municipal departments cannot track the gamut of interconnected issues included in a POA research program that influences location, neighbourhood connectivity, and infrastructure development. Nevertheless, a concerted approach requires combining technological innovation for building development with community development and household behaviours.46 Raising awareness about resource consumption requires updating zoning and bylaw legislation regarding how we approach and configure multi-unit residential buildings. SCP can link behaviours and approaches to consumption indicators and toolkits and checklists can help source more sustainable products and develop home procurement programs.47

The Statistics Canada household data presented in Appendix 2 highlights key findings that portray resource consumption in broad strokes, while highlighting policy initiatives about consumption. Qualitative data from household interviews indicate that there are many ways for municipalities to influence households, dwelling types, and neighbourhood infrastructure. For example, municipalities can promote urban agriculture practices by changing bylaws. Urban agriculture promotes fruit trees in parks, vegetables grown on balconies, raising chickens in backyards, and community gardens.

Energy use is pervasive in municipal jurisdictions due to cross-sectoral stakeholders and indirect usage. Since energy deregulation, sites have more opportunities to diversify energy sources and convert, store, and transfer energy commodities. Community district heating can generate municipal benefits including: conversions to renewable energy; connecting multiple users; adapting fuel sources, capital, and maintenance savings for consumers; energy efficiency; and optimizing building space by eradicating individual boilers. Municipalities should wean themselves off fossil fuel and onto community district heating because private companies have
converging interests dependent on energy consumption and higher profits, rather than conservation and diversification.

In Denmark, Copenhagen’s district heating system supplies 97% of the city’s energy needs by capturing waste heat normally released into the sea and rerouting the energy into residential homes, which saves $2,200 CDN annually per household. An energy company in Toronto uses the natural water temperature from Lake Ontario to air condition 29 million square feet of high-rise building space that reduces electricity consumption by 90%. When an avalanche damaged a major power line that supplied 85% of its electricity needs near Juneau, Alaska, the price of fuel increased five-fold. Municipal energy reduction strategies were implemented to cut consumption by 40% through public education campaigns, equipment efficiency improvements, and escalation in electricity prices.

Clear, reliable information about building energy performance is crucial to guide policy and energy efficiency initiatives. Information can be reported to householders through energy bills, feedback metering, and energy labels on buildings. In the EU, buildings must track and display energy performance when built, sold, or rented. These practices could be mandated by housing authorities in the rental sector to identify the worst housing stock for repair. Green buildings should highlight ecological attributes with signage in common areas and around main entrances.

Municipalities that lower rates of consumption are generally less costly to service and are geographically more compact. Households located in core-area neighbourhoods produce fewer greenhouse gases from weekday urban trips than those in suburban neighbourhoods. Residents in urban neighborhoods average 36-60% lower travel-related greenhouse gas emissions than those residing in outer areas. Compact development is estimated to save 8% in development costs that could reduce local government deficits 10% by 2025. One study compared a Vancouver neighbourhood to a suburb in the Fraser Valley, finding 38% of Vancouver homes were within a kilometre of rapid transit and 252,000 jobs were within a 5-kilometre radius. Only 3% of homes were within a kilometre of rapid transit and 26,000 jobs were within five kilometres in the Fraser Valley suburb. Another study revealed that when using lifecycle costing analysis to estimate development costs, high density neighborhoods were as much as 50% more cost efficient than low density neighborhoods.

Sustainable mobility such as walking, cycling, and using public transit is more viable when destinations are close to home, and pedestrian and cyclist infrastructure exists. One study estimated doubling density would reduce travel-related greenhouse gas emissions by 5% with urban households spending half as much on travel expenses as those in the suburbs.

Local government bylaws are facilitating smarter development, yet outdated bylaws still inhibit the development of compact communities. While bylaws allow municipalities to redesign buildings, gaps exist in understanding how sustainable building materials perform. Zoning bylaws have also historically created barriers to livable communities by restricting infill housing or artificially separating commercial from residential usages. Development standards often restrict narrower roads or nature-induced stormwater systems, and comply with the status quo, rather than drive innovation. Reforming zoning bylaws, and alternative development standards and permits are critical to reduce resource consumption levels associated with single-family dwellings, green space, and dispersed land use. MURBs conserve resources, save municipal expenses, and create economies of scale to implement more favourable actions with greater service to volume ratios.
density reduces land consumption, a message successfully promoted in downtown Vancouver.62

One site using alternative bylaws and comprehensive zoning is Dockside Green, a 5.9 hectare (14.6-acre) former brownfield in Victoria, BC that is developing into an innovative light industrial, commercial, and residential mixed-use community. The site aims to be greenhouse gas-neutral, treat its own wastewater and sewage, provide public amenities and reach LEED® Platinum certification standards. A biomass cogeneration plant generates heating and electricity to accommodate 2500 people.63

The municipal fiscal framework stymies a municipality's ability to invest in infrastructure improvements.64 Municipal governments receive 8% of Canadian tax dollars, yet face a $60 billion infrastructure gap.65 This gap is increasing with recent deficit budgets. Property taxes contribute the most to municipal revenue (approximately 63%), but municipalities collect taxes based on land value and the associated structure, rather than on their proximity to municipal services.

Many municipalities and regional districts have authority to set rates for solid and liquid waste, parking, property, water and sewage, yet these remain largely unexplored as revenue sources (unlike some cities in the US, BC municipalities cannot set GHG emission rates, eco-taxes, or automobile occupancy levels). User fees represent approximately 15% of total revenues in the US, but average 1% in Canada.66 One area worthy of greater experimentation is user-fees that target consumption. Municipalities should partner with the private sector to leverage tax-exempt municipal bonds for energy efficient tax credits and location-efficient mortgages.67 Changes to property tax legislation should also be explored that separate property assessments from building and land values. For example, instead of taxing total property values, building improvements should not be charged to establish incentives for improving buildings and density levels. Only unencumbered values of land parcels are taxed.

Instead of collecting revenue based on land and structures, regional districts or provincial authorities could tax energy and waste more aggressively.68 As resources increase in value and price, the resource savings could be passed onto taxpayers. Ultimately, as infrastructure is upgraded and fewer resources are consumed, the tax base will decline overtime. Municipalities might set a 10-20 year time horizon to target resource consumption with corresponding incentives and regulations. Applying lifecycle cost assessments to evaluate the entire impact and cost of materials from extraction to disposal (or regeneration) also generates more market activity for regional resources.

Including user fees in municipal tax reform is not without controversy. Those seeking a lesser role for government perceive user fees as a panacea for declining local tax revenues, yet tax reform requires an equity analysis to measure its impact. Equity refers to the distribution of market impacts through two components, horizontal equity and vertical equity. Horizontal equity pertains to how fair impact allocation is for individuals and groups in their ability and need to pay based on their ability, or in other words, “to get what they pay and pay what they get,” unless qualifying for supplemental subsidies, credits or assistance.69 Vertical equity focuses on the allocation of costs between income and social classes by providing the greatest benefit at the least cost to help compensate for inequities in disadvantaged groups.

When a typical trip to the supermarket showcases 3,600 brands that compete with needs and wants, a consumer requires assistance to make responsible choices.70 Tesco supermarkets in the UK and Wal-Mart in the US are developing
carbon footprint calculations and lifecycle assessments. Further work is required to standardize and verify calculations, yet the product labelling will compliment other standards, such as the International Organization of Standardization (ISO), Eco-Logo, the Forest Stewardship Council, the Energy Star Program, the International Fairtrade Labeling Organization (FLO), and TransFair Canada. While consumer labelling serves an important purpose, municipalities can target suppliers for the greatest gains. Municipalities should also improve accuracy in tracking local grown and consumed food. Vancouver is surrounded by some of the most productive farmland in the world, yet three-quarters of the food arriving on the kitchen table is imported from outside the province.

Demand Side Management (DSM) combines a range of technical, organizational, and behavioral solutions to decrease the demand of resource consumption. While human behaviour is prone to resist imposed lifestyle changes, more responsiveness is shown when combined with appropriate price signals and options. DSM strategies can defer capital costs that expand supply by focusing on energy, water, waste, and mobility. Lowering fossil fuel demand increases the feasibility of renewable energy because these technologies become more economically viable as petroleum prices rise. Benefits are often overlooked when overcapitalization, low prices, and a supply-side bias restricts widespread adoption. DSM also catalyzes economic multipliers through public electricity reductions, the localization of commodities (see Appendix 1), increased end-user satisfaction, reduced investment in producers and suppliers, an enhanced public image, and loyal customer base. Barriers implementing DSM include inadequate data collection, lack of funding, and inflexible municipal policies.

Municipalities are faced with inconvenient waste and recovery collection systems, technology stagnation, and industrial objectives out of synch with recycling targets. Organic matter consists of one-third of municipal solid waste, yet rarely is included in a municipality’s curbside recycling program. A notable exception is Toronto’s organic program that collects 115,000 tonnes of organic matter annually in “yuck buckets.” Nevertheless, multi-unit residential housing is almost always exempt from municipal organic matter collection programs.

Solid waste decay in landfills generates methane gas, a potent and harmful byproduct, but also a potential heating source. There are more than 520 landfill gas-capture projects in the US; the remaining 600 landfills have the potential to provide electric power to 900,000 homes. In British Columbia, methane produces 7% of the Province’s greenhouse gas emissions that could provide energy for 2,400 houses.

After organics, construction and demolition waste comprise 20-22% of municipal solid waste. Construction and demolition projects accounted for 160 million tonnes of building related materials in the US, but 60% of these materials were sent to landfills. Recovering construction and demolition debris can reach 90% recovery rates and save money by reducing project disposal and transportation costs, conserve energy and landfill space, reduce the cost of new construction materials, and create new job opportunities.

Used household goods and electronics often end up in landfills even though they can still be of use. Second-hand household goods and clothing can be sent to consignment stores and thrift stops. Electronic bulletins such as Craigslist account for 630 million web page views per month that have capacity to find a home for just about anything. Return-It centres have contracts with regional electronic recycling companies like Encorp that promote product stewardship through managing and improving systems to recover used packaging and provide a home for end-of-life products until more durable products and appliances make a return to the marketplace.
SCP activities contribute to the emerging “green collar economy” because they move away from fossil fuels to renewable energies. Energy efficiencies require a workforce specialized in household efficiency, retrofits, and insulation, yet training programs are required for renewable energy professionals in solar, ocean, sewer, biomass, ground-source heat, and district heating applications. The US-based Renewables Portfolio Standard (RPS), for instance, requires the increased energy production from renewable sources, such as wind, solar, biomass, and geothermal. It is estimated the RPS will create 119,000 person-years of employment in California alone, over the lifetime of renewable energy plants built through 2017.

For better or for worse, consumers rarely invest in residential efficiency upgrades without public policy that drives price signals and offers incentives. Programs such as the federal government’s successful ecoENERGY Retrofit program (formerly EnerGuide home retrofit) require a series of tools accompanied by third-party pre- and post-consumption audits, efficiency rebates, and financing options. More programs could model this delivery system and leverage efficiency issues by sending a clear signal that cities are serious about consumption issues.

Industrial land is disappearing at an increasing rate in Greater Vancouver as urban pressures force industries to relocate from traditional downtown cores, inner harbours, and freight nexuses to suburban business parks. Longer distances to work create employment dispersion because of inflated real estate and housing demands. Regionally, the BC Lower Mainland loses 121 hectares (300 acres) of its 7700 hectares of industrial land per year.

Manufacturing plays a pivotal role in maintaining a stable employment base in urban environments. As high tech, scientific, and entertainment clusters continue to gain prominence in creative sectors, manufacturing is often overlooked in local and regional economies for providing stable, well-paying jobs for an important sector of the population and an array of value-added commodities that strengthen local reliance and diversity. Despite their historical significance in urban development, industrial lands are rapidly disappearing from urban nodes throughout North America as is evidenced by low vacancy rates and lack of land within city limits.

Cohousing’s arrival in North America during the 1980’s has developed a slow but steady following. Current land use attitudes often dictate homeowner opposition to anything built out of the norm, which is a major challenge for Cohousing. Municipalities should highlight examples so the public can learn about Cohousing first hand. Denmark is much ahead of North America in this regard, having developed more than 200 cohousing projects. Initiating demonstration projects is another way to increase public awareness. Cohousing requires a personal champion to raise its profile, attributes, and potential to developers, policy makers, and the public alike.

Cohousing builds community resilience as most individuals experience various family configurations throughout their lifetimes and often wish to remain in their homes despite few alternatives to the single-family dwelling. Cohousing offers privacy and community through encouraging multi-generational environments.

Locating and purchasing suitable land is a major obstacle in hot real estate markets like Vancouver. Another barrier cohousing faces is the necessity to assume the role of developer. Established developers possess a large land bank, but searching for suitable land collectively is onerous and time-consuming. In the case of Cranberry Commons, the development was initiated because the parcel was not offered for
public tender, allowing the group to negotiate directly with the municipality. Amateur developers and first-time homeowners often implement Cohousing that requires devoting considerable volunteer hours and “sweat equity.” Transferring technical expertise between cohousing groups and developers could facilitate a private development model. Though few if any developers specialize in Cohousing, various consultants offer services to navigate through the process. Finance options during construction, such as bridge financing, can also help facilitate Cohousing.

The Canadian Cohousing Network (CCN) should partner with municipalities and the real estate community to facilitate knowledge transfer for groups interested in the development process. The CCN should consider marketing and rebranding cohousing as a 21st Century niche market to invoke a similar lure that loft living provides to a distinct market segment. Senior or assisted living facilities may also be interested in cohousing principles.

Cohousing residents are often civic-minded, who resonate with community issues. Because Cohousing functions as an intentional community, mobilizing around various issues is efficacious. Cohousing development processes strive to be transparent and can help break down stereotypes regarding Not In My Backyard (NIMBY), ecological design, density, crime, traffic, parking, and affordability.

The following implications should be considered for developing SCP policies:

1. Replace the assessed market value of residential properties with a Location Value Charge (LVC). The LVC will capture increased land value that results from infrastructure and development financed by the surrounding community. LVC separates property assessments from building and land values. Instead of paying tax on the total value of property, only the unencumbered value of the land parcel is charged, without taking into account the value of any improvements or buildings. The municipality can tax the land at a higher rate than the buildings, which increases taxes on under-utilized and vacant lots, encourages densification, and protects agricultural land. A land charge acts as an incentive to improve or maintain property by eliminating implicit rewards for properties to degrade. It also recoups lost revenue from land speculators who leave prime parcels vacant in anticipation of higher profits upon a sale.

2. Ensure Development Cost Charges (DCC) reflect differential costs for buildings to better reflect the true costs of roads, water lines, drainage, and other community amenities. Areas well serviced by transit and with higher densities should have lower charges than in lower density greenfield development sites that require higher servicing costs. Municipalities should ensure DCCs reflect the real cost of development and refrain from spreading out the higher costs of greenfield development across a municipality.

3. Promote Cohousing as a housing model that can partner with municipal departments, the real estate community, Canadian Cohousing Network, housing providers, and financial institutions.

4. Ensure TDM strategies are part of transportation programs that encourage private development by offering reduced parking in return for TDM measures.
Tax policies can encourage consumers to adopt less consumptive lifestyles. Federal and provincial jurisdictions collect income and sales taxes (e.g., goods and services, harmonized sales tax, and provincial sales taxes), excise or “sin” taxes (e.g., gasoline, alcohol and tobacco), and payroll taxes. The federal government is able to levy tax, collect tariffs, and withhold tax on payments by non-residents. Provincial jurisdictions are confined to direct taxation, and property taxes are left to provincial and local governments. Taxes best assigned to the provinces are those that do not interfere domestically with the flow of goods and services, are relatively straightforward to collect, and relate to their spending powers in areas such as health, education, infrastructure, and the environment.92

The analysis of the Statistics Canada household spending data uncovers many ways for provincial and federal policies to influence consumption (and production) for households. For example, some correlates within the high consumption group are surprising and warrant further investigation (see Table 9 in Appendix 2). Those receiving government transfers, for example, on vehicle license fees, public medical insurance premiums and interest on consumer debt, have lower education levels and newer heating facilities. The literature in Appendix 1 supports findings that consumerism, rather than asset accumulation, is a primary cause of rising debt. A finding that requires rethinking about why economic growth has not alleviated poverty, and why people are encouraged to borrow on their future.

When governments subsidize unhealthy or environmentally destructive behaviour, they often penalize their citizens twice. Citizens first pay taxes for subsidies that form direct financial payments or tax credits, yet they absorb indirect costs resulting from degraded natural resources, increased health care costs, and lower quality of life. These perverse subsidies benefit polluting and extractive industries since society also ends up paying for monitoring, regulating, and mitigating industrial activities that are inadequate to protect the public commons.93

Ecological Tax Reform (ETR) is neither a “tax break” nor a “tax grab,” but offers an efficient and cost effective way to incorporate “user pays” and the “polluter pays” principles into the tax code.94 Shifting the tax base toward positive activities, like investing in intellectual and creative development and away from negative activities; like pollution and non-renewable resource extraction, provides a mechanism for restructuring the local economy.
The carbon tax, such as recently imposed in British Columbia, is applied to carbon emissions generated by fossil fuels and is an example of a consumption tax incorporating externalities into the market economy. Taxes on carbon are converted into tax rates on fossil fuels (by 2012, the $30-per-tonne tax will be equivalent to a 7.6¢ tax on gasoline). Tax flows remain neutral and will not increase or decrease government revenue. Rather than allow provinces to initiate their own carbon taxes that result in a piecemeal approach around the country, Ottawa should establish a federal carbon tax and provide cross border adjustments for trade.

The proposed cap-and-trade system by the Western Climate Initiative (WCI) will place a market price on carbon for a large and expanding portion of North America. Four provinces representing 25 million Canadians have already signed on as partners. The market-based auction system combines regulation with market-based mechanisms and could compliment a carbon tax. Cap-and-trade requires a firm to have an emissions permit for every ton of carbon dioxide it releases into the atmosphere. Over time, the cap becomes stricter, allowing less pollution as permits become more expensive. Gains from emissions trading are largest when the inclusion of reduction opportunities is as wide as feasible to allow a range of abatement costs. Because some companies will reduce their emissions below their required limit more rapidly than others, they will sell their extra permits to companies not able to make reductions as easily.

The cap-and-trade system should be implemented as soon as possible providing that a stringent emissions cap is set each year. Some non-governmental organizations suggest at least 90% of emissions should be captured within each capped sector and authorities should auction 100% of allowances to ensure that the system adheres to a polluter-pay approach, rather than allocate free permits based on historic or projected levels. Companies with higher baseline emissions that have historically done the least to reduce their pollution should not be allowed to benefit the most. Reductions should result from companies covered by the cap-and-trade system, rather than by their ability to purchase offsets.

Creating a level economic playing field is the single most important action all levels of government should take to guide SCP policies and decrease greenhouse gas emissions. Reducing aggregate consumption levels is the responsibility of each government that has authority within its jurisdiction to reflect a truer price for fossil fuel and all things that contain carbon.

Regulatory standards can mandate more stringent requirements for housing, vehicles, appliances, and toxins, but often fail to do so. The building industry compliance code of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), for example, does not enforce energy intensity targets or carbon emission reductions. Once ASHRAE certifies heating and cooling equipment for compliance, they are not regularly reassessed. Regulatory standards should be reviewed every couple of years with more stringent standards calibrated every five years at a minimum.

Provincial authorities can learn from post-secondary institutions, which bundle discounted transit passes with student fees. The U-Pass program reduced single vehicle occupancy by 48% at Simon Fraser University and shows promise for other large employers and residential developments. The developer offers a subsidized annual transit passes to households on campus in return for higher density development. Nevertheless, a lack of transit infrastructure is a significant barrier toward scaling up U-Pass programs. Parking fees can also subsidize transit. Boulder, Colorado deters
single-occupancy vehicle travel by using downtown parking revenues to subsidize free transit passes for its citizens.

Planned obsolescence is a key contributor to waste and over consumption. It refers to a product design strategy that expects the product to no longer be usable or socially desirable after a given period of time. Planned obsolescence is often referred to as innovation, rather than associated with inefficient and wasteful business practices. Businesses depend on introducing new models with additional features, but give little attention to the product once left out-of-date or unserviceable. If durability were a prime business strategy, there would be less emphasis on planned obsolescence, by which the latest I-Pod is expected to last 18 months. This is particularly relevant in lower-end housing stock. While European buildings are built to last 250 years, buildings in North America rarely are expected to last longer than 45 years.

A design strategy to help curtail waste uses “closed loop” design practices and Extended Product Responsibility (EPR) (see Appendix 1). A first step towards “closing the loop” establishes responsibility for industry to collect and reuse old products and components. Other initiatives reduce packaging, phase out toxic substances, reduce greenhouse gas emissions, and eliminate manufacturing components from the waste stream. These conditions are dependent on public and political support to draw attention to EPR systems.

The following recommendations should be considered for SCP provincial and federal policies:

1. Canada should adopt a federal carbon tax and sign onto the Western Climate Initiative cap-and-trade system with a stringent emissions cap set each year as tangible examples of federal consumption policies and ecological tax reform that charge truer prices on fossil fuel derived from goods and services.

2. Transit infrastructure should be prioritized over highway expansion. U-Pass types of programs should be expanded that broaden and bundle transit options.

3. Provinces should establish transportation demand management (TDM) frameworks that use least-cost mobility planning to co-ordinate urban metropolitan areas. Municipal transportation departments lack a provincial-wide transportation demand management (TDM) framework to co-ordinate urban metropolitan hubs. Legislating urban containment boundaries within regional plans to reduce inefficient land use patterns is one tangible step towards increasing energy and mobility efficiencies. Any new developments within the urban containment boundaries should be within 400 metres of transit and commercial services.

4. Provincial and federal jurisdictions should develop a revolving Sustainability Fund by partnering with private financial institutions and energy service companies to access capital to reduce carbon emissions and resource conservation projects. The fund should create economies of scale to increase the magnitude of energy retrofits, renewable technologies, worker trainings, and payback schedules to recoup savings on operating costs. Each application should require the preparation of a business case using full-cost accounting criteria.
5. Provincial and federal regulations must take into account lifecycle assessments and planning legislation and building codes should provide municipalities with the authority to demonstrate leadership at the local level. Energy efficiency policies emphasizing absolute energy demand (rather than energy intensities) would encourage downsizing and could reverse present trends towards more energy consuming appliances and equipment. Regulators should develop and update building standards, labels, signage, and profile-leading practices that target laggards and educate the public about consumption.

6. Industry Canada’s Office of Consumer Affairs should develop a common language to improve awareness and resource efficiency for industry and support cross-sectoral government departments to work on SCP issues with political leadership and strategies for implementation.

7. Statistics Canada should expand material and energy flows to provincial and municipal jurisdictions that include, at the very least, personal consumption expenditure data. It should also establish measurements for baseline indicators, targets, and actions that compliment a mix of policy instruments including regulation and incentives. Consolidate indicators and metrics in order to monitor holistically economic, ecological, and social outcomes by adopting new indexes such as the Genuine Progress Indicator or Canadian Index of Well-being.

8. Governments should work with industry to develop EPR, consumer labeling, and choice editing that creates greater predictability to tighten legislation and standards.

9. The federal government should actively participate in the UN and regional SCP meetings and processes.
ROLES AND RESPONSIBILITIES FOR SCP ACTORS

The DPSIR framework demonstrates how households are linked to global consumption issues through monitoring consumptive processes in buildings and surrounding communities. Actors, roles, and responsibilities establish a context to engage in household consumption and production as part of an inter-related system. The DIPSIR framework helps to gauge progress toward SCP through determining where indicators fit along the policy-action continuum. The benefit of adopting an integrative approach helps clarify different roles and responsibilities for various SCP actors.

Household roles involve purchasing commodities that influence lifestyle choices. Households that function in transient environments and in isolation are not prone to influence peers. When households actively participate in governing activities, they may be more prone to politically engage in democratic reform, as suggested in the empirical data from Appendix 4. Behavioural change is more malleable when engaged with one’s peers around complex issues that often require collective action. For example, Quayside Village Cohousing reduces their solid waste through a strong peer support network and a personal champion, rather than relying on technological fixes.

The role of strata councils in managing and governing the operations of multi-unit residential developments can influence social cohesion, ecological impacts, and community well-being. Strata councils are responsible for managing safe and reliable buildings and equipment upgrades. Stratas can also adopt bylaws and rules that regulate property owner and tenant practices, which can influence SCP practices. For example, while some strata corporations prohibit air-drying clothes, other developments actively encourage and exemplify it through supplying clotheslines and passing on financial savings to residents.

Municipalities and regional authorities can target SCP practices through infrastructure design considerations that prioritize more sustainable practices with cost (e.g. living near services is cheaper than further away) and convenience (e.g. transit is easier than driving). Municipalities often lack authority and enforcement within building code and development permit legislation in areas such as lifecycle costing of materials and performance standards that require provincial and federal direction. Community indicators are also required to highlight consumption impacts through real-time resource measuring, such as for water use and fossil fuel.
The role of industry includes economic development, investment, and legal compliance as key components of production. Industry is responsible for choice editing by eliminating environmental deficient products. Added responsibilities for businesses include educating consumers who require greater transparency and ethics with purchasing decisions. A greater role requires educating rather than shaping decisions through advertising. Within housing, there is little incentive to purchase materials that last longer or have lower operating costs, since developers are excluded from post-occupancy assessments. Stewardship in extended producer responsibility requires involving post-consumer stages of a product’s lifecycle.

Provincial and federal governments are responsible for setting lifecycle laws of products, which lags in Canada in comparison to countries such as Sweden or Japan. Rebates on recycling initiatives can form attractive incentives and spur private sector activity. Public transit is another responsibility that suffers from chronic funding shortages, yet the BC provincial government finds taxpayer monies to support freeway expansion, such as the proposed $4-5 billion Gateway project. A shift in priorities could create U-Pass type programs for all citizens in metropolitan areas. Despite these challenges, legislation has proven to change quickly with political will. In BC, high-efficiency furnace standards were put into policy in only 14 months and the carbon tax was implemented in less than a year.

Civil society, including nonprofits, academic institutions and faith-based groups, contribute to SCP by influencing public opinion and cultural shifts. Independent reviews and thought leader positions address cultural change that merges into areas dealing with social issues and the public commons. Civil society helps inform and educate other actors’ growing roles and responsibilities by contributing to a community-led ground swell. Additional discussions with peers raise the profile of consumption in public discourse.
Four general conclusions emerge from the data analysis that implicates SCP policies. The first is that full cost accounting must transcend conventional economic decision making to represent the truer costs of unsustainable consumption and production such as fossil fuel dependency. Until economic models are realigned, SCP has little chance of reaching the transformational shifts to adequately address climate change and over consumption. Full cost accounting principles can convert taxation policies to target consumption, such as carbon taxes, cap-and-trade systems, and lifecycle costing. Finance and development regulations must better ensure infrastructure pays for itself, not only economically, but also socially and ecologically.

Second, land tenure mechanisms are required to promote access and secure rights to land and other natural resources. Land tenure affects how municipalities develop infrastructure and households invest in home improvements; as reflected in development cost charges, property rights, design guidelines, planning by-laws, and building codes. Failure to recognize collective responsibility for enhanced livability within the domain of property rights contributes to the unsustainable nature of private land tenure.

Intentional community living is a tangible land tenure example that should be demonstrated on a larger level, but suffers from confinement to grassroots initiatives with little support. Intentional community models can foster the development of household nodes and urban villages that invoke individuals working with their neighbours. The analysis of empirical data presented in Appendixes 2 and 5, and the literature cited in Appendixes 1 and 4 suggest a pent-up demand for meaningful interactions within community. While the cohousing model is not a panacea to resolving isolated lifestyles, nor a viable option for everyone, it holds promise for increasing occupant well-being and shifting consumption levels for a larger percentage of the populace. The housing model requires creative organizing, time, and cooperation amongst households. It still may be viewed as a red herring to risk-averse financial and real estate markets, which until recently have ignored liability in terms of financial security and conservation when faced with volatile fossil fuel prices, future climate change impacts, and carbon offset requirements.

Third, governance and management structures and approaches require rethinking how to organize households more effectively. The strata council is an untapped conduit to effectively mobilize households through training, resources, tool kits, and checklists.
When consumption issues are viewed through the operational portal of energy use, mobility, and food there is significant potential to reduce waste. Flexible unit layouts, collective purchasing of some items and residential best management practices can enhance household awareness. Transportation demand management frameworks can practise least-cost mobility planning to coordinate urban metropolitan hubs. SCP in Canada requires a stronger voice through international and regional representation with consistent and clear language amongst governmental departments and jurisdictions.

Fourth, community indicators for SCP require conscious and concerted effort particularly within housing, mobility, and food. Feedback mechanisms require exploration of locally significant indicators and ambient signals to bring attention to greenhouse gas emissions. Building certification systems should be consolidated and emphasize ongoing monitoring and audits to maintain high performance operations and flag laggards for equipment repairs and retrofits. Community indicators help create awareness to measure progress toward SCP by instilling behaviour change strategies that integrate households, buildings, municipal infrastructure, and national networks. Demonstration projects that profile cohousing developments locally can generate interest and knowledge transfer.

The general conclusions are consolidated and prioritized into policy implications in Figure 1 below. Within the four conclusions, the expert policy focus group reviewed the draft policy implications and arrived at priority items requiring immediate attention.

Figure 1 - SCP Policy Implications

<table>
<thead>
<tr>
<th>Full Cost Accounting</th>
<th>Land Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cap-and-Trade</td>
<td>• Curbing dispersed development</td>
</tr>
<tr>
<td>• Carbon Tax</td>
<td>• Urban containment boundaries</td>
</tr>
<tr>
<td>• Sustainable home procurement with lifecycle costing</td>
<td>• Cohousing developments</td>
</tr>
</tbody>
</table>

Management and Operations

• Re prioritizing support for public transit

Community Indicators

• Monitoring resource consumption

Key Policy Implications
When combined and integrated with behaviour change strategies at the local, regional, provincial and federal level, the policies have potential to influence and shift consumption patterns. Top policy implications include:

- Putting a price on carbon through entering into a cap-and-trade system with a stringent emissions cap set each year;
- Establishing a federal carbon tax;
- Curbing dispersed development through the more efficient planning and design of communities;
- Reprioritizing financial support for sufficient public transit;
- Establishing urban containment boundaries when backed with affordable housing strategies;
- Spearheading sustainable home procurement programs that publish building product performance measures and lifecycle costs;
- Scaling up cohousing developments; and
- Using indicators to monitor resource consumption, such as real-time smart meters for energy use.
Green buildings in their current iteration are getting more efficiently unsustainable. Rather than become fixated on construction materials and building science to resolve ecological, social, and economic issues, greater emphasis is required on household organization and feedback. Cohousing is a model that offers new parameters for building more sustainable housing through establishing effective organizing practices that target aggregate consumption levels. Nevertheless, new terminology is required to instil greater acceptance of this emerging model to overcome the North American mindset and cultural stigma of “cohabitating.” Rebranding Cohousing may help foster the development of intentional communities within urban nodes that involve households consciously interacting with their neighbours. Intentional communities serve as a response to the driving forces that increase resource consumption illustrated in Appendix 4. Tenure for intentional communities implicates a multi-unit residential focus, options to decrease automobile dependency, and a diet promoting local and regional specialties.

Building on this research, the following actors, roles, and responsibilities require additional investigation to expand and scale-up the intentional community model for SCP. Empirical data supports a demand for intentional communities planned by occupants in conjunction with private developers. Exposing a market niche involves identifying developers to facilitate land tenure in partnership with individuals and groups seeking to live within the same development. Since the primary challenge for intentional communities is land assembly, interested developers expedite this niche by advancing a tenure model that secures an appropriate site (e.g. a land parcel, or designated floor within a building). They then work with individuals interested in forming an intentional community to develop an appropriate governance model, conceptual design, and building materials in keeping with the groups’ ideals and budget. Future research requires further identification of institutional barriers and appropriate mechanisms to articulate and ensure a viable approach.

Financial institution perspectives are needed to discuss appropriate “Common Ground Mortgages” (CGM) products designed for intentional communities. CGMs could be modelled after Location Efficient Mortgages (LEM), that combine transportation and housing costs to assess a household’s borrowing potential. Homeowners located within close proximity to work can take advantage of LEMs by reducing automobile travel in exchange for a favourable mortgage rate because cost savings from driving less are treated as additional income. CGMs could facilitate a gap in financing when individuals form legally-binding collective agreements to live intentionally in higher density developments.
Senior policy makers should seek effective legislation to improve residential quality of life that target consumption levels through collective forms of tenure. Collective tenure legislation and an alternative regulatory framework should be explored in the wake of pioneering cohousing groups that have succeeded only after enduring years of erroneous hardship. Many groups have not been successful due to tenure issues.

In light of an aging population that desires to age in place, interact with neighbours, and be less isolated; senior housing, retirement communities, and assisted living environments should also participate in future research discussions. Intentional retirement communities, such as Old Abbey Fields St. Margaret’s in Burnaby, BC, accommodate 9-12 persons per house. Residents live in private suites and share meals prepared by a live-in house coordinator. Input from the real estate community and Canadian Cohousing Network are required to market intentional communities.

Post Occupancy Assessment (POA) is in its infancy and requires systematic and regular reviews to monitor a building’s function over time. POA compels additional research with occupant users and residential buildings that merge building science with social science.

An occupant-centred approach to better understand the nature of SCP in households implicates blurred assessment boundaries in relation to how dwelling type, location, and the urban form influence consumption, and how household consumption influences the urban form. These characteristics complicate the ability to analyze household consumption and to offer policy recommendations. SCP can help frame these fields through examining consumer tendencies in the home, building, municipality, region, and nation.

Further research is required to investigate effective interventions in order to shift household consumption levels while maintaining a high quality of life. Potential areas of inquiry include:

- Policy and management implications of housing occupant feedback as a multidisciplinary practice for addressing climate change;
- Defining absolute housing performance/consumption per capita and globally;
- Systematizing user feedback in housing and user-informed feedback from housing users;
- Identifying opportunities and barriers emerging from different communities of knowledge and integrating user feedback into knowledge transfer systems in housing developments;
- Establishing legislative milestones for feedback in the certification, contractual, and commissioning process for buildings.
This report argues that consumption lies within sustainability’s deepest quandary. Households organized to instil high levels of trust with neighbours can actively engage in new forms of governance. Nevertheless, households require clear and consistent information from governmental jurisdictions that are lacking within the Canadian context. If Canadian society continues to develop along current trends, there will be little or no absolute carbon emissions reductions by 2050. The two cohousing sites demonstrate practical applications toward SCP. Green building advocates and policy makers are missing key opportunities because efficiency gains are being overrun by increases in consumption. Key responses toward sustainable livelihoods focus on the way households are organized rather than how green technology in buildings is marketed. These unique approaches predicate financial implications for consumers and producers that have yet to be fully addressed through legislation to mitigate current material consumption levels.

History reminds us that transformative change and human ingenuity can spread rapidly. At the beginning of the industrial revolution, cotton manufacturing increased efficiencies four-fold, and then efficiencies increased up to ten-fold within two decades. It then tripled yet again by 1815, spinning from one to as many as 80 threads simultaneously. Fast-forward two centuries and technology once again leapfrogged at unfathomable speeds as Gordon Moore, founder of Intel, accurately predicted computer-processing speeds would double every 18 months. While we have historical evidence of technological gains, until we can shift our insatiable appetites for more, moving towards sustainability is slow at the best of times and, at others, a lark. That is until we figure out ways to rein in consumption, which remains key in this most perplexing and dire challenge.

Sustainability discourse has failed to deal adequately with the demand side of the ecological, political, and cultural crisis. The social context must interact more aptly with efficiency measures to rethink labour and productivity while decreasing aggregate material consumption levels. Ultimately, humanity and all living creatures are short-changed when consumption and technology are not integrated with behavioural considerations.
Findings from this investigation indicate that cohousing occupants generally consume differently and in some instances more sustainably than green or typical occupants within the cases studied. A closer examination of household activities and lifestyles is necessary to develop essential responses to this dilemma.

Possible solutions toward changing the consumptive treadmill involve applying a social trajectory of inquiry to technical challenges. If greener practices can save humanity from itself, the physical environment needs to coalesce more fully with socio-cultural perspectives, since innovation has failed to move us in a sustainable direction fast enough. Until sustainable options become easier, cheaper, and more convenient, behavioral change will remain reticent in efficacy and uptake. Appropriate solutions should adopt a suite of holistic and local approaches that predicate financial implications on consumers’ and producers’ choices. While perhaps a formidable task in light of a volatile and changing climate, unstable economic system, and deteriorating sense of well-being, communities need to consider seriously whether we are not in fact consuming ourselves to death.
APPENDIX 1: CONSUMPTION AND PRODUCTION

Though no conclusive definition exists, themes unify and integrate consumption and production processes within community actors, materials, disposal, labour practices, and markets by applying demand-oriented approaches to shift and to reduce consumption (refer to Figure 3 below). Reducing material consumption does not necessarily mean reducing quality of life. For example, switching to a car that uses half as much fuel, or a refrigerator that uses one-tenth of the electricity protects the environment, saves money, and provides equivalent levels of service and satisfaction. Efficiency savings can then support personal development, such as cooking, art classes or premium priced organic products. Organics are not subsidized, which is one reason these products may be more expensive. Reducing resource consumption does not mean an end to economic development because savings are ultimately maximized by using fewer resources, shorter supply chains support local and regional suppliers as fuel costs rise, and job creating services take precedence over disposable commodities. Sustainable Consumption and Production (SCP) aims to describe the use and procurement of products processed with strong environmental and social accountability.

Unsustainable Consumption and Production

Production. Production depends on the money, labour, time, and natural resources that make up investments. Raw materials convert into commodities through manufacturing. The global trading system favours unrestricted free trade over environmental or health concerns. In other words, the economy over-consumes nature and undervalues people, causing unsafe labour conditions and environmental destruction by using and producing toxic materials. Manufacturing prioritizes cheap labour above geographical proximity as inefficient production fails to confront diminishing petroleum reserves and efficient material reuse.

Distribution. Distribution facilitates exchanges of goods and services through sales, transportation, and packaging, yet globalized commerce ensures each region seeks specialization and comparative advantage. Retail outlets distribute products to large format retail stores dependent on low prices, variety, and “just-in-time” inventory made in maquiladoras, or “sweat shops” maintaining long work hours for little pay. Land, labour, and capital create and distribute goods and services to maximize profit with low, externalized, and distorted costs to privatize gains. Supply and demand govern price points, but rarely reflect full costs or obtain consent before imposing costs, such as dumping its waste into an ocean, a river, or the air. Consumption. While market decisions influence product composition, supply and demand, pricing, location, and the business climate, the market transcends into the psyche by feeding on human insecurities expediting new wants. Media and corporate interests bombard communities with advertisements and messages that incite social isolation, fear, alienation, inadequacy, and personal debt.

In North America, we teach our youth, you are what you wear, how you look, and what you drive, as consumerism supplants the dominant religion. Citizens are distracted with iPhones™ and celebrity prima donnas; Britney Spears garners front-page headlines while Antarctica’s Wilkins Ice Shelf disintegrates on page 16.

Disposal. Disposal is the consequence of consumption and production processes terminating in landfills and incineration plants. Unsustainable consumption relies on a cradle-to-grave approach featuring a one-way life cycle with more than 90% of extracted materials designated as waste almost immediately. Communities can reduce their solid waste through down-cycling and composting. Down-cycling converts materials into other commodities, but fails to prevent waste generation. Down-cycling is a stop-gap measure that reduces toxic outputs and disposal while bona fide recycling activities convert materials into new products. Landfilling and burning garbage epitomizes a tendency to “sweep dirt under the carpet,” rather than integrate non-polluting, closed-loop natural systems into product design. This is a critical shortcoming because communities are running out of landfill space and garbage incineration releases dioxin, a deadly, cancer-causing toxin not readily broken down by humans or the natural environment.

Earth. The Earth reflects local, regional, and global carrying capacity of ecosystems, which define consumption and production types, intensities, and scales. The biosphere consists of minerals, plants, and animals – all encompassing essential services that counter anthropogenic inclinations to deplete non-human life and natural resources. Natural constraints and scientific laws acknowledge humans live in a closed system (the Earth), which specify natural capital thresholds are non-substitutable. Coca-Cola™ does not substitute for clean aquifers, and sunscreen cannot substitute for depleted ozone.

Over Consumption. Over consumption is defined as humans living beyond the means of natural biophysical systems (i.e. the Earth) and acknowledges most North Americans consume inordinately more than a fair share of the planet. An exploitation of nature beyond sustainable yields has led to contaminated...
materials, water, and energy flows. A dotted line extending beyond the Earth illustrates over consumption and living beyond natural limits that is impossible to sustain indefinitely. Nevertheless, it is what the dominant economic system advocates. The total biophysical allotment of productive land is currently 1.8 hectares per capita if distributed equally, yet North Americans consume approximately 9 hectares each.

**Under Consumption.** 1.4 billion people in Southern industrialized countries lack the right to basic necessities such as shelter, clothing, food, health, and education and live on the equivalent of $1.25 USD per day or less. Global poverty rates fell 25% between 1981-2005, yet this is largely due to China’s poverty alleviation policies for over 600 million citizens. Under consumption is also evident in Canada where British Columbia has the highest provincial poverty (16.1%) and child poverty rates (21.9%). Unlike US and UK poverty reduction strategies, the Canadian government has failed to contain the rapid growth of homelessness relying on homeless shelters and other short-term, crisis-based services. In First Nations’ and Inuit communities one in four children grows up in poverty.

The unsustainable consumption and production of communities means that some consume an exorbitant amount while others consume little. Over consumption and inequitable power relations are the central reasons for under consumption and the unsustainable nature of communities. The material economy of consumption and production entails rethinking the predominant economic system by questioning what constitutes enough and too much.

*Figure 2 - A Conceptual Framework of Unsustainable Consumption and Production*
Toward Sustainable Consumption and Production (SCP)

SCP seeks to mobilize communities to renewable and reduced material resource use and clean production strategies, low carbon and transparent investment, localized utilization, non-toxic, minimal waste disposal, and responsible consumption. These elements mitigate the process, manner, rate, and pattern of irreversible damage to ecosystems that currently deprive future generations of using these resources (see Figure 3 and Table 3).

Resource Use. Raw materials have expended natural resources by over one-third in 30 years. If current rates continue, and data suggest an acceleration, many resources will be limited or unavailable. Presently, the rate of change for maintaining life on Earth is more important than the amount of change. As J. Schaeffer remarks: “A slow rate of change is akin to gently applying the brakes to stop at a light, while a fast rate of change is akin to hitting a brick wall. Both take a vehicle and passenger from 60 to 0 miles per hour, only one is faster.” Converting to renewable energy focuses on non-polluting energy sources and ultimately phasing out toxic extraction processes such as cyanide and mercury.

Production and Investment. Manufacturing processes often disregard chemical applications that are unsafe or unknown to workers and consumers. There are over 100,000 known chemicals, the majority never tested for toxicity. SCP strives to enhance biodegradable product assembly, and socially desirable labour practices. Cyclical natural design promotes reuse, durability, and interchangability rather than linear design assembly.

Investment of money, labor, energy, knowledge, and time target manufacturing decisions that ultimately shape production, such as procurement initiatives, socially responsible investment, hidden subsidies, and financial institutional reform. Certification recognizes standardization, legitimacy, consistency, and accountability through independent third party products, service audits, reports, and labels. As more companies report environmental and social impacts, third party certification reinforces connections with consumers. For example, the International Labour Organization audits independent non-compliance code standards by social compliance practices. Regulatory agencies formulate appropriate rules and easy-to-administer (dis) incentives to reward compliance and to penalize non-compliance.

Labour practices recognize transparency, such as fair trade coffee certification; enhance safe and healthy working environments, livable wages with benefits, workplace safety, profit sharing amongst employees, and environmental stewardship. Labour and management practices recognize equitable access and assume long-term community outlooks. Relationships give way in favour of market relationships; yet place-based relationships separate from the market place manifest in labour and social issues, and prioritize regional frameworks such as the social economy. Clean production and ethical investments benefit from “choice editing,” the practice of cutting out damaging products and getting more sustainable choices on the shelves without interfering with consumer habits or routines. Consumers are directed to more sustainable options without sacrificing on quality, but support and enhance environmental options, e.g. lighter fuel efficient vehicles to replace inefficient SUVs.
Distribution. Within conventional economics, land, labour, and capital do not emphasize place-based proximity, labour conditions, environmental stewardship, or behaviour change. These factors fall through the cracks when predicated on the highest and best use, a.k.a. “the bottom line.” The fully competitive market is limited to an abstraction of social and ecological systems, since oligopolistic structures are not necessarily brokered on an equal playing field. A lack of consensus challenges redefining alternative and self-reliant trading systems. Corporations are often stronger than governments, which foster “having your cake and eating it” and weakens governance structures to negotiate international trade laws and protect community environmental health and safety concerns.

Localized distribution promotes safe labour practices and full societal costs, and substitutes disposable and import-based commodities with durable, reusable products by focusing on the process between product and consumer. By relying on low-overhead costs and inexpensive and frequent shipping, communities are adverse to rising risk and insecurity. Localizing supply chains focuses on decentralized political and economic structures, downscaling infrastructure development and basic levels of human security using local food, energy, and

<table>
<thead>
<tr>
<th>Sustainable Consumption and Production Framework</th>
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<tbody>
<tr>
<td><strong>Community Actors</strong> – comprised of households, industry, governments and civil society.</td>
</tr>
<tr>
<td><strong>Resource Use</strong> – the rate of raw resource extraction mitigates the most prevalent toxic applications and fossil fuel dependent processes.</td>
</tr>
<tr>
<td><strong>Production and Investment</strong> – Biodegradable materials produce commodities located within close physical proximity using safe working conditions, livable wages, and socially desirable labour practices.</td>
</tr>
<tr>
<td><strong>Distribution</strong> - Goods and services bought, sold, and bartered support local economies and reflect the full costs of product and manufacturing processes.</td>
</tr>
<tr>
<td><strong>Utilization</strong> – promotes reuse and material recycling through product redesign, renewable energy, and non-toxic materials through enhancing product durability, reparability, and ability to “reincarnate” into a new product.</td>
</tr>
<tr>
<td><strong>Disposal</strong> - uses biological processes to biodegrade into organic nutrients and industrial processes that stay separate and do not contaminate each other until detoxification technology emerges to dispose safely.</td>
</tr>
<tr>
<td><strong>Responsible Consumption</strong> – Value-added activities replace value-subtracted activities that emphasize a transition from commodities and materials to products, services and ultimately experiences focusing on immaterial values for greater fulfilment.</td>
</tr>
<tr>
<td><strong>Earth</strong> - finite biophysical resources on the planet cannot be expended indefinitely into the future.</td>
</tr>
<tr>
<td><strong>Sustainable Consumption and Production</strong> – the interaction of renewable, reusable, and efficient natural resources through relocalizing safe and ethical labour practices to mitigate the unsustainable methods, rates, and patterns of irreversible damage to ecosystems that deprive future generations of these resources.</td>
</tr>
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</table>
Public investment strategies and laws are based on subsidiary governance, price signals, and behaviour change to prioritize renewable energy, user-convenience, and long-term solutions to fossil fuel dependency and climate change. Ethical and ecological procurement practices enhance common property and public access through local food and currency systems, regional social economies, and independent small business alliances. For example, Carrot Commons in Toronto enacts localized distribution by promoting organic food and fair trade clothing merchants, reparation, and rideshare services.123

Responsible Consumption. Renewable resource consumption and reduced disposal activities do not in themselves create societies that are more equitable. Once basic needs are met, responsible consumption changes the quality and quantity of consumption experiences. It prioritizes value-added activities (e.g. education, self-development, culture and arts, and uses benign, renewable materials) above value-subtracted activities (e.g. mallmania shopping as a hobby) (refer to Table 4). Consumer activities shift from commodities and materials to products, services, and finally experiences focusing on immaterial values for greater fulfilment. For these reasons, it is the most important component toward implementing SCP strategies.

Value-added and value-depleted activities are based on their inherent nature to develop greater personal development and self-awareness versus inciting greater acts of consumerism. That does not imply value-subtracted activities are negative activities within themselves, but they tend to emphasize self-gratification, apathy, and individualism. They are in response to the cultural crisis that modern life predicates success on materialism and conspicuous consumption. Responsible consumption acknowledges humans should have a fair share of environmental resources to catalyze virtually unlimited personal and economic development opportunities. It acknowledges unsustainable consumption is everyone’s problem and ultimately reprioritizes activities based on personal experiences rather than external distractions that lead to paralysis and despair.

Table 4 - Criteria for Responsible Consumption

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Value Added Activities</th>
<th>Value Depleted Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate food</td>
<td>Eating whole and natural foods and drinking clean potable water</td>
<td>Processed and fast food outlets</td>
</tr>
<tr>
<td></td>
<td>Practicing localvores, Celebrating slow food, and 100-mile diet potlucks</td>
<td>Bottled water</td>
</tr>
<tr>
<td>Products and lifestyles</td>
<td>Reusable shopping bags, Bicycles, Massages, Natural materials, Clotheslines</td>
<td>One-time use products (e.g. disposable cameras), Toxic cleaners and Lawn care products</td>
</tr>
<tr>
<td>Recreation, entertainment and</td>
<td>Public broadcasting &amp; educational television, Music making, Storytelling, Making gifts, Gardening, Arts and culture, Spending time with family and friends, Active citizenship and volunteer activities, Meditation and spirituality</td>
<td>Watching TV game shows, Couch potato sport enthusiasts, Mallmania shopping, Fenced-in front yards</td>
</tr>
<tr>
<td>social activities</td>
<td>Diverse, heterogeneous communities, Livable wage employment with benefits, Intergenerational activities and interactions, Mixed sizes and types of homes</td>
<td>Homogeneous suburbs, Car dependent neighbourhoods, Gated communities</td>
</tr>
</tbody>
</table>
Utilization. Products typically are discarded at the end of their lifecycle because disposables and throwaways supersede reparation and reuse. The tax system encourages “bads,” such as pollution and discourages “goods,” such as ecological efficiency, capital, and labour investments. Reutilization promotes reuse and material recycling through product redesign, renewable energy, and non-toxic materials. Consumers and producers reutilize goods through assessing product durability, reparability, lifecycle costs, and its ability to “reincarnate” into a new product. Designs develop material reuse, interchangability, and ecological adaptation through imitating nature. Reutilization rethinks product design to interconnect energy and material exchanges through diverse biological systems. Product Service Systems (PSS) can change relationships between producer and user by consumers’ not necessarily owning products, but pay per unit of use transferring a point of sale to a point of service.

Disposal. Benign natural resources decompose additive and irradiation free. Waste disposal is minimized through biological and industrial processes that stay separate and do not contaminate each other. Products from biological materials biodegrade into organic nutrients. Disposal is dealt with locally and on-site rather than transporting debris over expansive distances. Toxic and hazardous products (e.g. nuclear waste and PVC) are securely stored until detoxification technology emerges to dispose of it safely. Waste is minimized when producers are responsible for the entire product lifecycle of a durable product (e.g. cars and computers), such as Extended Producer Responsibility (ERP) stewardship principles.

Renewable and reduced material resources, clean production and ethical investments, localized utilization, minimal waste disposal, and responsible consumption constitute SCP’s primary characteristics, interactions, and intentions. Community accountability helps ensure adequate levels of equity, social inclusion, security, and adaptability for a higher quality of life, the efficient use of natural resources, and the satisfaction of human needs. Environmentally, reductions target aggregate outputs and impacts. Socially, equitable development requires greater distribution for current and future generations reducing over consumption and under consumption. Economically and technologically, long-term yields of natural resources take precedence over short-term exploitation and financial gain. Combined over time, over consumption and under consumption subsides within Earth’s limits as illustrated by the arrows and dotted lines. The SCP framework moves toward an alternative economic order by questioning the status quo of unlimited growth and mobilizing toward action. Components, roles, and policy implications then catalyze toward SCP (refer to Table 5).
Table 5 - SCP Components: Roles and Implications

<table>
<thead>
<tr>
<th>SCP Component</th>
<th>Role</th>
<th>Policy Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Actors</td>
<td>Households Industry Governments Civil Society</td>
<td>Focuses on absolute consumption rather than intensity targets.</td>
</tr>
<tr>
<td>Resource wUse</td>
<td>Rate of extraction takes precedence over the amount. Emphasis on renewable energy and non-toxic applications.</td>
<td>Subsidies are tracked to increase consumer awareness of public expenditures on unsustainable practices such as fossil energy.</td>
</tr>
<tr>
<td>Production and Investment</td>
<td>Independent monitoring, certification, reporting, and labelling. Livable wages and benefits, workplace safety, and employee owned/operated business models.</td>
<td>Lifecycle costing Procurement initiatives Socially responsible investments, Hidden subsidies, and Financial institutional reform</td>
</tr>
<tr>
<td>Distribution</td>
<td>Local and regional emphasis by reducing travel distances, pollution, packaging, and greenhouse gas emissions. Over and under consumption subside over time.</td>
<td>Investment strategies and laws based on subsidiary governance, price signals, and behaviour change. Enhanced common property laws and public access through local food and currency systems, regional social economies, and independent small business alliances.</td>
</tr>
<tr>
<td>Utilization</td>
<td>Product redesign, Renewable energy, and Non-toxic materials</td>
<td>Closed-loop systems Cogeneration Product Service Systems</td>
</tr>
<tr>
<td>Disposal</td>
<td>Biomimicry Separate biological and industrial processes. On-site separation and disposal.</td>
<td>Lifecycle costing Extended Producer Responsibility Take-it back programs</td>
</tr>
<tr>
<td>Responsible Consumption</td>
<td>Changes the quality and quantity of consumption experiences by delineating needs from wants. Value-added activities differentiated from value-subtracted activities.</td>
<td>Material to service/experience economic shift. Increased consumer education Community building.</td>
</tr>
</tbody>
</table>
To group Canadians into low, mid range, and high consumption categories, a quantitative methodology for a multivariate statistical analysis was made of Statistics Canada’s Survey of Household Spending data (2004). The results placed approximately 25% of all households into the low and high groups, leaving 50% in the middle, for a range of social, economic, and geographic characteristics.

Applying the Statistical Package for the Social Sciences (SPSS) software to the national data established a baseline within the key consumption socio-demographics. Households exclude province, education level of the head of household, or household structure when unknown/unclassified, those reporting negative household income before taxes, and those living in other housing types (hotels, motels, boarding houses). Thus, the largest effective sample from Statistics Canada’s Household Survey data was reduced to 13,217 respondents. The resulting independent variables are provided in Table 6.

### Table 6 - Independent Variables

<table>
<thead>
<tr>
<th>Independent Variables</th>
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<tbody>
<tr>
<td>- Age in years of household head</td>
</tr>
<tr>
<td>- Female headed household</td>
</tr>
<tr>
<td>- Head of Household is married</td>
</tr>
<tr>
<td>- Head of Household education (less than High School, High School, Certificate, Degree omitted)</td>
</tr>
<tr>
<td>- Log household income (income also examined in $ or quintiles, using hhtotinc or OECD, and neither worked as well as the natural log of household income before taxes)</td>
</tr>
<tr>
<td>- Number of adults</td>
</tr>
<tr>
<td>- Number of children</td>
</tr>
<tr>
<td>- Household receives government transfers not including old age pension</td>
</tr>
<tr>
<td>- Homeowner</td>
</tr>
<tr>
<td>- House type (single family, semi-detached, apartment omitted)</td>
</tr>
<tr>
<td>- Number of vehicles</td>
</tr>
<tr>
<td>- Place and type (large, small, rural omitted)</td>
</tr>
<tr>
<td>- Province (BC omitted)</td>
</tr>
<tr>
<td>- Number of rooms</td>
</tr>
<tr>
<td>- Number of bathrooms</td>
</tr>
<tr>
<td>- Household structure (elderly, young adult, mixed adult, single parent. 2+ parents omitted)</td>
</tr>
<tr>
<td>- Principal heating equipment (steam, air, stove, electric omitted)</td>
</tr>
<tr>
<td>- Age of heating equipment (5 years or less 6-10 years, 11-15 years, 16-20 years, 21+ years omitted)</td>
</tr>
<tr>
<td>- Number of appliances (0-7 years for washer, dryer, freezer, microwave, dishwasher, air conditioner, and computer)</td>
</tr>
</tbody>
</table>
Energy and GHG Emissions

Table 7 and Table 8 highlight key findings that portray new understandings or policy initiatives about Canadian resource consumption in broad strokes, while highlighting some possible surprises or irregularities that help formulate new understandings or policy initiatives about Canadian consumption.

Table 7 - Correlates of High Energy Consumption

<table>
<thead>
<tr>
<th>Correlates of high per-capita energy consumption:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Higher income households.</td>
</tr>
<tr>
<td>2) More rooms, bathrooms, and appliances imply that house scale is important.</td>
</tr>
<tr>
<td>3) Single detached houses or semi/duplex/row housing is less energy efficient than multi-unit residential buildings.</td>
</tr>
<tr>
<td>4) All provinces exhibit high-energy consumption except BC, which has milder winters and relies more heavily on hydro energy.</td>
</tr>
<tr>
<td>5) Moves before 2004 indicate newer homes are more efficient. Further evidence asserts that houses built post-1970 correlate with lower per capita energy consumption.</td>
</tr>
<tr>
<td>6) Forced air heating is less efficient than steam heat or stoves.</td>
</tr>
</tbody>
</table>

Table 8 - Energy Consumption Findings

<table>
<thead>
<tr>
<th>Category</th>
<th>More likely in Low Consumption Group…</th>
<th>More likely in High Consumption Group…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total energy</td>
<td>Houses built before 1980 Steam or stove heating</td>
<td>Older-headed households Higher income More rooms, adults, children, bathrooms Unmarried-headed Lower education Single detached house Atlantic, Ontario, Saskatchewan, Alberta Moved between 1990-2003 Air or steam heating</td>
</tr>
<tr>
<td>Total energy per capita</td>
<td>More adults, children House built after 1970 Steam or stove heating</td>
<td>Older-headed Higher income More rooms, bathrooms More appliances Unmarried-headed Owned house Single detached house or semi/duplex/row All provinces except BC Moved before 2004 Air heating</td>
</tr>
</tbody>
</table>
A multinomial logistic regression next estimates the likelihood that a particular attribute (demographic, regional, economic) will increase or decrease the chances that a household will shift from the middle consumption group to the high or low group. Using the data findings, it is possible for a particular attribute (e.g., age of the household head) to be positively correlated with both high and low consumption groups, if those holding this attribute are sharply bifurcated within the consumption category (summarized in Table 9). The “none” group was examined in relation to the middle group where applicable.

Table 9 – Correlates of High and Low Goods Consumption

<table>
<thead>
<tr>
<th>Category</th>
<th>More likely in Low Consumption Group...</th>
<th>More likely in High Consumption Group...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Goods (Furniture and equipment, Clothing, Tobacco)</td>
<td>Older-headed Moved before 2004</td>
<td>Higher income More rooms, adults, appliances Receives transfers Lower education Newer heating</td>
</tr>
</tbody>
</table>

Goods

Those receiving government transfers, for example, on vehicle license fees, public medical insurance premiums and interest on consumer debt, have lower education levels and newer heating facilities. One possible explanation is increasing personal debt levels (see Table 10).

Table 10 - Correlates of High and Low Consumption

<table>
<thead>
<tr>
<th>Correlates of High Consumption:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Older-headed households.</td>
</tr>
<tr>
<td>2) Higher incomes.</td>
</tr>
<tr>
<td>3) More cars, rooms, adults, children, and bathrooms.</td>
</tr>
<tr>
<td>4) Unmarried-headed.</td>
</tr>
<tr>
<td>5) Receives transfers.</td>
</tr>
<tr>
<td>6) Ontario.</td>
</tr>
<tr>
<td>7) Steam heating.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlates of Low Consumption:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Older-headed households (a highly bifurcated consumption group).</td>
</tr>
<tr>
<td>2) Female-headed households.</td>
</tr>
<tr>
<td>3) Atlantic, Quebec, Prairies—or in other words, not Ontario or BC.</td>
</tr>
</tbody>
</table>
Total Consumption

Key factors differentiate low and high consumption findings in each category relative to the middle 50% of consumers in the product category (Table 10 and Table 11).

The total consumption analysis indicates that low education levels and transfer payments are more likely to occur in the high consumption group and in the goods category due, as mentioned, to high personal debt. Consumerism rather than asset accumulation is a primary cause of rising debt. During the past 30 years household debt has increased 4.7% annually, outpacing gains in personal disposable income, assets and the GDP.

Table 11 - Total Consumption

<table>
<thead>
<tr>
<th>Category</th>
<th>More likely in Low Consumption Group…</th>
<th>More likely in High Consumption Group…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Goods (Furniture and equipment, Clothing, Tobacco)</td>
<td>Older-headed Moved before 2004</td>
<td>Higher income More rooms, adults, appliances Receiving transfers Lower education Newer heating</td>
</tr>
<tr>
<td>Total all categories</td>
<td>Older-headed Female-headed Older-headed Higher income More cars, rooms, adults, children, bathrooms Unmarried-headed Receiving transfers Ontario Steam heating</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 3: FIELD SITES

Live Lightly Tour
sustainable living in an RV powered by veggie oil

www.livelightlytour.com
Constructed: 2005

Units: 67 units, one guest rental unit.

Developer: 16th Street Development Ltd. (a joint venture between West Coast Projects and Marcon Construction), Designer - Perkins and Company.

Designation: Canada’s first LEED® certified residential building (Leadership in Energy and Environmental Design). “Green” elements amount to a 2 ñ 3% hard cost premium, which was compensated for by news media exposure.

Features:
  - An estimated 75 - 83% of construction and demolition waste was diverted from landfill including the reuse of asphalt and glue-lam beams.
  - Locally sourced materials such as insulation, flooring and drywall
  - Stormwater output is reduced by 20% by incorporating a green roof and native drought resistant landscaping minimizes irrigation needs.
  - Water conservation appliances and low flow plumbing fixtures (dual flush toilets and low flow fixtures) cut water consumption by 40 ñ 60% compared to Metro Vancouver’s average of 320 litres/person/day.
  - High performance low E windows locally manufactured, BC Hydro PowerSmart efficient lighting, Energy Star appliances and natural ventilation reduced energy consumption 14 ñ 20% when compared to similar sized buildings.
  - Low VOC paints, sealants and adhesives used.
  - 40% of the units are designed with universal design to accommodate people in wheelchairs.
  - Concrete/steel stud construction with fibreglass batt insulation.
  - Occupancy sensors regulate lights in common areas.
  - Heat rated gas fireplaces.
  - A common exercise and a meeting room with a few small garden plots on the second floor.

Sources:


2) Quayside Village, North Vancouver
Constructed: 1998
Developer: Artian Construction. Designer - The Courtyard Group, Community Dream Creators (cohousing consultants)
Designation: Cohousing Development, Silver Georgie Award: Best Low-Rise Development, 1999
Units: 19 units (with one guest bed-sitting room), four affordable units sold at 20% below market price, covenants ensure units will remain below market in perpetuity. One two-bedroom rental unit designated as affordable, wheelchair accessible. Commercial space accommodates a small convenience store.
Features:
- Common space features a Mediterranean-style courtyard surrounded on three sides and a 2,500-square-foot common house. Open fireplace and lounge, shared office, fully accessible bathroom, laundry area and craft room, and large country kitchen and dining area. Shared dinners scheduled each week for those interested.
- Third floor deck and octagon shaped reading room replicated from the old Dome Market building in North Vancouver with water and mountain view.
- Landscaping features native shrubs, vines, berry bushes, fruit trees and flowers. Small garden plots, composting and recycling program, grey water treatment system, funded by CMHC.
- All units feature gas ranges, energy efficient gas fireplaces, soaker bathtubs and access to outside spaces.
- Many units use recycled hardwood flooring and most have views of the city, mountains or ocean.
- Units range in size from bachelor to three bedrooms in flats and townhome layouts featuring few hallways with rooms garnishing off central room.
- Most units share common laundry facilities.
- Development has obtained up to a 90% waste recovery rate.

Sources:
3) Cranberry Commons, NW Burnaby
Constructed: 2001

Developer: CDC Cohousing Development Consulting and a not-for-profit corporation acting as the developer for financing, design, and development.

Designation: Cohousing Development. City of Burnaby Environment Award (2002) for the development of an environmental and social housing model.

Units: 22 units in a 26,662 square foot, multi-family residential building.

Features:

- Units range in size from 500-1200 square feet.
- Each unit is privately owned in a complete, self-contained home with some shared common facilities.
- Located within a block of a busy commercial street with grocery stores, shops and restaurants, banks and other amenities, and close to public transportation.
- Commercial grade high efficiency boiler for domestic hot water and space heating combined with in-floor radiant heat distribution system. Additional costs for an in-floor system that avoids dust and noise issues associated with forced air and electrical heating. Estimated to save $3,500/year in energy costs.
- Compact fluorescent lighting in some locations such as porch lights. Estimated to save $1,000/year.
- Solar hot-water panels offset domestic hot water by 50% with support from the Renewable Energy Deployment Initiative (federal government program) and the BC Government’s Renewable Energy Technology Program.
- Low-flow toilets and showerheads installed.
- Landscaping employs native plantings, which require lower maintenance and water use and enhance the local natural ecosystem. Rain barrels located near planted areas reduce potable water demands.
- Use of high volume fly ash concrete in parkade and building slab reduce GHG emissions associated with cement production by 50%.
- 10% reclaimed timber used for building wood. Challenges confronted a lack of supply and high costs for de-nailing wood on site.
- Construction site recycling mandated in construction contracts to maximize material diversion rates including cardboard, clean dimensional timber and palette wood, concrete, scrap metal, drywall, and paint.
- Shared composters and designated community recycling bins.
- A 2400 sq. ft. structure common house includes a spacious kitchen, dining area, children’s area, library, lounge, and meeting room. Other common areas include a laundry room, work room, guest room and storage space. Common facilities shared by the community facilitate sharing resources and bulk purchasing.
The City of Burnaby worked with the community to provide development variances (setback and density levels) that contributed to the viability of the development’s courtyard and helped make units more reasonably priced. Metro Vancouver provided funding to support non-material costs of using high volume fly ash concrete.

The up-front development of the community plan paid off by fostering acceptance of changing neighbourhood and avoiding Not in My Back Yard (NIMBY).

Comprehensive zoning allowed greater flexibility in building design and setbacks.

Extensive common facilities necessitated a special consideration of development density for the site, and an increase in allowable density.

Required relaxation in parking requirements and alternative servicing methods.

Homes are equipped with connections for private washers and dryers, but more than 50% of units share common laundry services.

Some residents share cars, canoes, and kayaks.

Bicycle storage in parkade.

All units are equipped with two runs of CAT5 wiring, a local area network and a high-speed Internet connection.

Air-drying lines.

Long life (40 year) roofing shingles.

Natural and low VOC finishes.

The use of salvaged lumber for 10% of the building construction.

While each home comes equipped with its own full kitchen, residents have the option of eating in the common house each week.

Sources:

4) Clements Green, UBC
Endowment Lands
Constructed: 2006
Developer: Vanmar Constructors Inc. Architect - Raymond Letkeman Architects Inc.
Designation: Green Building. A silver certified Residential Environmental Assessment Program (REAP) building.
Units: 55 units.
Features:
- A four-storey wood frame building with 55, two and three bedroom units.
- 75-80% of construction waste was diverted from the landfill.
- Water efficiency measures include dual flush toilets, water efficient fixtures and rainwater sensors on landscape irrigation.
- Each suite is allocated only one stall in the underground parking facility.
- A 27 stall secure bike storage facility available in the underground parkade.
- Water is metered and building occupants pay for the volume of water supplied (and the resulting volume of sewage disposed of) through strata fees. Reducing hot water reduces energy bills, likely to be in the region of 40-50% from the Metro Vancouver average rate of water consumption in a similar type of building.
- Dual flush toilets and faucet restrictors used in all bathrooms (0.5 gallons per minute).
- Clothes washers are Energy Star compliant and front-loading (offered to purchasers as options). Dishwashers are Energy Star compliant.
- Site landscape design includes water efficient landscape with drought tolerant plants, such as Otto Luyken, Laurel, Rugosa Rose and Spiraea and an Integrated Pest Management Plan to reduce pesticide use.
- Rainwater sensors installed on the landscape irrigation sprinkler systems to reduce sprinkler use by up to 50%.
- Energy cost recovery based on actual usage rather than on a square footage basis via occupant strata fees.
- Hot water meters in each suite encourage accountability and lifestyle choices (individually metered).
- Low E glass throughout the building decreases heat loss in colder seasons and decreases heat gain in warmer periods.

- High-recycled content, free of urea formaldehyde such as Johns Manville or Ottawa Fibre insulation installed in walls, roof and the underside of the concrete slab in the ground floor parkade.

- Light emitting diode (LED) lights use less than 3 watts, compared to 15 ñ 30 watts by incandescent lamps in exit signs.

- Sensor-activated lighting in selected common areas and in the parkade. When these common areas are not in use the lights would be set to a low level that meets safety requirements.

- Compact fluorescent lamps are used in all common areas, recessed down lights and wall sconces. Underground parkade, service and storage rooms are illuminated use high efficiency T8 or T5 fluorescent lamps.

- All exterior lighting is specified as “full cut-off” that throw light down rather than up to reduces light pollution and preserve the night sky.

- Geothermal system involves installation of a ground loop pipe drilled into the Earth beneath the building to reduce the amount of gas needed to heat hot water. A heat pump intensifies the warmer water before a boiler “polishes” hot water temperature to 140° F.

- The geothermal system provides approximately 30% of the hot water peak load demand (50-60% of the total load) and the remainder is heated conventionally.

- The plumbing and distribution system remains similar, since gas and electricity is used. Individual hot water flow meters are installed in order to allocate gas and electricity usage among occupants.

- Enerpro Systems provides an energy management system for hot water energy monitoring. It collects information and monitors, manages and controls the gas fired central hot water boiler system through a modem attached to the boiler. The system analyzes hot water demand on a daily basis and adjusts the boiler’s settings to respond to specific lifestyle patterns of occupants.

- Direct air vents bring fresh air in from outside the building.

- Flooring is carpet, hardwood, or tile. All carpet is CRI Green Label approved to reduce off-gassing. All paint carries an EcoLogo label or is LEED® approved as identified by the Master Painters Institute.

- Adhesives and sealants used throughout the building do not exceed the VOC limits of the Canadian Environmental Choice/EcoLogo program.

- Garbage divider bins are installed in kitchen cabinetry to assist owners’ sort paper, metal and plastics.

- The garbage room located in the underground parking facility includes a recycling area.

- Clements Green is a co-development project initiated by UBC faculty and staff built with assistance from UBC Properties Trust. By using Co-Developers equity (future residents) fund the required working capital, and avoid the developer’s profit, sales, and marketing commission, amounting to savings of 10-20% of the appraised value of a home. Upon completion of construction, each Co-Developer becomes a homeowner.
5) Journey, UBC Endowment Lands
Constructed: 2004

Developer: Adera

Designation: Typical Building

Units: 80 units

Features:

- Units range from 838-1560 sq ft. Most popular upgrade options are stainless steel GE appliances, granite countertops and hardwood floors.

- Several layout options include a three-bedroom convertible to a two bedroom with a separate suite mortgage helper.

- Common space includes a 1,500 sq ft sunset roof deck and garden.

- The UBC Community Card, given to all residents, provides discounted rates and benefits to UBC’s athletic facilities and access to the UBC and Vancouver Public Library.

Sources:

6) Reflections, UBC
Endowment Lands
Constructed: 2005

Developer: Adera

Designation: Typical Building

Units: 77

Features:

- Located adjacent to Rhododendron woods and the Mid Campus Park in Hawthorn Place.

- The developer provided a water meter fund to run for the first few years. Meters were read once per year and a bonus was given to the more water-efficient occupants. The Strata Council decided not to continue the program once the initial funds expired. They recommended that water metering should be written into the BC Strata Act, to entrench water consumption into policy to ensure implementation.

Sources:
7) Carleton Terrace, NW Burnaby
 FIGURE 10 - CARLETON TERRACE

Constructed: 1992


Designation: Typical building. 9 storey concrete high-rise.

Units: 74 units.

Features:
- Two level underground parkade
- Mixed use – retail on ground floor, 2 – 9 features residential levels.
- Concrete building with stucco
- Penthouse on 9th floor with common roof deck
- Units heated with electrical baseboard heating
- Conventional landscaping
- $3 million renovation in 2001 due to water leakage. Included remediation of exterior walls, removal of existing claddings, installation of new rain screen wall system, replacement of windows and resurfacing of horizontal balcony and roof deck surfaces.
8) Symphony, City of North Vancouver
Sources:

Constructed: 2002
Designation: Typical building, 15 storey, concrete high-rise in Central Lonsdale.
Units: 67 units (one and two bedroom units).
Features:
- Parking for 89 vehicles, including 68 residential, 7 commercial, and 14 visitors.
- 13 one-bedroom units, 52 two bedroom, and 3 penthouse units.
- Density transfer featured a Floor Space Ratio total of 88,140 sq ft.
- All windows utilize low E tinted glass.
- Water foundation is located beside the front entrance.
- Ornamental landscape and courtyard.
- Uses 1998 Adaptable Design Guidelines, levels 1, 2, and 3.

FIGURE 11 - SYMPHONY
Figure 12 – UBC Endowment Lands

Figure 13 – Northwest Burnaby, BC

Figure 14 – Central Lonsdale, City of North Vancouver
APPENDIX 4:
INDICATORS AND THE DPSIR FRAMEWORK

To measure SCP, one must first identify how policy drivers interact with appropriate analytical tools. Among sustainable development approaches, expenditures and ecological accounting tools require acknowledging environmental characteristics. Sustainability indices that bridge economic, ecological, and social gaps include the Genuine Progress Indicator (GPI), the Happy Planet Index (HPI), and the Ecological Footprint (EF). These innovative indices embed social, economic, and environmental metrics, targets, and outcomes into city policies, infrastructure planning, households and lifestyles, and low impact design.

Figure 15 - Standard of Living Evolves Toward Sustainable Consumption and Production for Households
Figure 15 illustrates the role that earned expenditures play toward measuring the standard of living. Standard of living translates into measures of material and economic well-being that emphasizes expenditures that drive performance as measured by economic value. SCP’s contribution to well-being does not ignore social or ecological characteristics, but attempts to integrate intrinsic qualities in addition to economic aspects.

Community well-being is defined in multiple ways because of its integrated applicability. Environmentally, it encompasses qualities such as clean air, green space, and non-toxic material use. Economically, it includes low unemployment rates and poverty levels with accessible affordable housing options. Health and safety criteria include low crime levels, healthy and nutritional food, and drug prevention policies. Politically, adequate public services support strong governance. And socially, high perceived happiness, low stress levels, and adequate personal time is prioritized for family and friends. While concepts of SCP and well-being continue to evolve, supplemental conditions of well-being can augment the standard of living.

Toward SCP for Households Using DPSIR

Applying DPSIR to measure SCP attempts to connect global trends and responsibilities to local communities and households. The goal is to redefine and decouple quality of life issues and practices into lower-impact lifestyles that preserve and enhance freedom, security, social connections, environmental quality, health, community values, and other communitarian ideals.2
Table 12 – Indicator Types

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driving Force</strong></td>
<td>- Sectoral trends that change lifestyles and overall levels of</td>
</tr>
<tr>
<td></td>
<td>consumption and production that exert pressures on the</td>
</tr>
<tr>
<td></td>
<td>environment.</td>
</tr>
<tr>
<td><strong>Pressures</strong></td>
<td>- Anthropogenic activities that change physical and environmental</td>
</tr>
<tr>
<td></td>
<td>conditions.</td>
</tr>
<tr>
<td><strong>State</strong></td>
<td>- Observable quantitative and qualitative changes in social-</td>
</tr>
<tr>
<td></td>
<td>environmental-economic realities.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>- Effects on the health or changed environment.</td>
</tr>
<tr>
<td><strong>Response</strong></td>
<td>- Efforts from decision-makers to respond to the issue at hand.</td>
</tr>
</tbody>
</table>

The DPSIR framework (see Figure 16 and Table 12) serves to link households to global issues through monitoring consumptive processes in buildings and surrounding communities that establish the context for re-examining household indicators.

DPSIR composes of five indicator types:

1. Driving force indicators represent human activities, processes, and patterns that impact SCP and pertain to local and global developments in areas of energy, mobility, food, solid waste, social capital, livability, and consumption behaviour.

2. Pressure indicators describe anthropogenic variables that directly cause environmental-social-economic problems; examples include fossil fuel dependency, reliance on single-occupancy vehicles, and monoculture growing practices.

3. State indicators provide a snapshot about an environmental, social, or economic condition at a particular point in time. For example, lack of awareness about the most appropriate energy consumed by a household appliance.

4. Impact indicators describe the effects of changes to the present state or condition. For example, revenue generated from pollution levies or the indirect costs associated with social housing.

5. Responses are quick measures that monitor the economic system over time through policy instruments, incentives, regulations, and budgetary decisions. Response indicators identify opportunities for community actors, such as public authorities, businesses, and non-profits to take action. Finding statistical correlations between pressures, states, and impacts are difficult because of societal and economic influences and time delays.3
APPENDIX 5: SCP FINDINGS FOR HOUSEHOLDS

Mobility

Cohousing reports they are less likely to drive than Typicals and more likely to drive shorter distances to shop. Greens and Cohousers report they are more likely to drive less and over shorter distances than in the past.

Table 13 – Frequency and Distance of Driving to Work

<table>
<thead>
<tr>
<th>Driving to Work Frequency</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>z</th>
<th>P&gt;z</th>
<th>95% Conf.</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Green&quot;</td>
<td>-.283618</td>
<td>-0.45</td>
<td>0.654</td>
<td>1.52496</td>
<td>-1.52496</td>
<td>.9577245</td>
</tr>
<tr>
<td>Cohousing</td>
<td>-.5999914</td>
<td>-0.77</td>
<td>0.443</td>
<td>2.131533</td>
<td>-2.131533</td>
<td>.9315502</td>
</tr>
<tr>
<td>Driving Distance to Work</td>
<td>Coef.</td>
<td>Std. Err.</td>
<td>z</td>
<td>P&gt;z</td>
<td>95% Conf.</td>
<td>Interval</td>
</tr>
<tr>
<td>&quot;Green&quot;</td>
<td>-.2271274</td>
<td>-0.38</td>
<td>0.701</td>
<td>1.387792</td>
<td>-1.387792</td>
<td>.933537</td>
</tr>
<tr>
<td>Cohousing</td>
<td>-.8402971</td>
<td>-1.05</td>
<td>0.292</td>
<td>2.403409</td>
<td>-2.403409</td>
<td>.7228143</td>
</tr>
</tbody>
</table>

Socializing with Neighbours

The degree neighbours socialize compared to where they previously live is variable (see Figure 17). Cohousing (100%) report they socialize more than where they previously lived, compared to Greens (27%) and Typicals (16%). One third of Typicals report they were socializing less than they did in their previous homes. While Cohousing have generally known each other longer than residents at other investigated sites, other variables may provide clues to why plays a role for mobilizing households toward SCP.

Figure 17 - Socializing with Neighbours Since Moving
Active Citizenship Behaviour

Active citizenship is defined as the level of volunteerism offered and whether donations are reported to help establish altruistic tendencies. Figure 18 shows occupants' affiliations with environmental and social justice associations. Cohousing and Greens report a higher level of involvement with environmental organizations than Typicals do.

Figure 18 - Volunteering Work and Donations

Table 14 - Volunteer Hours

<table>
<thead>
<tr>
<th># of Volunteer Hours (per month)</th>
<th>Green</th>
<th>Cohousing</th>
<th>Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>15</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>6-10</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>11-15</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16-20</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>20+</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Waste

Table 14 - Volunteer Hours

Rebound Effect

The rebound effect estimates the potential “energy savings” from improved energy efficiencies commonly using basic physical principles and engineering models. Yet, actual energy savings generally fall short of estimates. Energy efficient improvements may encourage the additional use of services rather than extend savings (e.g. driving an energy efficient gas electric hybrid further than a conventional car due to the perceived cost savings). Efficiency gains often counter rebound effects by consuming other products that increase intensities. While the range of rebound effects vary, in some cases they lead to an overall increase in energy consumption, particularly because technologies, sectors, and income groups exacerbate effects differently. The rebound effect raises concerns about solely using intensity-based emission standards and modeling rather than aggregate consumption levels.

Table 14 - Volunteer Hours

Household’s influence rebound effects in numerous ways. Electronic appliances are more prominent in homes compared to previous decades and most products consume energy when not in use. In 2006 an average Canadian household used 25 electronics, and standby or “on” buttons use electricity, often called phantom power, which may consume up to 10% of a home’s energy. Respondents report paying less for utilities in their previous homes compared to where they live currently, often (they speculate) because of downsizing to smaller accommodations. Many purport to spend more on retirement, recreation and travel, family, or decreasing their mortgage payments. If expenses merely transfer “one malicious consumption act to another,” the likelihood of moving toward sustainable livelihoods is low.
2 Tukker, 2006 p. 10
3 © Copyright: Building Use Studies Ltd 2007 Used under license.
4 Leadership in Energy and Environmental Design (LEED®) is a voluntary, market-based rating system for defining environmental elements and quantify how “green” a building is when compared to other certification programs. LEED® is administered by the US and Canadian Green Building Councils.
5 Meltzer, 2005
6 Timmerman, 2009 p. 30
7 Wilson, 2004 p. 44
8 When Cohousing is compared to Typicals, predicted probabilities indicate 46% are more likely to report that they drive less frequently for shopping, 18% are less likely to drive the same amount, and 28% are less likely to drive more, since moving from their former home.
9 Thompson, 2007
10 Thompson, 2007
11 Hoyer, 2001; Oughton, 2003; van Diepen, 2001; Holden, 2004; Perkins, 2005
12 Statistics Canada, 2008
13 Adams, 2008
14 Lopez, 2004; Frumpkin, 2001; Ewing, 2003
15 Balfour, 2007
16 Canadian Population Health Initiative, 2004
17 Richardson, 2007
18 McDonald, 2009
19 Boyd, 2007
20 Smith, 2009
21 Robbins, 2007
22 A cohousing member compared their garden courtyard to the yard of a nearby building, “We do know everybody here and it’s, you know, like just the way our landscaping looks. There’s a conventional strata next to us on the other half of the block. They have the typical, you know, cheap bushes and short-cut grass. Right? That gets maintained every week or two by a company that comes around with a contract, snip, snip and she’s done.”
23 Halifax Regional Municipality, 2009
24 McKenzie-Mohr, 1999; Department for Environment Food and Rural Affairs, 2005
25 Department for Environment Food and Rural Affairs, 2005
26 Buzzelli, 2009
27 Darnton, 2004
28 Duhig, 2008; UNESCO - UNEP, 2002
29 An interview respondent acknowledged, “I guess the fundamental question is how do we make people individually responsible. It’s easy to say well it’s too big for me it’s really somebody else’s problem. It’s the polluting buses or whatever. It’s the commuters. I think we need to work on, for people in homes, but for everybody, developing a psychology that says we’re all individually responsible and we can all individually participate in and contribute to the sum of those individual contributions that is real and significant. How do we do that? Because we don’t have leaders. We don’t have political leaders at least.”
30 A respondent reflected, “It’s the kind of thing that everyone thought the environment had solved when we brought out the blue boxes. And everyone sat back and said, yeah, got my blue box and we’re recycling and you know, expect those glaciers should be coming back any minute now. Yeah, they should be growing. Why aren’t they growing? They’re still melting. Hmm. Damn, you know? And it took 10 years for that to sort of sink in. So — I think it is an addiction.
issue that we’re dealing with and that’s why it’s so hard and why there’s so much resistance and also so much lying to ourselves.”

31 Queen’s Printer, 1998
32 LEED® for Existing Buildings administered by the USGBC requires an evaluation during a specified performance period and re-certification every five years. The CaGBC is currently creating a new certification-verification system commencing with existing buildings aimed at verifying and certifying actual performance and operational practices.

33 Janssen, 2004
34 New Building Institute, 2008
35 Pitt, 2007
36 Bizikova, 2008
37 Bethel New Life, 2006
38 Vincent, 2009
39 One cohousing respondent summed up these solutions to the waste paradox, “The addiction model is to put everything into one container and the solution is going to be never put anything in one container. And for North Americans, we’re used to having it as easy as possible and that means one bin for all.”

40 A respondent explained, “I think that most of the stuff that happens occurs at the strata level in each building and measures that might change how the environmental footprint is managed or quantified would occur or need to occur for strata councils for sure. Because they’re usually the only people that actually care that much about managing the building. If you’re on the strata council it means you actually care and if you’re not on the strata council you’re pretty ambivalent.”

41 Cranberry Commons Cohousing, n.d.
42 A respondent explained, “You know if you’ve got a leaky tap or a leaky toilet or something chances are one of the neighbours will just come and fix it for you. You don’t have to have a guy drive across town in a van to come and charge you a couple hundred bucks to fix your tap if you’re not, you know, inclined that way.”

43 A respondent added, “…we had an Ethernet cable put into the whole development and so we have one Internet connection for the whole joint. Right? So it costs us $10 a month for high-speed Internet. Saves everybody $30-$40 a month on their Internet. But it doesn’t really help sell out your, you know, 20-storey tower. Right? It doesn’t really make a difference. . . . If you’re the developer, you’re profit motivated, you don’t bother. Right? And that’s why a lot of the reason why we have things the way we do is because that was the way that worked well, that was dependable, that would sell.”

44 A cohousing respondent added, “the guest room thing is really handy because then you don’t have to have, you know, a couple hundred bucks a square foot you don’t have 150 square feet in your house that’s just there for you know, for [nine] weeks of the year.”

45 Wilson, 2004
46 Retzlaff, 2008

48 The US Mayors Conference, 2007
49 ICLEI, 2007
50 Chen, 2008
51 Forty Percent House, n.d.
52 IBI Group, 2002
53 Burchell et. al, 2005
54 IBI Group, 2002
55 Dillon Consulting Limited, 2005
West Coast Environmental Law developed a series of smart growth model bylaws and various resources for local government (see www.wcel.org.ca).

A cohousing respondent added, “. . . we have 22 households on what was five city lots. We could probably all use a little bit more room than we have. [Laughs] But at the end of the day it’s enough for a decent quality of life. . . . We’d be on two blocks otherwise. So that’s a lot less impact in terms of land use and that sort of thing.”


For example, the City of Port Coquitlam is planning to implement bimonthly curbside waste pick up. Community district heating in North Vancouver offers greater flexibility in how utility prices are set.

An interview respondent observed, “you still see a lot of buildings coming down and they literally just tear everything down with appliances and everything still inside of them and glass and you’re just like, wow. Where’s all that going? And why are they doing that? Why can’t they recycle or reuse it somehow?”
One cohousing respondent observed, “Whenever we have an election, my wife usually volunteers at the local polling station. And so she has a really good sense of who goes to vote because she’s there all day and we know everybody. And our typical turnout at elections, even like at the municipal level is, you know, well above 80%. And like out of 30 adults, 30-35 adults that live in a place [and] one or two people might not make it because they just got too busy. And that’s it . . . . So from local politics you have a 20% turnout kind of thing. I mean, there’s an angle to be considered. [laughter] Cohousing gets more voters.”


Mintz, 2009
Boyd, 2004
Boyd, 2004; Madsen, 2004
Rahilly, 2006
Hackney, 2005 p. 25

As one official commented, “I can tell a developer to put in drought-resistant plants, but I can’t recommend solar panels.”

Rees, 2009, October 20, Presentation at Gaining Ground Summit, Vancouver, BC
Boothroyd, 2000, p. 160
Jacobs, 1993; Daly, 1991
Freeman III, 2001 p. 280
Shor, 1998
McDonough, 2002


Hawken, 1999 p. 4; Lovelock, 1979
A. Smith rejected Quesnay’s Physiocratic emphasis on land’s importance that first pioneered the notion of ecological economics (Wackernagel, 1996).

First Call: BC Child and Youth Advocacy Coalition, 2008
Laird, 2007
Hawken, 1999 p. 4; Vitousek, 1986
World Wildlife Fund, 2006
Schaeffer, 2005 p. 19


Brown, 2001 p. 131
Barber, 2009 p. 8-9
British Columbia - Alberta Social Economy Research Alliance, 2006; Lewis, 2006
Tukker, 2008 p. 55
Hahnel, 2005
Korten, 1995
Bradford, 2007; Lerch, 2007
Carrot Common, n.d.
Two examples are the 2008 BC carbon tax and the 2012 Western Climate Initiative (WCI) regional cap-and-trade system for greenhouse gas emissions.
Benyus, 1997
The statistical analysis for Statistics Canada Household Spending data was performed with Dr. Peter V. Hall and Victor Thomas.

Organisation for Economic Co-operation and Development, 1999

Tukker, 2006 pp. 12-13


Michele Battisti performed the multiple regression analysis using STATA software.

When Cohousing are compared to Typicals, predicted probabilities indicate 46% are more likely to report that they drive less frequently for shopping, 18% are less likely to drive the same amount, and 28% are less likely to drive more, since moving from their former home.

No differences in statistical significance are reported, probably due to the small sample size (see p values in Table 13).

A logit regression analysis indicates that differences between Cohousing and Typicals are significant (p>0.015). No difference in statistical significance is reported between Greens and Typicals.

Greens report volunteering or donating to > 4 environmental organizations, compared to Typicals that report 1-2 organizations.

Sorrell, 2007

Greening, 2000; Sachs, 1999; Herring, 1999

Song, 2008