



Climate & Energy OCP Discussion Paper



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This Climate and Energy Official Community Plan Discussion Paper depended on contributions made by City of Victoria staff, notably Alison Ashcroft, Kim Fowler, Steven Gauley, Sierd Hortsing and Cameron Scott. The report was authored by Alex Boston, Micah Lang and Brendan McEwan of HB Lanarc Consultants.

This discussion paper has a stand-alone executive summary.

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1. INTRODUCTION AND CONTEXT FOR ACTION

Climate change has global implications to ecosystems, infrastructure and people. Given their vulnerability, authority *and* opportunity, local governments will be key players in either exacerbating or solving this defining problem of the 21st Century.

- Communities are vulnerable to a changing climate from stormwater incapacity to sea level rise, and drought to drinking water shortages.
- When disaster strikes – and insurance records already show intensity and frequency is greater – local governments are on the front line.
- Local governments have significant authority to both reduce emissions to avoid the most catastrophic long term impacts, and adapt to some of the inevitable changes we will encounter.
- Climate protection can reinforce a more integrated sustainability agenda that addresses long term economic, social, and environmental imperatives. A climate-sensitive Official Community Plan can be the cornerstone of local government climate protection.

This section introduces the objectives and organization of this discussion paper. The subsections then provide a context that underscores the rationale for action by local governments, and specifically the City of Victoria:

- Climate Science Imperative
- Energy Security Imperative
- BC Climate & Energy Policy Drivers
- Local governments, OCPs and climate change: relevance
- Climate Protection: Integrated Sustainability Agenda

A. DISCUSSION PAPER OBJECTIVES & ORGANIZATION

This discussion paper is intended to prepare Council, staff and community stakeholders to address climate and energy in a broad engagement, analytical and strategic planning process to update the Official Community Plan.

The paper has several objectives:

1. Establish the general context of climate science and policy, and energy security and policy relevant to the City of Victoria
2. Identify key analytical techniques for community energy and emission planning and climate change impact assessment and adaptation planning
3. Assess policies and actions to advance community energy and emission reductions, and climate change adaptation relevant to the City of Victoria
4. Identify process, policy and action opportunities that can be integrated into the OCP update process

Section One establishes the local government *Context for Action* on climate change by situating the impacts, authority and opportunity within the local government context and then examining the major drivers for action.

The following three sections provide analysis and an *OCP Checklist* summarizing *Process Suggestions* and *Policy and Action Opportunities*. The range of policy and action opportunities extend beyond what would conventionally be included in an Official Community Plan (OCP), and may be more appropriate included in a community energy and emissions plan, a broader adaptation plan or more focused initiatives like development of district energy strategy.

Section Two examines strategic *Governance and Management* issues associated with advancing a climate and energy agenda, including a meta approach for a) understanding the relationships of a traditional OCP and climate change, and b) a process for integrating climate change mitigation and adaptation.

Section Three explores *Climate Mitigation and Sustainable Energy*, including an energy and emission profile of the City of Victoria, a strategic approach to integrating emission reductions and sustainable energy into the OCP update, and policy and action opportunities by key sector: land use, transportation, buildings and waste.

Section Three explores climate change *Impacts and Adaptation*, including a high level local impacts and vulnerability profile, a strategic approach to considering adaptation in the OCP update, and policy and action opportunities.

Key Terminology

A number of terms, as used in this report, are defined to minimize ambiguity.

Emissions: Emissions in this report refer to greenhouse gas emissions or GHGs.

Adaptation: Adjusting natural and built environments and social systems to reduce vulnerability to climate change.

Mitigation: Minimizing long term climate change impacts by reducing GHGs.

Sustainable Energy: Improving energy security and reducing fossil fuel use through conservation, efficiency and renewables. *Mitigation* and *sustainable energy* are often used interchangeably.

Climate Protection: The combined efforts of climate change mitigation and adaptation.

B. CLIMATE SCIENCE IMPERATIVE

The balance of scientific evidence shows the climate is changing, and attributes *most* of this change to the surge in greenhouse gas emissions generated by the combustion of fossil fuels, e.g. oil, coal and gas. The Intergovernmental Panel on Climate Change is the world's preeminent climate science authority. The IPCC's 2007 Fourth Assessment Report, based on extensive review of the latest peer reviewed science, concluded global emissions need to peak around 2015, with 50-85 % reductions below 2000 levels by 2050, if we are to avoid tipping points with dangerous disruptions such as severe agricultural collapses, water shortages, droughts, and sea level rise.¹

The economics is also increasingly clear. Commissioned by the British Government and authored by former World Bank Chief Economist Nicholas Stern, the *Economics of Climate Change* estimated the costs of reducing greenhouse gas emissions to a safe level were one percent of global gross domestic product; compared to a loss of up to 20% of global GDP if we do nothing. Stern concluded "the benefits of strong, early action on climate change outweigh the costs."² See *Section Four, Impacts & Adaptation for a* profile of Victoria impacts and vulnerabilities.

C. ENERGY SECURITY IMPERATIVE

Beyond reducing emissions to avoid dangerous climate change, sustainable energy (composed of efficiency, conservation and renewable) strengthens security in the face of steadily rising prices. Victoria residents and businesses currently spend approximately \$200 million per year on energy—about \$2,500 per capita. The vast majority of this spending leaves town, flowing predominantly to distant petroleum companies, BC Hydro and Terasen Gas. It is not unreasonable to expect that without superior building performance, more efficient transportation, and a land use regime that reduces distances travelled, spending would at least double by 2020.

Constrained supply and increasing demand is expected to drive up prices:

¹ IPCC. Climate Change 2007: Synthesis Report.

http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm

² HM Treasury. Stern Review on the Economics of Climate Change. http://www.hm-treasury.gov.uk/sternreview_index.htm

- The International Energy Agency's *World Energy Outlook 2008* indicates global energy demand will increase 45% between now and 2030³, largely due to the growth in demand in Asia and the Middle East
- Supplies of many conventional energy forms, notably oil, are declining, and new sources have higher production costs because of their inaccessibility, e.g. tar sands. A middle of the road estimate of oil prices in 2020 by the US Energy Information Administration is \$115 per barrel. Their high estimate is \$185.⁴ A conservatively estimated 40-130% increase.
- BC Hydro forecasts essentially a doubling of electricity prices by 2020. Current electricity rates are 7.04 and 7.77 cents per kilowatt hour for residential and commercial/institutional customers, respectively. They would rise to 13.08 and 14.43 cents/kWh.⁵
- Natural gas prices are expected to rise but not as significantly, 13-85%, by 2020.⁶
- Rising carbon prices are also expected to incrementally increase fossil fuel costs, and in turn the cost of other energy sources. Conservative carbon price estimates vary dramatically from \$30-60 per tonne, equating to 7-14 cents per litre of gasoline.⁷

The volatility in oil and natural gas prices expected by most industry and government sources is potentially worse than rising energy costs. These fluctuations create uncertainty about the future, compromising budget forecasting and long term planning.

The economic benefits of sustainable energy are both direct and indirect. Investing in renewable energy creates twice as many jobs as equivalent investments in new supply; and investing in conservation and efficiency creates four times as many jobs.⁸ Much of this job creation is from the re-spending effect of avoided energy costs; most activities generate more jobs than conventional energy sector activities. Overall, a significantly higher percentage of the energy spending and re-spending effect is at the community level.

Box 1. Transportation Electrification

BC Hydro's Long-Term Acquisition Plan's demand forecast did not include the increased demand for electricity that significant uptake of electrical vehicles would take. This transition is being driven both by rising oil prices and policy, i.e. fuel economy standards, notably to reduce carbon emissions. Meeting this demand would likely force BCH to increase rates beyond those forecast.

Gilbert and Perl estimate a switch to 33% of vehicle kilometers traveled (VKT) to electric transport by 2025 would require a 6% increase in electricity production (based on a US estimate).⁹ This magnitude of penetration would require significant support from all levels of government to ensure the necessary infrastructure, specifically plug in requirements in garages, and chargers in key public areas, e.g. strategic parking lots.

³ International Energy Association. *World Energy Outlook 2008 Fact Sheet: Global Energy Trends*.

⁴ Energy Information Administration 2009. *Annual Energy Outlook*, p. 161.

⁵ BC Hydro Directive 17, 2006 IEP/LTAP Long Term Rate Increase Forecast filed with BC Utilities Commission. The average residential customer spends about \$720 per year on electricity.

⁶ Energy Information Administration 2009. *Annual Energy Outlook*.

⁷ BC's Carbon Tax will be \$30/tonne by 2012, i.e. 7 cents per litre.

⁸ Hornung, Robert. 1997. *Comparative Analysis of Employment from Air Emission Reduction Measures*. Pembina Institute

⁹ Gilbert, Richard & Anthony Perl. 2008. *Transport Revolutions: Moving people and freight without oil*. Earthscan.

D. BC CLIMATE AND ENERGY POLICY DRIVERS

In light of the consensus on the dangers of climate change, the BC Government announced in 2007 a commitment to reduce provincial GHG emissions 33% below current levels by 2020 and 80% by 2050. While many factors influenced development of these targets, the most important from a risk management perspective is their consistency with scientific evidence on the scale of reductions necessary to avoid dangerous climate change.

Since this time, the BC Government has begun to develop plans and policies that will require and support all sectors of the province to contribute to this commitment. Some of the more important policy drivers for local government change include:

- **Green Communities Act:** Bill 27 amended the Local Government Act and related Acts to address energy conservation and GHG reduction. Most importantly, new content requirements for Official Community Plans (by 2010) and Regional Growth Strategies (by 2011) include: "...targets for the reduction of GHGs... and policies and actions of the local government proposed with respect to achieving those targets"

Other notable amendments include provisions to enable Development Permits to address energy conservation, and reduce Development Cost Charges for green developments.
- **Climate Action Charter:** The BC Government and local governments unveiled the Charter in fall, 2007. It acknowledges the critical role of communities and the shared provincial-local responsibility in tackling climate change. Accepted by more than 170 local governments, it involves voluntary commitments to:
 - Measure and report community GHG emissions
 - Create complete, compact, energy efficient rural and urban communities
 - Become carbon neutral in local government operations by 2012
- **GHG Reduction Targets Act:** Bill 44 added legislative rigour to the province-wide targets and GHG reduction objectives inside government operations, specifically:
 - Province-wide GHG emissions reduction will be 33% below 2007 levels by 2020 and 80% by 2050
 - Public sector organizations, including school districts, health authorities and post secondary institutions, will be carbon neutral by 2010. This requirement may present opportunities for the City of Victoria to partner with these institutions, in emissions mitigation efforts.
- **BC Energy Plan:** Launched in 2007, the Plan features 55 policy actions to address climate change and energy security. Key policies affecting Victoria, include:
 - Clean generation and conservation goals (see BC Hydro below)
 - Building energy efficiency goals (see BC Building Code below)
- **BC Building Code:** The recently revised code contains some of North America's highest building standards. The BC Energy Plan contains 2020 targets for 20% reductions in energy use per home, and a 7% reduction in energy consumption per m² of commercial floor space. Due to the long turnover of building stock, reaching these targets will require stringent energy efficiency requirements for new buildings in the Building Code, and retrofit project encouragement.

Provincial officials have indicated that by 2020, within the applicable time span of Victoria's new OCP, net zero energy homes may be required, standards for larger (part 3) buildings may be 43% more efficient than current regulations¹⁰.

- **BC Hydro's Long Term Acquisition Plan:** This 2008 Plan aligns with Provincial commitments in the BC Energy Plan. The BC Utilities Commission is currently reviewing it. The Plan specifies:
 - A plan to meet 50% of new power requirements by 2020 through conservation
 - That all new power sources be carbon neutral, and that BC be electricity self-sufficient by 2016
 - Development of new clean power sources through:
 - Standing Offer Program for small independent power producers
 - Clean Power Call for renewable electricity supply

The BC Utilities Commission has rejected the current iteration of the Long Term Acquisition Plan. However, BC Hydro and the Provincial government have indicated that they intend to pursue similar strategies to meeting BC's power needs.

BC Hydro has also established a Sustainable Communities Group that is beginning to support local governments in advancing conservation and renewable energy.

- **Western Climate Initiative Cap and Trade:** Large emitters in five sectors across 11 jurisdictions, including BC and California, will meet legislated emission reduction targets. They will also be able to purchase a limited number of offsets that reduce emissions elsewhere but are applied to their target.
 - Beginning in 2012, sectors include 1) Electricity generation 2) Industrial and commercial fossil fuel combustion, and 3) Industrial process emissions
 - Beginning in 2015, sectors include 4) Gas and diesel consumption for transportation, and 5) Residential fuel use

E. CLIMATE CHANGE: CONVENIENT OPPORTUNITY

Climate Change is not *just* an inconvenient truth. It is a convenient opportunity! The policies and actions a community would pursue to advance a climate protection agenda are priorities that can simultaneously make our communities more livable, sustainable, resilient and prosperous, including reducing dependence on fossil fuels.

From Vancouver to Portland, and Bogota to Copenhagen, communities that have put a U-Turn on greenhouse gas emissions and supported more sustainable energy systems are discovering climate mitigation can be part of a much more integrated sustainability agenda. The leadership of all of these communities, in fact, was *not* driven by concern about climate change. However, the realization that other core community priorities reduced emissions has consolidated support for deeper action on climate change.

These opportunities are discussed in greater detail in the Section Two under *Building a Business Case*.

¹⁰ Based on HB Lanarc's communications with Provincial code authorities

F. LOCAL GOVERNMENTS, CLIMATE PROTECTION & OCPS

Local governments are where the rubber hits the road on climate change. They have significant influence over emissions. They are on the front line when disaster strikes, and in a powerful position to reduce vulnerability. The Official Community Plan is a powerful framework for advancing mitigation and adaptation. A climate protection agenda can support a more integrated sustainability agenda.

MITIGATION INFLUENCE

Three quarters of all greenhouse gases come from cities. While much of their control is indirect, local government decisions influence half of BC's greenhouse gas emissions, concentrated in transportation, buildings and waste.¹¹

It begins each morning when residents turn on the tap to brush their teeth. This is followed by the bus ride to work, walk to school, or the drive down the street. Local governments shape “waste” management practices and neighbourhood form, including density, site design, building types, lot sizes and parking space requirements. It ends last thing at night with a flush, and in some cases only when the lights are switched off. Decisions about these services shape individual, community and ultimately provincial and national energy and emission profiles.

ADAPTATION RELEVANCE

Communities are vulnerable to climate change due to an extensive infrastructure supporting high concentrations of people and economic activity. Insurance Bureau of Canada data shows costs of property damage from natural catastrophes doubling every 5 to 10 years and has attributed much of this growth to climate change.¹² In the 1990s, disaster assistance in BC was \$10 million/year. In the last several years, the figure has risen to \$43 million/year.¹³

Infrastructure standards are based on historical climate data with the premise that past averages and extremes will represent the infrastructure's lifespan. Under a changing climate, these standards are increasingly inadequate.

As witnessed by Prince George's Nechako River ice dam, Kelowna's wildfire, the windstorm that tore through Vancouver Island and Vancouver, and the recent flooding in Cowichan Valley, when disaster strikes, local governments are on the front lines.

At the same time, local governments have an immense capacity to reduce their vulnerability through land use, urban design and infrastructure decisions and policies.

MITIGATION, ADAPTATION AND OCPS

Some of the most important policy and planning tools to advance a climate protection agenda are part of the OCP. The following table shows some of the ways an OCP can and should be central to supporting climate change adaptation, and mitigating long term impacts through GHG reductions.

¹¹ Several sources arrive at similar figures including: Torrie, Ralph. (1998) Municipalities Issue Table Foundation Paper prepared for the Canadian Government's National Climate Change Process; and BC Ministry of Environment and BC Ministry of Community Development calculations used in public presentations (2008).

¹² Insurance Bureau of Canada. (May 4, 2003) Hurricane Juan insurance tab tops \$113 million: points to need for preventive measures.

¹³ Natural Resources Canada. 2007. Canada in a Changing Climate – Chapter 8: British Columbia

Table 1 Official Community Plan and Climate Change Adaptation and Mitigation Relevance

OCP Key Elements	Adaptation Relevance e.g.	Mitigation / Energy Relevance e.g.
Existing and future development: designation (com/ind/res), locations, density, mix, building types	Reduce development in vulnerable areas, improve public realm to strengthen social capital	Reduce GHGs with efficient land use mix, building type, density location
Existing and future transportation networks and their location, modal allocation, volume, form	Ensure systems are resilient and minimize risks to intense rainfall/floods and sea-level-rise	Reduce GHGs with efficient modes, connectivity, multi-modal potential
Existing and future agricultural land	Protect land – potentially from water related changes – manage risk of rising costs from disruption of imported food	Reduce carbon embedded in food, sequester soil carbon
Existing and future institutional development including schools, parks, recreational land uses	Reduce urban heat island with green space, reduce heat wave impact through passive heating/cooling building design	Reduce transportation GHGs with better parks access, sequester forest carbon; reduce building GHGs through reduced energy use
Public realm and design considerations	Reduce surface run off and urban heat island, strengthen livability to strengthen social capital	Maximize solar access, and increase livability of mixed use/higher density
Land with hazardous conditions or environmentally sensitive	Adjust setbacks due to increased erosion and or sea level rise	-
Housing affordability policies	-	Reduce energy costs in buildings (insulation) and transportation (public transit, mixed use)
Existing and future sewage and water systems	Ensure sewage capacity meets increased precipitation forecasts, and water supply meets drought forecasts	Minimize energy consumption, and maximize energy recovery through design

2. GOVERNANCE AND MANAGEMENT

This section provides guidance on the governance and management elements of climate change mitigation and adaptation. There are hundreds of good community energy and climate action plans across North America. Few are being implemented. The biggest climate and energy challenges are not technical. They are institutional! All organizations in the public and private sector endeavoring to take action are finding it difficult to reduce emissions for at least two important institutional reasons:

- Big new agendas don't immediately fit with the conventional policies, practices, routines and institutions of most organizations. There are alignment challenges.
- Climate and energy are crosscutting issues. Projects and policies run horizontally across organizations, and most organizations are generally vertically organized.

Integrating climate mitigation *and* adaptation into an OCP update is precedent setting. This can facilitate the integration of priorities into one of the planning cornerstones of local governments.

The following five considerations are outlined to help ensure the climate and energy planning processes integrated into the OCP process are not virtual activities, but generally support development and implementation of targets and high impact policies and actions.

1. Integrating Climate Protection into an OCP
2. Building a Business Case
3. Engagement and Partnership
4. Mainstreaming Climate and Energy
5. Monitoring, Evaluation and Continuous Improvement

A. INTEGRATING CLIMATE INTO AN OCP: META APPROACH

Integrating climate protection into an OCP requires a somewhat different treatment than traditional OCP sectors, like infrastructure or parks, for two reasons:

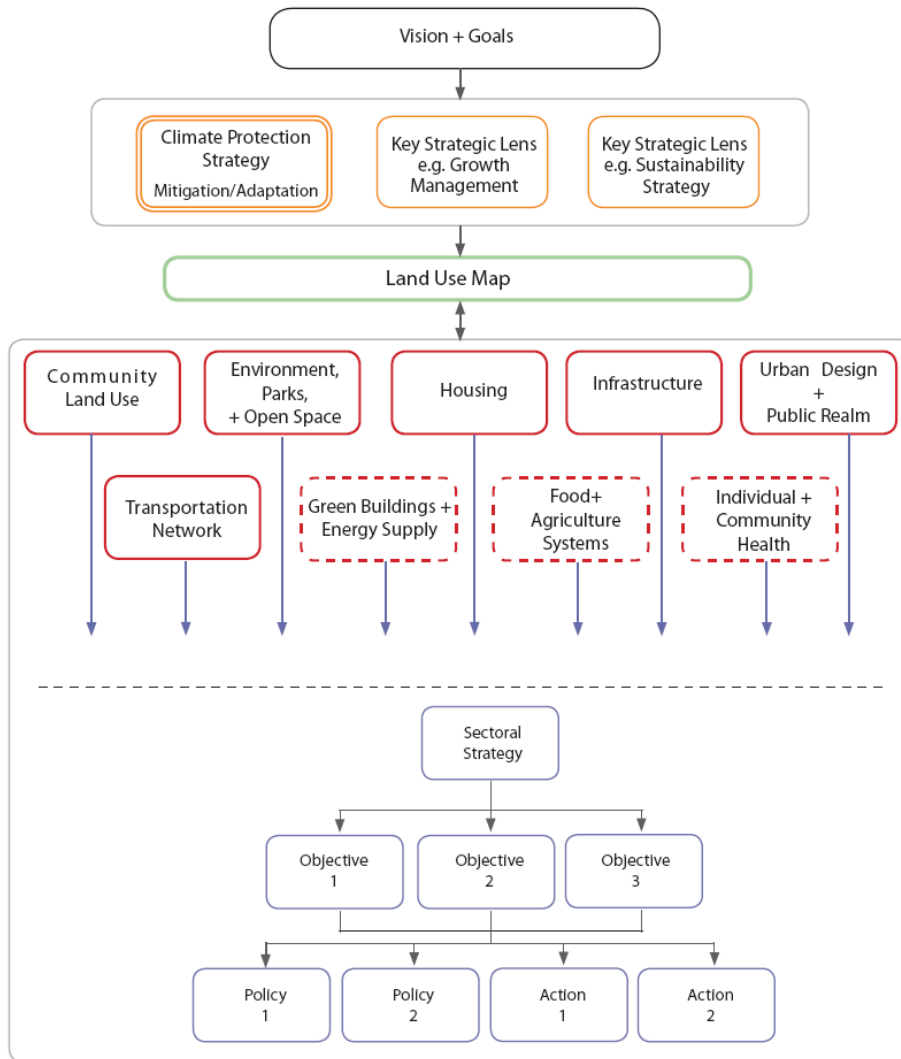
- 1) Mitigation and adaptation are novel in comparison to many of the issues typically addressed by local governments, and as such they currently require some increased knowledge and focus
- 2) Mitigation and adaptation are so profoundly cross cutting they are most effectively addressed by integrating them into existing departments.

The following two diagrams provide a meta-approach to integrating climate protection. Figure 1 illustrates the relationships of traditional OCP sectors to climate protection. While there are many ways to organize an OCP, the diagram's point is to showing how a Climate Protection Strategy should be *integrated* into each of the traditional OCP sectors, along with other strategic lenses, e.g. Sustainability Strategy or Growth Management Strategy. This approach also strengthens the potential for developing policy objectives that are mutually reinforcing, e.g. cost effective infrastructure and low carbon infrastructure, livable and sustainable neighborhood design, etc.

PROCESS SUGGESTIONS

- At the outset of the OCP Process, determine the relationship between climate mitigation and adaptation and traditional OCP sectors. This report recommends establishing a high level climate protection strategy or lens through which mitigation and adaptation will be integrated into the traditional OCP sectors.
- At the outset of the OCP Process, determine the key climate mitigation and adaptation goals and the elements necessary to achieve a strong outcome.

Climate + OCP Sector Relationships



- Vision + Goals** A statement and goals that describe future community form and provide direction about how the community will get there, likely incorporate high level climate and energy priorities.
- Strategic Lenses** Community priorities that influence land use and policy directions. A separate section could flesh out in a high level each of these lenses. Climate Protection, for example, could articulate its relevance and briefly identify how it is addressed in each OCP Sector. The community wide and sectoral greenhouse gas targets could be summarized.
- Land Use Map** Ideally reflecting a spatial appreciation of how to manage energy and emissions, e.g. complete, compact land form has lower GHG intensity. There could be current and future maps showing changes in energy and emissions on a household basis over the OCP period driven by policies and actions identified in the sectors.
- Traditional OCP Sectors** Clear sectoral objectives to support the City's vision and goals, and inform the strategies, policies and actions. It could be appropriate to add detail to sector level greenhouse gas targets.
- Optional OCP Sectors** Additional sectors that may be appropriate. Buildings, and Food and Ag notably have significant climate and energy implications.
- Strategy by Sector** Each sector lays out a more detailed strategy with policies and actions. The climate and energy could be identified along with their relevance in meeting sector-level targets. These contributions could potentially be quantified.

Figure 1 –Relationship between traditional OCP sectors and climate protection

OCP Climate Integration Process

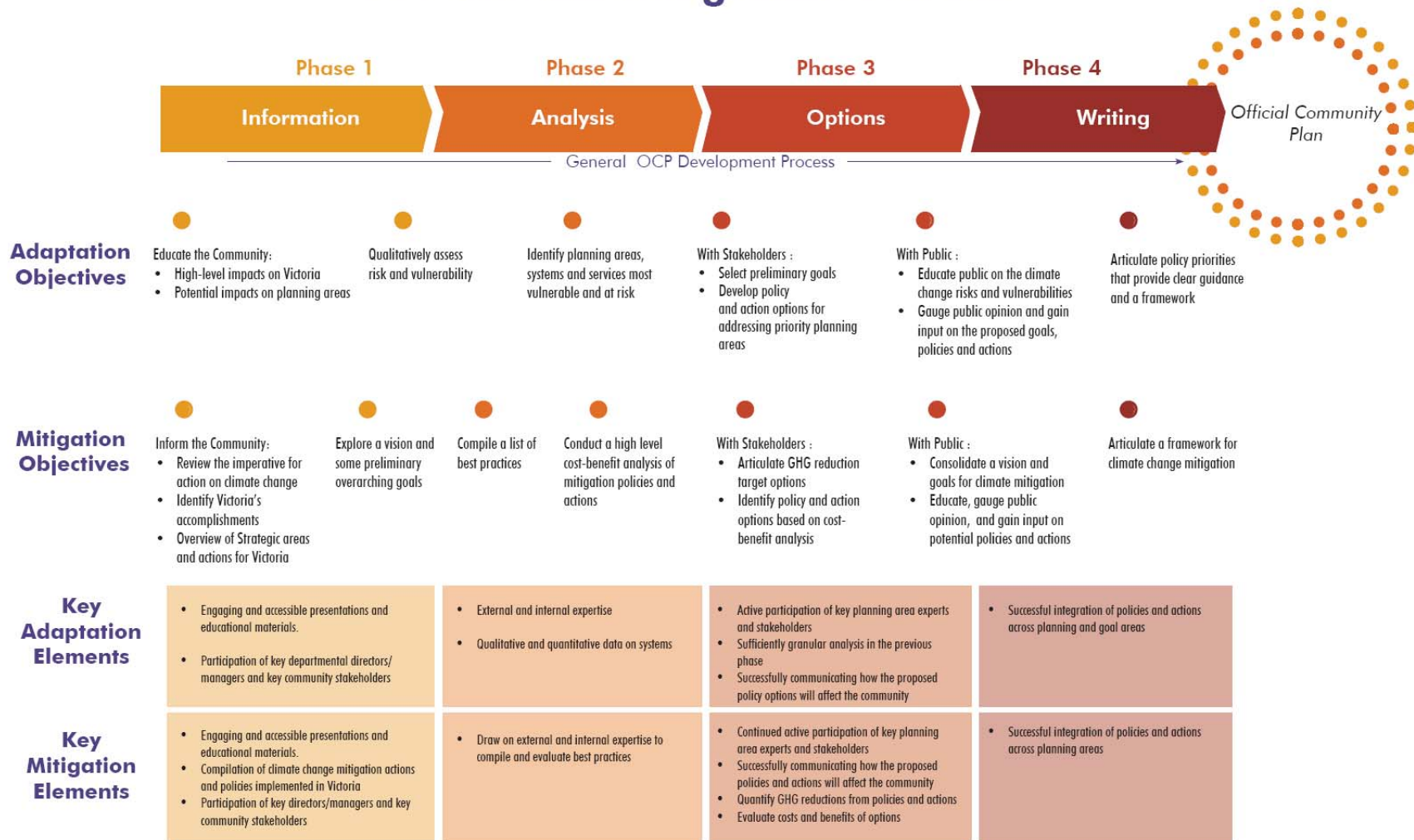


Figure 2: OCP Climate Integration Process

The diagram illustrates how climate protection *could* be addressed in an OCP update. These objectives and elements are discussed in Section Three and Four.

B. BUILDING A “BUSINESS CASE”

Getting traction on big new policy agendas involves establishing a compelling imperative for action, and underscoring the risks of inaction.

Climate programs tend to fail when they focus *exclusively* on emissions and/or climate change. Climate change impacts are slow moving and distributed around the globe. The benefits from deep emission reductions will be enjoyed by future generations and at a global level only if jurisdictions worldwide take collective action.

Local governments with successful climate programs have shown how emission reduction measures compliment other core priorities that resonate with Council, staff and the community, e.g. Sudbury’s interest in community economic development or Portland’s commitment to liveability and integrated land use and transportation.

The most successful emission reduction measures have, in fact, never been driven by a concern about climate change, e.g. London’s investment in public transit and congestion charge, or Stockholm’s fight for energy security. Deep emission reductions in these cases were co-benefits that once calculated consolidated support for existing programs and inspired more intense action.

In attributing success and failure to municipal programs across in the US, Professor Michele Betsill from Colorado State, explains the best programs are inspired by a strategic twist on an old philosophy: “Think Local. Act Local.”¹⁴

To help enable the City of Victoria advance an effective climate agenda with Council, staff and the community, it would be useful to identify local core priorities that dovetail a climate agenda. Ideally, these priorities will begin to form a triple bottom line business case and narrative. Priorities might include:

- Reducing congestion with land use and transportation networks that facilitate transit and active transportation
- Improving affordability by improving housing choice and energy performance, and reducing car dependency
- Strengthening the City’s asset management regime by building lighter, more strategic infrastructure
- Building on Victoria’s established success in premium efficiency developments like Dockside Green
- Reducing resident and business risk to volatile and rising energy prices for electricity, heating, transportation
- Reducing resident and business risk to water shortages by investing in conservation and efficiency
- Reducing resident and business risk to flooding from extreme precipitation events by reducing run off and strategically upgrading infrastructure
- Increasing safety by strengthening the public realm

PROCESS SUGGESTION

- Identify core Council, staff and community priorities that can reinforce a climate agenda.

C. ENGAGEMENT AND PARTNERSHIP

The challenges are so complex, deep rooted and cross cutting, no single office in City Hall can single-handedly advance a successful climate agenda. Meaningful engagement processes are necessary to harness the intellectual, political and financial capital *inside* local government and *out in* the community to make this happen.

PROCESS SUGGESTIONS

- Develop an interdepartmental structure and process that explicitly considers advancing climate protection in the OCP process. (This could be an existing body. What is important is that climate is explicitly addressed.)

¹⁴ Betsill, Michelle. 2001. “Mitigating Climate Change in US Cities: opportunities and obstacles.” *Local Environment*. 6(40): 393–406

- Engage key stakeholders in, and or relevant to the community to consider climate change mitigation and adaptation in the OCP process.

D. MONITORING, EVALUATION AND CONTINUOUS IMPROVEMENT

Monitoring, evaluation and continuous improvement are decisive elements in highly successful climate action plans. Moreover, the provincial government is placing increasingly greater importance on monitoring and performance, e.g.

- Local Government Act's requirements for targets in OCPs by May 2010 – the catalyst of this project
- Climate Action Charter's commitment to carbon neutrality in corporate operations by 2012
- Ministry of Community Development has been exploring development of a Green Communities Incentive System that would use a comprehensive set of indicators across sectors to assess and incent improved performance on sustainability with an emphasis on greenhouse gas emission reduction.

Ideally, the OCP and Bill 27 target setting process helps shape an effective monitoring, evaluation and continuous improvement system. This would include:

- Targets and indicators provide meaningful guidance for policy design and implementation on short and long term basis¹⁵
- Targets and indicators are integrated into departmental business planning and evaluation
- Indicator data is readily accessible, reasonably consistent and tracked long term.
- Targets are defensible, ambitious and achievable with a concerted effort

PROCESS SUGGESTIONS

- The OCP process is used to develop an effective monitoring, evaluation and continuous improvement system composed of meaningful short and long-term targets integrated into broader City of Victoria business activities.

E. GOVERNANCE AND MANAGEMENT OCP CHECKLIST

PROCESS SUGGESTIONS

- At the outset of the OCP Process, determine the relationship between climate mitigation and adaptation and traditional OCP sectors. This report recommends establishing a high level climate protection strategy or lens through which mitigation and adaptation will be integrated into the traditional OCP sectors rather than treating them in isolation.
- At the outset of the OCP Process, determine the key climate mitigation and adaptation goals and the elements necessary to achieve a strong outcome.
- Identify core Council, staff and community priorities that can reinforce a climate agenda.
- Develop an interdepartmental process that explicitly considers advancing climate change mitigation and adaptation in the OCP process. (This could be an existing body. What is important is that climate change is explicitly addressed.)
- Engage key stakeholders in, and or relevant to the community to consider climate change mitigation and adaptation in the OCP process
- The OCP process is used to develop an effective monitoring, evaluation and continuous improvement system composed of meaningful short and long-term targets integrated into broader City of Victoria business activities.

¹⁵ Targets are generally composed of an indicator (the metric) and a performance benchmark (the goal).

3. CLIMATE MITIGATION AND SUSTAINABLE ENERGY

Meaningful energy and emission management will not be a fundamental departure from current City activity. It will be more about an intensification of its leadership in mobility, sustainability, liveability and land use planning. In contrast to most other cities, Victoria has slowed emission growth. Today's challenge is stopping and reversing it. This section includes:

- **Energy and Emission Profile** that looks at historic trends, current activity, future growth, and contrasts the City's emissions with the Capital Region.
- **Strategic Approach** situates energy and emission management within an OCP Update process, provides guidance for setting emission reduction targets, and examines relevance of energy and emission mapping. This part includes a series of *process suggestions*.
- **Taking Action** includes a discussion of each sector's relevance, variables that drive emissions, a strategic approach, and *policy and action opportunities*. Sectors covered are:
 - Land Use
 - Transportation
 - Buildings
 - Waste
- **An OCP Checklist** summarizing the process suggestions and some *preliminary opportunities* selected from the *policy and action opportunities*.

Two short reports will complement this guidance: *Energy and Emission Baseline Mapping* by HB Lanarc, and *District Energy Screening Analysis* by Kerr Wood Leidal Engineering. The *Baseline Mapping* report has geocoded the community's emissions so it is possible to see where transportation, building, and solid waste is generated at neighbourhood level. These emission levels are then explained and guidance is provided to minimize them. The *District Energy Screening* examines supply and demand across the community, preliminarily evaluating some of the locations with greatest potential.

Without too much additional effort, the climate change mitigation component of the OCP Update would enable the City of Victoria to complete the first three milestones of the FCM Partners for Climate Protection Program.¹⁶ Increasingly, local governments are integrating this climate action planning into other activity such as Integrated Community Sustainability Plans or Environmental Plans. A climate change mitigation chapter or subsection of its OCP Update could meet the requirements.

¹⁶ The FCM PCP Milestones are: 1. Create a GHG inventory and forecast 2. Set an emissions reduction target 3. Develop a Local Action Plan 4. Implement the Local Action Plan 5. Monitor progress and report results. (The first milestone is completed in the first part of Section Three of this report.)

A. ENERGY AND EMISSION PROFILE

This profile provides insight into the City's historic and current energy and emissions. It includes:

- Historical emission drivers and trends
- A baseline of current energy and emissions:
- A forecast of emission growth if historic trends were extended forward
- High level emission comparisons with the Capital Region

ENERGY AND EMISSION DRIVERS AND TRENDS

Historical energy and emission data for the City of Victoria was never directly collected. However, by looking at national and provincial activity and adjusting for differences in growth, a crude but reasonable assessment of drivers and trends can be extrapolated.

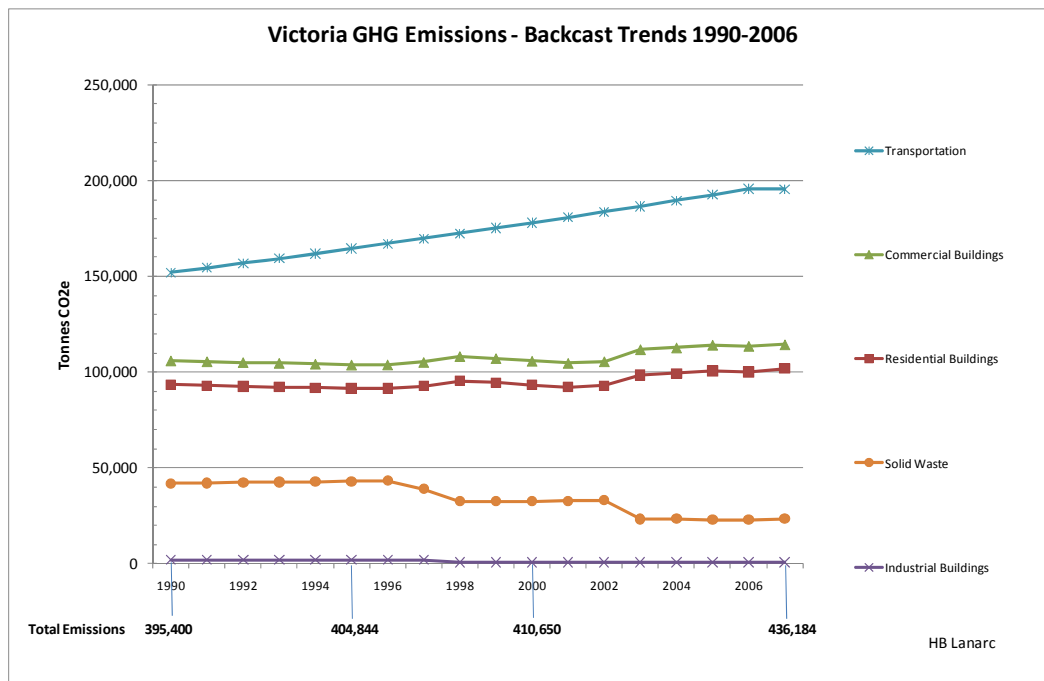


Figure 3 – Backcast GHG Emissions for Victoria, 1990-2006.

In BC, emissions on a *per capita basis* remained relatively constant from 1990 to 2005 while *total* emissions increased close to 30%. Over the same period, population rose 35% from 3.1 to 4.3 million.¹⁷

¹⁷ Based on BC emissions growth rates and adjusted for Victoria historical population growth rates as well as calibration to CEEI 2007 baseline, sources: BC Ministry of Environment, 2007 Environmental Trends in British Columbia: 2007. State of the Environment Reporting. Victoria, BC; Environment Canada, 2007. National Inventory Report 1990-2007, Greenhouse Gas Sources and Sinks in Canada. Greenhouse Gas Division, Environment Canada.

While BC has begun decoupling waste and building emissions from population growth, transportation emissions have outstripped population growth, rising 42% over this period.

Victoria's population has grown slower than BC as a whole since 1990, increasing 9.6%; it is likely, however, that similar emission drivers were in play, meaning per-capita emissions have held relatively constant and community-wide emissions have grown about 8%.

TRANSPORTATION TRENDS

Victoria's emissions growth is largely concentrated in the transportation sector. Emissions in the transportation increased 10% during 1990-2006. This is slightly lower than the BC rate when adjusted by population because of higher than average bike share, some higher density development and the relatively shorter home-work commute. The much greater pattern, nevertheless, is growth and can be attributed to predominantly two key drivers:

- A. A shift away from cars to SUVs, vans, and pickups for personal transportation. (Driven over 25,000 km, an average "light truck" produces about 2 tonnes more greenhouse gases than an average car.¹⁸)
- B. Increase in vehicle kilometres traveled (VKTs) due to rising commuter distances often associated with single use and/or lower density development, including distributed work places.

There is some indication over the last 5 years that *at a provincial level*, this rapid transportation growth has come to a plateau. Early analysis suggests this is attributed to:

- A. Greater density in metropolitan and some surrounding areas. This would include Victoria.
- B. Reduced VKTs and total vehicles insured, potentially due to a combination of fuel price and metropolitan density and mixed use.
- C. A shift back to more efficient cars away from pickup trucks, SUVs, and mini vans.

BUILDING TRENDS

As elsewhere in BC, Victoria has increasingly decoupled building energy use and emissions from population growth. Residential, commercial and institutional emissions in Victoria are estimated to have grown approximately 5% during 1990-2006, lower than the population growth rate. Increased floor space has increased demand for space cooling and heating and increased the number of appliances in homes and equipment in offices.¹⁹ This upward trend in floor space and equipment was significantly offset by improvements in end-use efficiency, and significant improvements in the thermal envelope of houses, higher efficiency heating systems, and

¹⁸ NRCan (Natural Resources Canada). 2007a. Fuel consumption guide 2007. Available at: <http://oee.nrcan.gc.ca/transportation/tools/fuel-consumption-guide/fuel-consumption-guide.cfm>

¹⁹ Natural Resources Canada, 2005. Energy Efficiency Trends in Canada, 1990 to 2003. Office of Energy Efficiency, Natural Resources Canada. Ottawa, Ontario, Canada. #M141-1/2003.

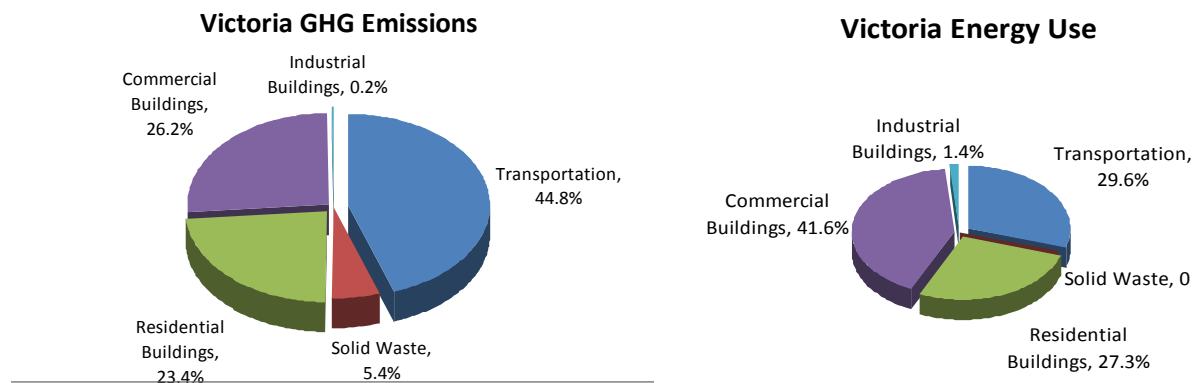
a growing share of more efficient housing typologies on a per unit basis, i.e. multi unit residential vs single detached.²⁰

WASTE TRENDS

GHG emissions from landfill disposal of waste are estimated to have decreased 44% during the period 1990-2006, as a result of the phased installation of a landfill gas capture system at Hartland Landfill and the increased rate of recycling and diverting materials from the landfill. In BC, per capita emissions from solid waste landfill disposal have also declined.

EMISSIONS BASELINE

The graphs below reflect an updated baseline (2007) of energy and emissions by sector. This breakdown indicates overall emissions in Victoria are dominated by transportation and buildings sectors. The updated inventory is based on the 2007 CEEI inventory, with inclusion of fuel oil and wood for residential heating (not included in CEEI) and a different methodology (methane commitment) used for solid waste emissions.²¹ These updates result in increasing the building sector emissions and decreasing the solid waste emissions relative to the CEEI inventory.



Activity	Energy (GJ)	GHG Emission (CO ₂ e)
Electricity	3,248,341	19,851
Natural Gas	2,278,799	116,559
Gasoline	2,281,605	164,397
Diesel	424,955	30,536
Fuel Oil	720,038	51,702
Propane	24,882	7,336
Mobile Propane	10,148	610
Wood	190,472	21,735
Solid Waste	0	23,457
Total	9,179,240	436,183

Table 2: City of Victoria Total Energy and emissions by fuel type, 2007

²⁰ Environment Canada, 2008. Annex 12. National Inventory Report 1990-2007, Greenhouse Gas Sources and Sinks in Canada. Greenhouse Gas Division, Environment Canada. May, 2008

²¹ Fuel oil and wood data is from: SENES Consultants, 2006. *Greenhouse Gas and Energy Use Inventory for the Capital Region, 2004*. November 15, 2006.

Buildings								%	%
	Electricity (kWh)	Natural Gas (GJ)	Fuel Oil (GJ)	Propane (GJ)	Woodstove/ Fireplace (GJ)	Energy Total (GJ)	GHG Total (Tonnes CO2e)	Energy	Emissions
Residential Buildings	338,747,246	370,254	720,038	7,220	190,472	2,507,473		27.3%	
GHG Emissions (Tonnes CO2e)	7,452	18,938	51,702	2,128	21,735		101,955		23.4%
Commercial Buildings	526,630,273	1,908,545		17,662		3,822,076		41.6%	
GHG Emissions (Tonnes CO2e)	11,586	97,621		5,208			114,415		26.2%
Industrial Buildings	36,939,445					132,982		1.4%	
GHG Emissions (Tonnes CO2e)	813						813		0.2%
Subtotal						6,462,532	217,183	70%	50%

Transportation							%	%	
	Gasoline (liters)	Diesel (liters)	Mobile Propane (liters)			Total Energy (GJ)	Total GHG Emissions (Tonnes CO2e)		
Small Passenger Cars	20,734,712	235,518				727,775		7.9%	
GHG Emissions (Tonnes CO2e)	51,782	655					52,437		12.0%
Large Passenger Cars	8,387,083	101,781	25,802			295,286		3.2%	
GHG Emissions (Tonnes CO2e)	20,946	283	39				21,268		4.9%
Light Trucks, Vans, SUVs	30,606,144	325,927	239,156			1,079,469		11.8%	
GHG Emissions (Tonnes CO2e)	76,435	906	364				77,705		17.8%
Commercial Vehicles	3,154,059	4,693,441	112,661			293,713		3.2%	
GHG Emissions (Tonnes CO2e)	7,877	13,045	171				21,093		4.8%
Tractor Trailer Trucks		252,481				9,766		0.1%	
GHG Emissions (Tonnes CO2e)		702					702		0.2%
Motorhomes	1,337,406	49,279	23,329			48,851		0.5%	
GHG Emissions (Tonnes CO2e)	3,340	137	35				3,512		0.8%
Motorcycles and Mopeds	889,824					30,841		0.3%	
GHG Emissions (Tonnes CO2e)	2,222						2,222		0.5%
Buses	718,960	5,328,000				231,006		2.5%	
GHG Emissions (Tonnes CO2e)	1,796	14,809					16,605		3.8%
Subtotal						2,716,707	195,544	29.6%	44.8%

Solid Waste						%	%		
	Tonnes Landfilled	Methane Commitm ent (Tonnes CH4)			Energy Equivalent (GJ)	Total CO2e			
Landfilled Waste	64,162	1,117				0	23,457	0.0%	5.4%

Grand total 9,179,239 436,184 100.0% 100.0%

Table 3: City of Victoria GHG Emissions and Energy Use Summary, 2007 ²²

²² Waste data: Capital Regional District; Fuel oil and wood data: SENES Consultants, 2006. *Greenhouse Gas and Energy Use Inventory for the Capital Region, 2004*. All other data: BC Ministry of the Environment and Hyla Environmental Services, 2009. *Victoria Community Energy & Greenhouse Gas Emissions Inventory: 2007*. April 14, 2009

PRELIMINARY SIMPLE GROWTH FORECAST

The following graphs the City of Victoria’s emissions to 2050 using a “simple growth” scenario. It assumes emissions will follow 2000 - 2007 trends, as well as increasing proportionately with population growth. Under this scenario emissions would grow 15,700 tonnes by 2020 (3%) and 70,141 tonnes by 2050 (16%). For sake of comparison, the BC Government reduction target of 33% reduction below its 2007 levels by 2020 and 80% reduction target by 2050 are also shown. Figure 5 forecasts emission to 2050 broken down by sector.

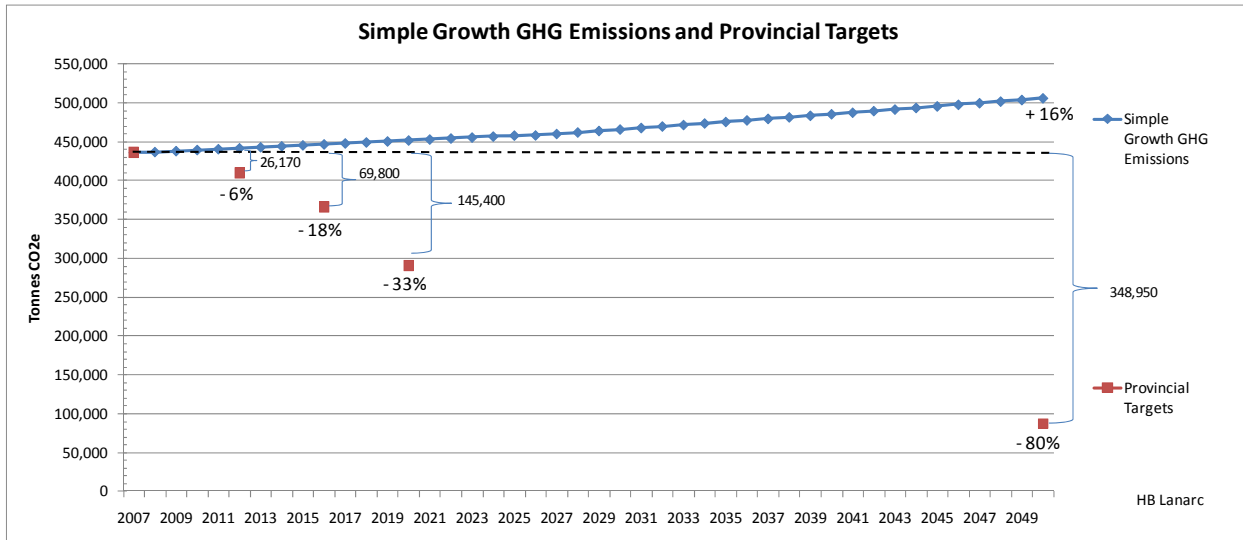


Figure 4 – Comparison of a forecasted Simple Growth Emission Scenario for the City of Victoria and the emission path that would be followed in order to meet the Province’s emission reduction targets.

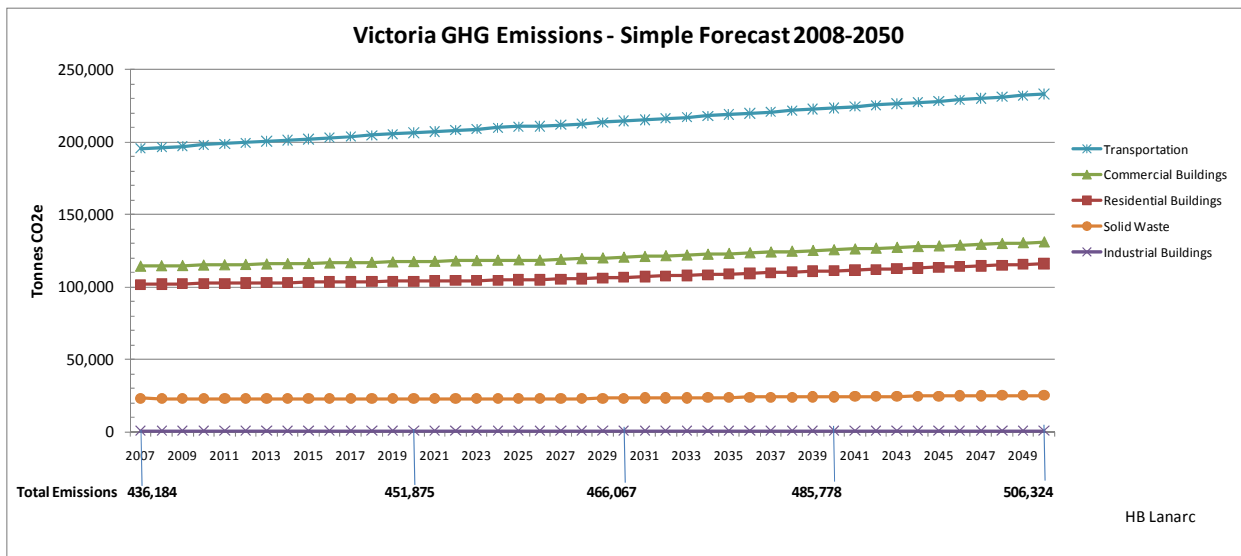


Figure 5 - Simple Growth Forecast in GHG Emissions in Victoria, by sector, 2007 – 2050²³

²³ Annual sector emissions were calculated by multiplying per-capita emissions by sector with forecasted population. 2008-2026 population projection is from CRD (http://www.crd.bc.ca/regionalplanning/factsheets/documents/Pop_Forecast_2026.PDF). Population growth for 2027 through 2050 follows the same growth rate as the 2008-2026. Per-capita emissions for

HIGH LEVEL CRD EMISSION COMPARISONS

In comparison to Capital Regional District municipalities as a whole, Victoria has appreciably lower *household emission intensity*. Victoria can and should be proud of this performance. At the same time, this contrast is typical of most urban regions, i.e. cities with strong central business districts with all the characteristics listed under the *Rationale* (below) tend to have lower emissions than inner suburbs and considerably less than outer suburbs.

Victoria in comparison to most medium-large metropolitan hubs in Canada and North America would, nevertheless, have lower than average emissions. This can be explained by better than average performance on the indicators identified under the *Rationale*: notably more complete, compact neighbourhoods and stronger transit/active transportation infrastructure/participation. This performance would be further accentuated by the mild climate, older population and low carbon content in BC's hydro-powered electricity grid.

The disproportionately larger institutional and commercial sectors (notably extensive government buildings), nevertheless, result in higher overall emissions *per capita* (on a residential basis). Emissions per resident and employee, however, are 20% lower, due to the large amount of employees working in the downtown core. Lower diversion levels and higher volumes of solid waste in the commercial/institutional sectors also increase waste emission per capita.

Emission Indicator		Victoria	CRD	Rationale
Household Emissions Per Capita Per Yr		2.3 tonnes C02	2.8 tonnes C02	Residential emissions (residential buildings, personal transportation) are lower due to lower vehicle kilometers traveled, generally smaller homes, and more active transportation. (This does not include commercial/institutional buildings/waste)
Emissions Per Resident and Employee Per Yr		2.2 tonnes C02	2.7 tonnes C02	Per resident and employee emissions are lower due to lower per capita VKT and residential building emissions
Emissions Per Capita Per Yr		5.2 tonnes C02	4.8 tonnes C02	Per capita emissions are higher due to larger relative share of commercial and institutional emissions in buildings and waste
Transportation Emissions Per Capita (Residential) Per Yr		2.5 tonnes C02	3.1 tonnes C02	Per capita emissions are lower due to higher density; greater land use mix; better active/public infrastructure/use; closer access (proximity) to destinations (grocery store); more local jobs
Modal Split	Auto Driver Auto	53.0%	59.0%	
	Passenger	14.0%	19.2%	
	Transit	9%	6.4%	
	Walk	13%	10.0%	
	Bike	5%	3.2%	
	Other	2%	2.2%	
Average Vehicle Kilometers Per Household Per Yr		2,827	3,607	
Residential Building Emissions Per Capita Per Yr		0.3 tonnes C02	0.4 tonnes C02	Per capita emissions are lower due to more multi unit residential vs single detached, generally smaller single family homes
Waste Emissions Per Capita (Residential) Per Yr		1.0 tonne CO2e	0.6 tonne CO2e	Per capita emissions are lower due to large share of commercial/institutional sector emissions <i>and</i> low diversion in these sectors

transportation and waste were held constant at 2007 levels. Per-capita emissions for residential and commercial building sectors decrease 4% between 2007 and 2026—reflecting recent energy intensity decreases—then held constant to 2050.

B. STRATEGIC APPROACH: KEY CONSIDERATIONS

The strategic approach identifies key considerations for developing integrated measures within an OCP Update. There are three subsections:

- Integrating energy and emission management into an OCP Update
- Target Setting Approaches
- Energy and Emission Mapping

ENERGY AND EMISSION PLANNING IN AN OCP

Integrating sustainable energy and mitigation into an OCP update typically involves learning and applying some novel concepts – many of which are intensely cross cutting in nature, and are most effective integrated into existing planning areas. The following process, shown graphically in Section 2.A, *Integrating Climate into an OCP*, articulates key objectives and elements at typical stages of an OCP Update.

EDUCATION/LAUNCH: PROCESS SUGGESTIONS

Objectives

- Inform the community. Some engaged community members and stakeholders will be very familiar with climate change concepts and the need for action. Most won't. Outreach should focus on:
 - Exploring the imperative for action and broader community co-benefits.
 - Victoria accomplishments to date.
 - Overview of areas and actions that could be most strategic for Victoria
- Explore a vision and some preliminary overarching goals. Inform the community on the connection among climate, transportation and renewable energy goals and explore how they are related to other core community and municipal priorities.

Key Elements

- Conduct an inventory of sustainable energy/mitigation actions and policies implemented to date.
- Participation of key directors/managers and key community stakeholders (experts/potentially impacted) in areas of planning, land use, transportation, and integrated resource management.
- Engage the community to explore the climate action imperative, and mitigation opportunities.

ANALYSIS: PROCESS SUGGESTIONS

Objectives

- Compile a list of best practices
- Conduct a high level cost-benefit analysis of potential actions, consider the range of evaluation criteria

Key Elements

- Draw on expertise external and internal to the community to compile and evaluate best practices. Because of time constraints for analysis, it will likely be necessary to analyse some costs and benefits qualitatively. Active engagement of planning area experts and community stakeholders will be helpful.

OPTIONS: PROCESS SUGGESTIONS

Objectives

- With stakeholders:
 - Articulate potential GHG reduction target options informed by analysis of potential actions
 - Develop policies and action options shaped by evaluation criteria
- With public:
 - Consolidate a vision and goals for climate mitigation that resonates with the community.
 - Engage the public on potential policies and actions in each sector to meet different GHG reduction target options
 - Gauge public opinion on actions that emerged as top priorities based on evaluation criteria

Key Elements

- Continued active participation of key planning area experts and stakeholders
- Evaluate costs and benefits of various options at a qualitative or high level.
- Quantify GHG reduction from policies and actions to inform target options, and provide guidance for policy and program development
- Communicate the proposed actions impact on the community and the cross-linkages among departments

WRITING: PROCESS SUGGESTIONS

Objectives

- Articulate a framework for climate change mitigation with clear goals, policies and actions that provides strategic guidance.

Key Elements

- Successful integration of policies and actions across planning areas and priorities.

TARGET SETTING APPROACHES

Given the new OCP content requirements, local governments are particularly interested in targets. It is, therefore, useful to understand target setting methodologies and specific types of targets.

An individual local government's energy and climate knowledge, and the stage in its planning cycle will likely influence the nature of those targets as well as the rigour of the process. Moreover, it is logical that a local government will go through a variety of processes where these targets are refined. Although, the City of Victoria

has not developed an Energy and Emissions Plan, it is at a relatively advanced stage of development in understanding energy, climate and the respective policy tools that can be deployed.²⁴

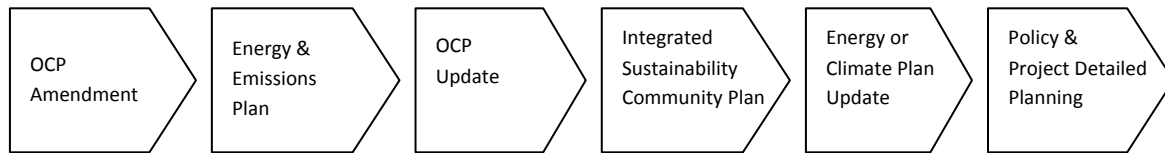


Figure 6 - Different stages in the planning cycle can demand a different rigour in target setting and different genre targets.

There are a wide variety of methodologies that can be simplistically generalized as *top down* or *bottom up*.

Top Down: Conventionally, most national, local and institutional targets have been symbolically informed by scientific (e.g. Intergovernmental Panel on Climate Change) or political (e.g. Kyoto or BC Government) developments. This is a top down approach and was an important first step in demonstrating political support.

Bottom Up: More methodical approaches quantify the GHG reduction of specific policies and measures against an empirically derived baseline. There is a grand diversity of approaches with varying degrees of rigour in bottom up approaches, too, e.g. they can be roughly informed by precedent or modeled. Once again, depending on the energy knowledge and stage in planning, expectations can change.

These different methodologies, moreover, are not mutually exclusive. The BC Government is conducting more and more bottom up analysis to determine how to achieve its top down established target. The various Kyoto targets of many European countries, e.g. Germany, Sweden, UK, were politically established and they subsequently developed plans with quantified sectoral targets and have also met them.

DEFENSIBLE TARGETS

The urgency of our energy security and climate stabilization challenges will ultimately demand more defensible and strategic quantitative evaluation of policies and actions of all levels of government. For this purpose, target setting should provide meaningful guidance for policy and program development, and support ongoing measurement and monitoring for staff, council, and the community.

Such targets, therefore, would be characterised by:

- Aggregate benchmarks: per capita and community-wide energy and emissions
- Meaningful benchmarks using relevant indicators for staff, council and the community:
 - Buildings, e.g.: single detached/high rise/low rise mix, retrofit rates, new building performance beyond code...
 - Energy Supply, e.g.: district energy or solar thermal by area or building type, renewable power take up rates by neighbourhood type
 - Transportation, e.g.: transit route/cycle path KM growth (% per annum), mass transit, average headway between buses by key routes, vehicle fuel source, modal split...

²⁴ Evidence of this includes Victoria's transit and bike infrastructure, Docksider Green, higher density/mixed use development

- Land Use, e.g.: concentration of development in CBD, land use mix, household emissions by neighbourhood,
- Waste, e.g.: composting, recycling, reduction...
- Other, e.g.: local employment, forest carbon, community garden coverage
- Various benchmarks (targets) along meaningful horizons, e.g.: annual; short term (2020, BC climate milestone); medium term (OCP horizon) and long term (2050, BC/Global climate milestone, ICSP horizon)

Moreover, targets should have a critical appreciation of the authority and influence of local governments, as well as that of senior levels of government. The deep emission reductions articulated by the province are not possible to achieve at the local government level without active engagement by the province and other key players like BC Hydro.²⁵

PROCESS SUGGESTION

- Given its size and sustainability sophistication, the City could develop a range of defensible targets on a community-wide and sectoral basis with a quantified bottom up approach. Targets should be established at relevant milestones, e.g. annual, short term (2020), medium term (OCP horizon) and long term (2050 or ICSP horizon). Targets should provide policy guidance, and support ongoing measurement and monitoring.

SPATIAL ENERGY AND EMISSION MAPPING

The spatial dimensions of energy are profound in every major sector:

- **Transportation**, e.g. low density, single use, isolated developments are driving increased single passenger vehicle distances and emission growth
- **Buildings**, e.g. the best way to double *per capita* building performance is to transition from single detached to multi unit dwelling of various forms
- **Energy supply**, e.g. density=heat density; mixed use=load balancing; these are primary considerations for establishing a business case for district energy

Given these spatial implications, energy and emission mapping is capable of supporting several objectives:

- Map current energy demand and supply relationships to gain insight into the energy and emission intensity of different neighbourhoods.
- Adjust these energy relationships with different futures, mapping out the energy and emission implications of different scenarios in order to adjust policies and plans to optimize performance
- Graphically illustrate expansion of transit routes and ridership, changes in housing density and use-mix, vehicle-kilometres-traveled per capita, and district energy connections and the associated benchmarks to guide these policy changes.

Energy and emission mapping is a powerful new tool for OCP processes. It is by adjusting many of the fundamental elements of OCPs, local governments are able to make the biggest changes to energy and emissions, notably:

- Location of Residential and commercial growth, and the nature of these buildings (attached, high/low rise, etc.)

²⁵ These targets, moreover, are roughly in line with best scientific evidence regarding what has to be achieved to avoid dangerous runaway climate change.

- Location and phasing of water and sewer systems
- Location, nature and connectivity of transportation networks
- Location of public institutions and parks

Energy mapping can powerfully illustrate the relationship between energy and emission planning and other core local government activities

While community energy and emission mapping is in its infancy, there are a number of Canadian examples:

- Building and energy supply mapping of Calgary (current state and future scenario) by Canadian Urban Institute
- Transportation, building and energy supply mapping of Langford, District of North Vancouver, City of North Vancouver, Coquitlam, Markham and Ottawa/Gatineau (current state and future scenario) by HB Lanarc
- Building, transportation and energy supply mapping, and examination of synergies between CMHC land use and transportation model and standard transportation model (EMME) for Prince George by HB Lanarc & NRCan
- Several neighbourhood scale energy maps per community done in a variety of Canadian communities (current state) by NRCan
- Heat demand and renewable heat supply (current state) of the Capital Regional District completed by KWL

The City commissioned preliminary baseline energy and emission mapping. These brief reports are: *Energy and Emission Baseline Mapping* (HBL) examining transportation, buildings and energy supply, and waste: and *District Energy Screening Analysis* (KWL) examining heat demand and district energy supply opportunities. These reports are currently being finalized.)

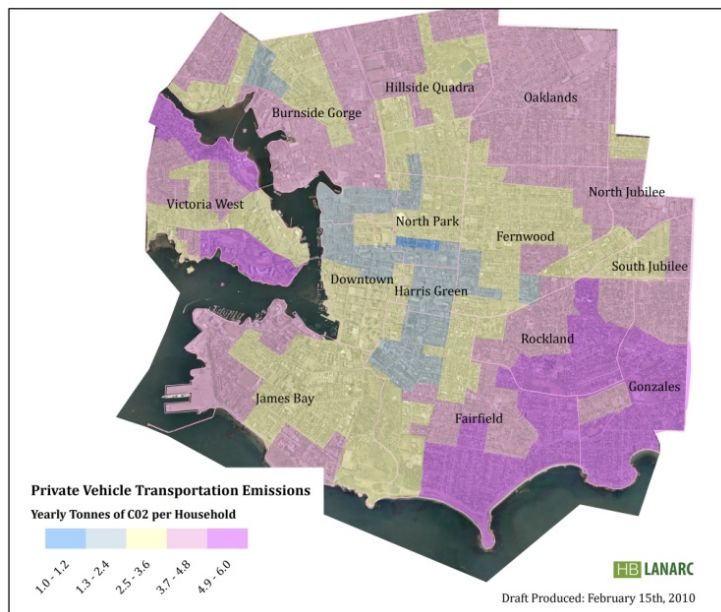


Figure 7: This map showing private transportation emissions by household and neighbourhood per annum is part the Victoria Energy and Emissions Baseline Mapping Report complementing this OCP Discussion Paper.

PROCESS SUGGESTION

- The City should build on its baseline modeling and mapping to explore the energy and emission implications of different land use and development OCP scenarios.

Box: 1. Innovative Financing

Financing is often considered the greatest barrier to climate change mitigation and sustainable energy. This is partially due to a lack of revenue. It also be due to contrasting incentives of different parties. It can also be “first cost orientation,” the preoccupation with initial capital costs versus longer term operation and maintenance costs.

Successful activity depends on *improved analysis* and *innovative tools*.

Improved Financial Analysis

Some of the more important processes for strengthening financial analysis include:

Life cycle analysis: Evaluate the full operational, maintenance and capital costs over an investment’s entire life cycle, rather than just the original capital cost.

Integrated design processes: Key players in building, financing, and using infrastructure are brought together at the front end. By sharing knowledge, superior infrastructure can be built often at or below conventional prices.

Integrated resource management: An ecosystem based approach to coordinating resources, including waste, so that the long-term sustainable benefits are optimized and conflicts among users are minimized.

Innovative Financial Tools

Revolving fund: Permanent funds that provide low or zero interest loans to public and private projects. Loans are re-paid based on savings from reduced energy bills and maintenance costs or new revenue, which are then reinvested in future projects. Toronto’s Better Buildings Partnership will have retrofitted 40% of the city’s commercial and institutional buildings through this mechanism.

Recycling fund: Savings or revenue generated from an initial seed investment are kept to reinvest in other projects. This mechanism has the potential to grow into a massive sum. The Borough of Woking outside London built successive combined heat and power systems clear across a large downtown area.

Performance contracting: Companies delivering services finance some or all a project and recoup their money though the savings in operation and maintenance costs or new revenue. Can be used in retrofits and renewable s.

Land use and development tools: While not typically considered financial tools, many traditional local government planning and development tools can be used to reduce costs for developers, incentivize sustainability and/or internalized the real cost of business to support more sustainable decisions. They include:

- Parking bylaw variance for less underground parking in exchange for alternative transportation investment
- Variable development cost charges to reflect higher costs of low density, isolated developments
- Revitalization Tax Exemptions to reduce costs for innovative design
- Density Bonusing for premium efficiency buildings or transit oriented development
- Development Permit Fast Tracking for sustainable developments
- (Re)Zoning conditional on meeting climate or energy criteria

C. TAKING ACTION

Taking meaningful action to manage energy and emissions will not be a fundamental departure from current activity. It will be more about an intensification of leadership in mobility, sustainability and liveability. In contrast to most other cities, Victoria has slowed emission growth. Its challenge now is stopping and reversing it.

Two short reports currently under development complement this guidance: *Energy and Emission Baseline Mapping* by HB Lanarc, and *District Energy Screening Analysis* by Kerr Wood Leidal Engineering.

Emission and energy management opportunities are organized under strategic objectives by energy end use or emission sector, preceded by land use given its overarching influence on transportation and buildings.²⁶

- Land Use
- Transportation
- Buildings
- Waste

D. LAND USE

Land use profoundly influences performance in the big emission sectors:

- **Transportation:** In the vast majority of BC and North America, the fastest GHG growth is in transportation. A major driver is low density, single use development. *High density, mixed use* development, in contrast, reduces driving distances 20-40 %, translating into a 18-36% GHG reduction compared to business-as-usual.²⁷
- **Buildings:** The most effective approach for local governments to double per capita energy performance is to move from single detached to any type of multi unit residential building – this improves thermal performance by reducing exposed walls and generally reduces building size.
- **Energy Supply:** Higher density, mixed use developments are more conducive for higher performance, low carbon heating and cooling systems, notably district energy systems

Local Government Influence

If there is one sector in which local governments have paramount influence, it is in land use. They have the authority to create, adopt, and implement a wide range of measures.

KEY VARIABLES

Land Use & Transportation

Empirical evidence shows a number of key land use variables impacting transportation-related GHGs.²⁸

²⁶ While they have considerable merit, broader ecosystem opportunities were not examined as part of this study, e.g. enhancing carbon in forests or reducing upstream transportation emissions through urban agriculture.

²⁷ These figures are based on a meta analysis of numerous US studies. The underlying development patterns, nevertheless, are similar. Source: Ewing, Bartholomew, Winkelman, Walters, and Chen, 2002. *Growing Cooler: The Evidence on Urban Development and Climate Change, Smart Growth America.*

1. **Neighbourhood Context and Design:** There is between a 36-60% difference in per capita emissions based on people living in a) Conventional Suburban (outer area), b) Medium Density (Inner Suburb), and c) Traditional Development (Inner Area)
2. **Location of Employment Centers:** Proximity to central business district and other employment areas. An increase in the number of jobs within a 5 km radius greatly reduces VKTs
3. **Proximity to Transit and Transit Frequency:** For each additional 400 metres from home and work, there is an associated 16 and 32% *reduction* in transit use respectively (Frank et al, 2008). Areas within walking distance (1 km radius) of rapid transit achieve transit modal shares several times higher than those that are not.
4. **Density:** There is a strong relationship between density and VKTs, and there is also a correlation between a lot of the variables associated with density, e.g. transit and employment accessibility. Ewing et al (2008) estimate a 0.75% decrease in VMT for every 1% increase in population density.
5. **Land Use Mix:** 20% increase in the likelihood walking for each additional institutional and recreational facility within a 1 km network from home. People with 2X the density, diversity of uses, accessible destinations and interconnected streets drive 1/3 less than comparable residents of low-density places (Frank et al, 2008).
6. **Walking, Bicycle, and Transit Connectivity:** Although density and mix determine proximity of activities, connectivity determines directness.
7. **Street Density and Lane Kilometres:** Denser networks of roadways (measured by higher number of intersections) leads to more route choices for pedestrians and cyclists. Traffic expands to fill the space available. A 1% increase in lane miles induces a 0.9 per cent increase in VKT within 5 years (Hansen, 1995)
8. **Cycling Network Connectivity:** Higher ratio of on-street or total bike routes to total roadway lengths within a traffic zone reduces VKTs.
9. **Pedestrian connections and comfort:** Residents living in the most walkable neighbourhoods drive 26% fewer km per day than those living in lowest density, least mixed use areas (Frank, et al. 2007). Walk mode shares can rise 20% or more in mixed-use neighborhoods even *without* high quality transit service (Ewing et al. 2008)
10. **Parking:** Parking can be an effective policy lever if supply and location are strategically conceived. Increasing parking costs at work destinations by \$0.50 decreases auto VKT by 3.4% (Hunt Analytics Inc. 1999)

Land Use & Buildings

Several land use variables powerfully impact energy and emissions in buildings:

1. **Building typologies:** Building typology dramatically impacts energy performance. Multi unit residential buildings have twice the per capita energy performance of single detached homes.
2. **Building size:** Over the last 20 years, one of the biggest factors driving emission and energy growth in new buildings was the increased size of homes.
3. **Low-impact heating opportunities:** Land use planning can maximize some renewable heating opportunities, e.g. access to waste heat from sewage, creating the preconditions for viable district energy systems such as density and mixed use, using greenspace adjacent to heating demand for geo-exchange.

STRATEGIC OPPORTUNITY

The aforementioned variables point to a strategy with four strategic objectives:

1. **Complete:** Strengthen opportunities for walking, cycling and transit, and low impact energy supply by supporting a form and diversity of mixed use development consistent with neighbourhood characters, encouraging development of appropriate key destinations, e.g. neighbourhood grocery stores and parks
-

²⁸ List is informed by a CMHC study, and corroborated by the cited analysis. (CMHC: IBI Group. 2000. *Greenhouse Gas Emission from Urban Travel: Tool for Evaluating Neighborhood Sustainability.*) Variables are similar to those in: Litman, Todd. 2008. *Land Use Impacts on Transport: How land use factors affect travel behaviour.* VTPI. (Latter study did not use GHG or energy metrics)

2. **Compact:** Strengthen building and transportation performance and low impact energy supply opportunities by concentrating development around neighbourhood centres and the central business district using contextually appropriate building types, e.g. secondary suites, laneway housing, townhouses, low rise, high rise.
3. **Connected:** Ensure pedestrian, cycling, transit and road network connectivity to facilitate efficient mobility.
4. **Centered:** Continue to strengthen the concentrated employment destination and major commercial district to support successful and efficient active transportation and transit, and overall economic and social vitality.

These objectives should be re-worked into a strategy that speaks more specifically to Victoria. This strategy could include meaningful, bold objectives like establishing Victoria as North America’s smart growth capital. The thrust of the strategy is about deepening the existing leadership of the City, not a fundamental departure. This strategy will involve collaborating with the Capital Regional District.

Box 2. Community Energy and Emission Planning Concepts

To facilitate strategic decision-making, key concepts can be articulated through **Community Energy Planning Spatial Principles** and the **Sustainable Energy Hierarchy**.

Community Energy Planning Spatial Principles

Land use planning has a profound influence on energy and emissions.²⁹

The larger the spatial scale, the greater the impact on energy use, i.e. land use and infrastructure decisions at a community or regional scale have a more profound impact on energy than site-scale decisions about individual furnaces and vehicles. At larger scales, it is possible to plan for systemic, integrated opportunities like rail or district energy networks that profoundly change energy profiles. This larger scale requires longer implementation periods.

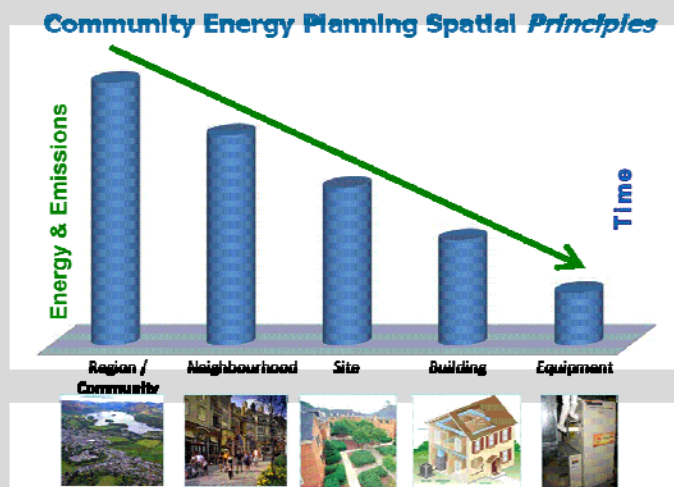


Figure 8 – Community Energy Planning Spatial Principles

Portland and Multnomah County, for example, is one of the few regions in North America that has brought emissions back down close to 1990 levels. The achievement was possible in part because of an integrated land use

²⁹ Two studies illustrating these relationships: Jaccard, M, L Failing, and T Berry. 1997. “Community Energy Management and Greenhouse Gas Reduction” *Energy Policy*. 25(13) pp 1065-1074; and Owens, Susan. 1992. “Land Use Planning for Energy Efficiency.” *Applied Energy*. Vol 43 pp 81-114.

and transportation agenda started in the mid 1970's. Portland's emissions gradually slowed and then peaked in 2002 and have dropped precipitously since.

Changing boilers in individual buildings can happen rapidly and alter the energy profile of those buildings significantly but not profoundly change a community's overall energy profile. Moving an entire neighbourhood of boilers onto a district energy system will have significantly more of an energy impact and also much more time.

The community energy planning spatial principles are characterized in this chart. The light blue line shows impact of different spatial scales on energy. The dark blue bars show implementation time frames. To make the depth of emission reductions necessary to avoid dangerous climate change, it is important to operate at all scales.

Sustainable Energy Hierarchy

The Sustainable Energy Hierarchy has driven sustainable energy planning in much of Europe, known there as *Trias Energetica*. In the North American context, it has also been applied in leading jurisdictions and is often known as the *California Loading Order*. The sustainability imperatives address reduced energy expenditures, reduced dependence on non-renewable fossil fuel, and improved environmental performance.

The concept was originally applied to buildings, energy supply and transportation fuels. However, it can equally be applied to land use and broader transportation planning, which, as discussed above, powerfully influences energy demand as well as the potential for maximizing low impact renewables, e.g. the heat density achieved in high density neighbourhoods strongly influences the business case for district energy systems.

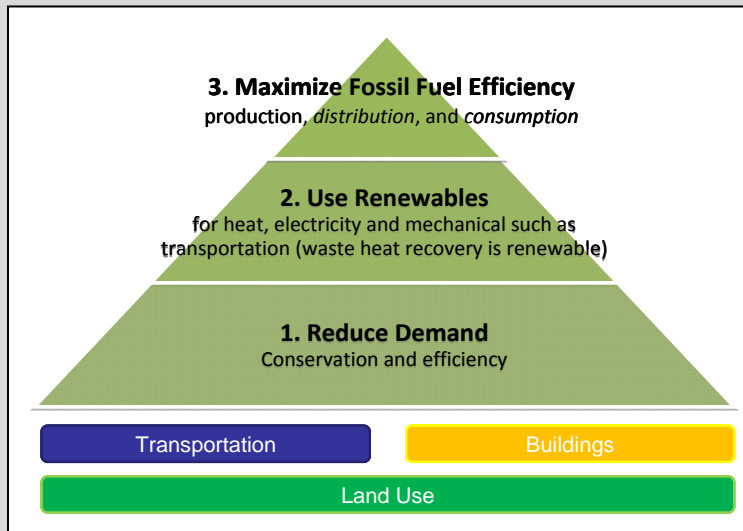


Figure 9 – Sustainable Energy Hierarchy

POLICY AND ACTION OPPORTUNITIES

This section identifies a range of potential policies and actions that could be used to address the four key points above. It also identifies some potential preliminary priorities, some that could be included in an OCP and some that could be addressed through other initiatives. The OCP could identify development of some of these opportunities outside of the OCP.

POTENTIAL POLICIES

Official Community Plan: The key elements of an OCP are fundamentally related to the four strategic objectives. Policies should be developed to ensure opportunities are maximized:

- Location, building types, and density of residential and commercial growth
- Location, nature and connectivity of all transportation networks
- Location of public institutions and parks
- Location and phasing of water and sewer systems

Zoning Bylaw: This is a key regulation for creating land use mix, building types, and designating the concentration of development. Zoning controls lot size and shape, lot coverage, density, siting, parking requirements, which are factors in creating compact and efficient development.

- Focus new development in mixed use, high density nodes and corridors served by active transport networks and transit and close to jobs; continue to focus major employers in the downtown core. | *preliminary priority*
- Increase residential development within walking distance of transit stops and shopping. Strategically increase key destinations (e.g. grocery stores) and employment densities around transit. | *preliminary priority*
- Provide parks and playing fields within walking distance or residential areas. | *preliminary priority*
- Increase diversity of land uses and key services within neighbourhoods. | *preliminary priority*

Financial Plan: Long term capital and operating planning are an opportunity to advance smart land use and climate change action, as well as improve local government fiscal performance.

Development Permit Area Guidelines: DPs can address ecological protection, revitalization, form and character, energy and water conservation, and GHG reduction, articulating how development and design should meet land use and climate protection at a site or neighbourhood level. Guidelines may aim to achieve interaction among uses, creation of vibrant, people-friendly streets, and potentially energy efficient site and building design, notably passive elements. | *preliminary priority*

Subdivision and Development Control Bylaw (including street design standards): Opportunity to require efficient street design (including roads, sidewalks, boulevards, parking, bike lanes) that is attractive and suited to multiple modes of transportation. Also an opportunity to save costs and increase resilience to climate change by combining infrastructure functions, like roads and stormwater management through features like swales.

Density Bonusing: The rezoning application process, which creates a lift in property value with more valuable permitted uses, is an opportunity to leverage community amenities in exchange for greater development density. | *preliminary priority*

Fast Tracking: A speed incentive for development applications with site location and design that meets determined objectives of smart growth land use and climate change action (e.g. site in existing area, green building design, desired uses like employment).

Sustainability Checklist: Educate and encourage development to meet smart land use and climate goals through the development and building permit process. It can be connected to other tools like rezoning and density bonusing to become more of a hard policy tool. The City may want to strengthen their existing sustainability statement to take advantage of broader energy and climate objectives in the strategy.

POTENTIAL ACTIONS

The following is just one predominantly land use-oriented, the City may want to pursue:

Low Carbon Quarters & Low Carbon Corridors: Building on Victoria’s achievement with Dockside Green, identify several representative neighbourhoods or zones to support development of ultra low carbon projects. These projects would include low carbon land use, building, energy supply (potentially smart grids), and transportation. Different neighbourhood typologies would allow a relevant examination of the options in each sector, e.g. appropriate key destinations and renewable energy are different in predominantly single family neighbourhoods versus high density, predominantly commercial downtown cores. Policies and design guidelines would be developed with the intention that they could be transferred to similar neighborhoods. Potentially engage other partners like utilities, energy service companies, anchor tenants or developers. | *preliminary priority*

E. TRANSPORTATION

Transportation has been the City’s fastest growing emissions source. The sector accounts for 45% of Victoria’s greenhouse gases, mostly from private automobiles.

The subsection focuses on transportation mode – automobile, transit, walking, bicycling – and transportation networks. Mode choice and distances traveled are strongly influenced by *land use* discussed in the subsection above.

Local Government Influence

Local governments have immense influence over land use which lays the groundwork for establishing an efficient, low carbon transportation system. Local governments also have significant influence over street networks and designs, active transportation systems, parking policies, and many elements of transportation demand management. Victoria does, however, rely on and must work with BC Transit, the Province and sometimes the Federal Government for transit and other infrastructure. Given the Capital’s fundamentally regional transportation dynamic, Victoria works closely with the Capital Regional District on integrated land use and transportation planning.

Co-Benefits

Some of the benefits of efficient, low carbon transportation systems include:

Reduced infrastructure costs: More compact development saves approximately 11% on capital for road infrastructure and 4% annually on operations and maintenance over sprawling development.

Reduced Congestion Time and Money: Car oriented transportation systems reduce freight and personal transportation efficiency amounts to significant losses in time and money.³⁰

Healthy communities: As well as driving 30% less, people make 5-10 times as many trips by foot or bike in communities with double the density of typical sprawling areas.³¹ People in walkable neighborhoods are less likely to suffer from obesity, heart disease, high blood pressure, depression, adult-onset diabetes.³²

KEY VARIABLES

The key variables influencing transportation energy and emissions by travel mode are:

³⁰ Conference Board of Canada attributes congestion to car-oriented transportation planning in *Mission Possible: Successful Canadian Cities*. 2007; Congestion costs in Canada’s largest nine cities \$2.3-3.7 billion annually (Transport Canada, 2006)

³¹ 2007 Natural Capitalism Solutions, Local Action Plan Best Bets in Chapter 5, Climate Protection Manual for Cities, <http://www.climatemanual.org>

³² Go for Green Fact Sheets: Making the Case for Active Transportation (2000), at Built Environment and Active Transportation, Resources & Useful Links <http://www.physicalactivitystrategy.ca/index.php/beat/links/>

- Mode Choice
 - Private automobile (+ number of passengers), Transit (+ number of passengers), Walking, Bicycling
 - Private vehicle efficiency and fuel source
 - Public transit fleet efficiency and fuel source
- Vehicle distances driven (vkmt: vehicle km traveled)
- Passenger distances ridden on transit (pkmt: passenger km traveled)

Mode choice and distance are profoundly influence by land use discussed in the sub-sector above.

STRATEGIC OPPORTUNITY

These variables and the City’s influence should inform a strategy whereby Victoria selectively advances opportunities, and works with senior governments and agencies to meet the following strategic objectives:

1. **Improved Transportation Choice:** Enable residents and visitors of diverse abilities to have a range of mobility options: walking, cycling, taking transit, car pooling, and traveling by car.
2. **Multi-Modal Integration:** Strengthen seamless transitions between modes.
3. **Reduced Automobile Travel Distance:** Reduce annual per capita vehicle kilometers traveled.
4. **Automobile Efficiency:** Support vehicle fuel efficiency improvements.
5. **Transportation Network Enhancement:** Strengthen and extend the existing network focusing on transit and active transportation elements.
6. **Integrated Land Use & Transportation:** Build on the city and region’s land use and economic development planning to strengthen mobility.
7. **Senior Government Engagement:** Encourage collaboration and investment in transit and active transportation.

While reasonably consistent with the City and CRD’s policies and plans, these objectives should be re-worked to speak more specifically speak to the community. This strategy could include meaningful bold objectives like establishing Victoria as North America’s cycling, walking or active transportation capital. This strategy will involve collaborating closely with the BC Transit, the Province, as well as the Federal Government and the CRD.

POLICY AND ACTION OPPORTUNITIES

These opportunities should be advanced to address the strategic objectives as part of an integrated process with other objectives raised during the OCP Update. Given many of these policies and plans will not be updated as part of the OCP, the OCP could identify key climate and energy priorities to be considered in future planning processes, such as the development of a Transportation Master Plan.

Transportation Plans: These opportunities are identified in a manner consistent with Victoria’s various plans.

Integrated Transportation Plan: Enrich the existing Plan, potentially addressing: | *preliminary priority*

- **Transit Stops:** Strategically increase the number and quality of transit stops in locations with sufficient residential or employment density.
- **Enhanced Transit:** Examine opportunities for strategically increasing transit frequency, hours and speeds along key routes; and adding key routes. This may include development of bus rapid transit, light rail or a staged approach on some of the City and Region’s key corridors. | *preliminary priority*

- **Multi Modal Transportation Hubs and Nodes:** Establish a network of primary multi-modal transportation hubs and secondary nodes starting with one major focal point for connecting a diversity of modes and potentially situating a car share network. Ensure the public realm is vibrantly supported with strong social and economic elements and good design. | *preliminary priority*
- **LEV Vehicle Promotion: Enhance programs that promote low emission vehicles.** Provide premium parking stalls at reduced rates to low emission vehicles including electric bikes, require installation of plug-in outlets in new buildings, and private and public parking areas.
- **Community Car Sharing:** Encourage car sharing by allowing developers to reduce parking for car share lots, providing free access to premium City parking, and replacing some of the City's fleet with car share vehicles. | *preliminary priority*
- **Transportation Demand Management:** Strengthen demand management measures such as:
 - **Telework & Flextime:** Encourage local employers to consider telework and flextime opportunities.
 - **Parking:** Ensure full costs of on street and off street parking are borne directly by users (particularly commuters); reduce parking where transportation choice exists; take advantage of cash-in-lieu of off-street parking authority.
 - **High Occupancy Vehicle Lanes:** Shift key existing lanes to car pooling and transit.
 - **Traffic Calming:** Improve safety and encourage opportunities for pedestrians and cyclists.
 - **Walking School Bus:** Encourage active transportation in children.
- **Complete Streets:** Develop a complete streets framework to design a range of streets for all modes of transportation and consider relevant social, environmental and commercial activity; take advantage of subdivision and development control bylaw.
- **Site, Neighbourhood, City, Region Network Coherence:** Link efficient, low carbon transportation networks across relevant scales.

Bicycle Master Plan: Enrich existing Plan; use development permit areas where appropriate. | *preliminary priority*

- **Commercial/Institutional End of Trip Facilities:** Require these buildings to provide facilities including changing rooms, showers and secure bicycle storage adequate for the number of employees.
- **Residential End of Trip Facilities:** Require these new buildings to have secure bicycle storage and electric plug-in recharging outlets suitable for charging an electric bikes.
- **Key Destination Bike Infrastructure:** Establish strong infrastructure (accessible, safe, secure, sheltered) at key destinations, downtown and in commercial nodes
- **Enhanced Network and Infrastructure:** Strengthen safety, connectivity, density, signage and public realm of network and connectivity to other modes to enable a wide variety of users.

Pedestrian Master Plan: Enrich the existing Master Plan, use development permits where appropriate; and consider: | *preliminary priority*

- **Pedestrian Infrastructure:** Strengthen pedestrian infrastructure for a wide diversity of users and consider additional sidewalks, curb ramps, automated crosswalks, signage, trees, shading, public realm and safety.
- **Enhanced Network:** Strengthen density and internal connectivity, and connectivity to other modes.

F. BUILDINGS AND LOCAL ENERGY SUPPLY

This sector focuses on the efficiency of the building envelope, renewable energy that could be deployed at the building or site scale, and technologies associated neighbourhood scale low impact energy supply, like a district energy system that supplies heat and cooling to a whole number of buildings. Building performance can also be improved through land use planning, e.g. multi-unit residential versus single detached. This is addressed in the previous section.

Buildings account for 70% of energy use, and 50% of emissions in Victoria.³³ Although commercial buildings consume much more energy than residential, the dominance of BC's low carbon electricity in residential (predominantly hydroelectric) means total commercial and residential GHG emissions are roughly equivalent.

Local Government Role

Local governments do not currently have a huge influence in building envelope performance (this is the domain of the Province), nor have they traditionally played a big role in energy supply in BC (this is traditionally BC Hydro's domain). Local governments can, however, play an important role in augmenting the province's work in advancing efficiency, ensuring standards are being met, and creatively asserting themselves in areas where they have not traditionally exercised influence, notably energy retrofits and low impact energy supply.

Co-Benefits

Typically, modest capital premiums for green building result in life cycle savings well in excess of initial investment. Premiums vary by location – where government regulations are conducive to green buildings, and professionals have experience developing green buildings, first costs are less.³⁴ An analysis of California's LEED certified buildings found a 2% investment in first costs would result in a 20% reduction in amortized life cycle costs.³⁵

Encouraging local low impact energy supply, like a district energy system, can strengthen the local economy, generate a new source of revenue for local governments, and reduce long term energy bills and operating costs for consumers.

KEY VARIABLES

The key variables influencing *building envelope* performance and energy supply performance are:

- Existing building performance, age (strong performance indicator)
 - Size, and type (e.g. single detached, low rise, high rise) is addressed under land use
- The rate at which buildings receive energy retrofits/upgrades
- New building performance
 - Size and type is addressed under land use

There are a number of *energy supply* variables that relate to emission performance in buildings

- Building scale renewable heat (space and water) and electricity (the latter is generally not cost effective in BC)
- Electricity carbon content (BC Hydro)
- Conventional natural gas

³³ Derived from BC Ministry of Environment, City of Victoria Community Energy and Emissions Inventory

³⁴ Miller, N.; J Spivey & A Florance. July 2008. Does Green Pay Off? CoStar.

³⁵ The same study showed a \$33 - \$67/square foot Net Present Value (NPV) for LEED Gold and Platinum buildings. More recent studies have estimated an NPV of \$153/sf

- *Local* renewable energy supply
 - Renewable heat and electricity (including District Energy)

STRATEGIC OPPORTUNITY

These aforementioned variables and the relative importance of local governments should inform two areas of activity each with several high level objectives:

1. High Performance Building Strategy

- New Buildings:** *Enforce* and strategically advance energy efficiency requirements in new residential, and commercial and institutional buildings.
- Existing Buildings:** Strategically advance the energy efficiency of existing residential, and commercial and institutional buildings.
- Building Scale Renewables:** Displace low efficiency electric and gas heat through building scale renewable heat; prepare for longer term, cost effective building-scale renewable electricity.

2. Low Impact Energy Supply Strategy

- District Energy:** Establish low carbon district energy systems throughout the community.
- Low Impact Renewable Energy:** Increase site and large scale renewable heat and electricity opportunities, including recovery of waste heat.

3. Senior Government and Utility Action

- Engagement:** Encourage development of stronger policies and programs to enable local governments to facilitate energy efficiency and low carbon energy supply

This work can best be advanced by remaining cognisant of the authority and influence of senior governments and utilities, and collaborating with them to encourage investment into utilities and building policy. An appropriate goal may be becoming a national green building centre of excellence.

POLICY AND ACTION OPPORTUNITIES

The City should select the most appropriate of these opportunities to address the strategic objectives. Some of these opportunities may be more appropriate to advance through other initiatives.

POTENTIAL POLICIES

Service Area Bylaw: Require developments within an area to connect or be able to connect to a current or future District Energy system.

Sustainability Checklist: Encourage greener buildings and developments or require existing buildings to undergo energy retrofits if other work is being done. Strong checklist performance can be explicitly associated with rewards, such as fast-tracking or used in rezoning. Victoria has a sustainability statement that could be enhanced.

Development Permit Areas: DPs can address ecological protection, revitalization, form and character, energy and water conservation, and greenhouse gas reduction. This tool can define energy efficient site and building design, notably passive elements, and begin to explore some powers allowing “special features” to promote conservation and GHG reductions and onsite renewables. | *preliminary priority*

Rezoning Process: For sites/buildings that are being rezoned, local governments can establish premium performance standards, including an energy retrofit of the existing building for additions, e.g. secondary suite, or additional buildings, e.g. laneway house. | *preliminary priority*

Occupancy Permit: It may be possible to grant an occupancy permit *only* upon a building meeting the energy requirements of the *current* building code through a test such as blower door.³⁶ Alternatively, there *may* be other tools to enforce existing codes such as posting bonds. | *preliminary priority*

Revitalization Tax Exemption: Local governments can waive or reduce property taxes for low carbon developments. OCP support for renewables or efficiency can guide bylaw development. This incentive is likely more effective for building *owners* rather than developers, thus targeting the building type is important.

Development and Building Permit: This process can be used to incentivize renewables or efficiency by *fast-tracking* permits. The process can be coupled with a sustainability checklist. | *preliminary priority*

Density Bonusing: Extra density may be granted if certain efficiency requirements or renewable energy is being used. OCP should identify maximum density 'uplift'; zones where extra density allowed/encouraged; encourage good public process for density bonusing. | *preliminary priority*

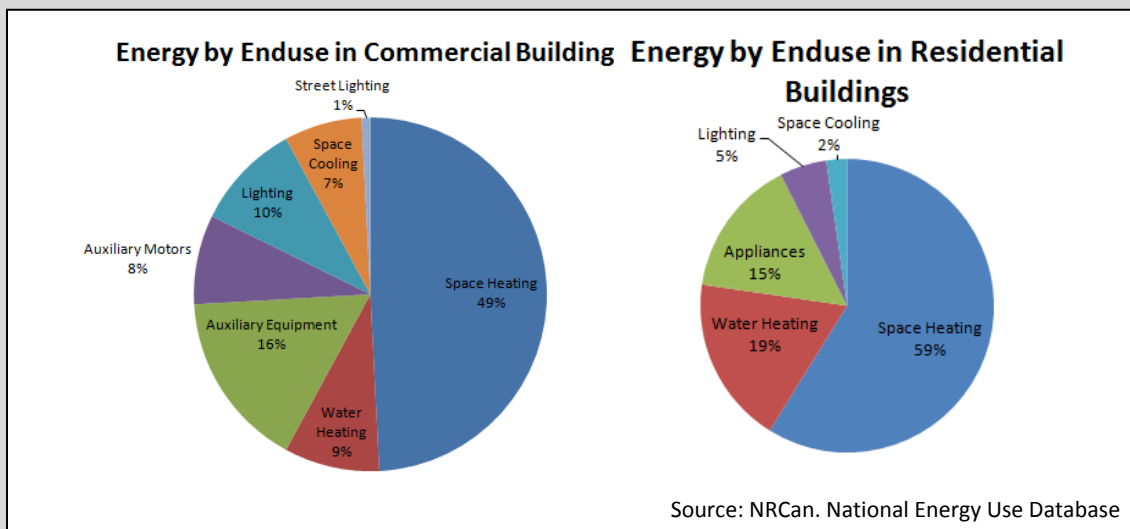
Statutory Building Schemes: A covenant can be placed on land being sold by the City requiring certain building performance or energy supply. Developers can also be encouraged to register such covenants, especially during rezoning or sub-division. OCP can specify this. | *preliminary priority*

Box 3: Strategic Building Considerations

Consider existing buildings: Maintaining and restoring existing buildings can contribute to sustainability by limiting resource use. Existing buildings are vital to a sense of history and place, and provide housing diversity. To make big sectoral gains, a built out city like Victoria will have to make significant improvements in existing buildings.

Price Signals & Incentives: Maximize Influence: Enable energy users to pay actual costs, and are connected to financing arrangements allowing them to make efficiency upgrades. Many *strata* are structured so that energy payments are communal. This reduces the individual incentive to conserve.

Focus on high impact end-uses: Consider which systems use the greatest amounts of energy to inform what elements are targeted to produce more energy efficient new construction and retrofits, i.e. heating.



³⁶ It is not uncommon for many new buildings to not meet the energy requirements of existing codes.

G. SOLID WASTE

While solid waste accounts for only 5.4% of Victoria’s GHG emissions, the impact of waste and materials management is very large on a national and global level when accounting for the upstream energy and emissions associated with extraction, processing and transportation.

Current Waste Operation and Management

The vast majority of waste management opportunities are not part of a traditional OCP. Waste management systems and infrastructure, nevertheless include collection, processing, recycling, recovery and disposal, account for significant municipal operations costs.

Solid waste is jointly operated by the City, CRD and private haulers. The City is responsible for waste collection. It is taken to Hartland Landfill, which is owned and operated by the CRD. Because landfill waste decomposes anaerobically emitting methane, a potent greenhouse gas, CRD is continuing to increase its capture efficiency.

CRD curb-side recycling uses a co-mingled “blue box” for plastics and aluminum, as well as paper and cardboard pickup. Organics currently comprise 30% of waste. CRD acknowledges all organic waste will need to be diverted to achieve the region’s 60% 2013 diversion target. Two private companies operate limited organic collection. Residents can also take yard waste to Hartland Landfill and the Victoria Municipal Yard for composting.

Box 4. The Imperative of Senior Government Action on Reduction Measures

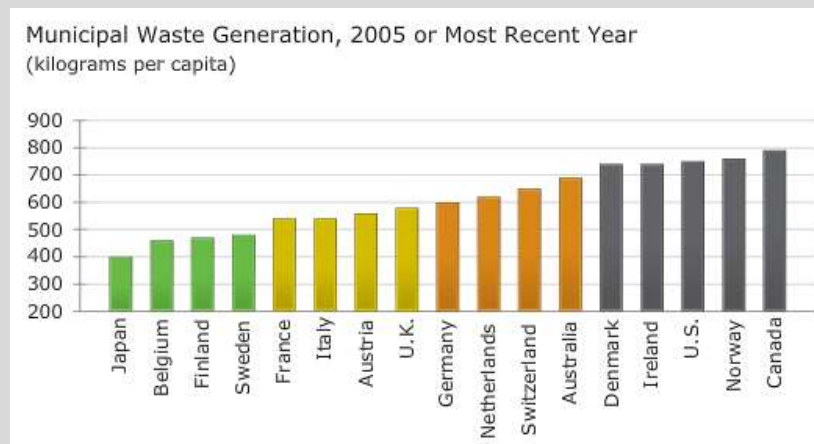


Figure 1: Municipal waste per person, in kilograms. Conference Board of Canada, <http://www.conferenceboard.ca/HCP/Details/environment/municipal-waste-generation.aspx>

Canadians rank last among Western industrial countries in waste generated per capita per year. Avoiding the production of waste, has significant resource protection as well as waste benefits. Local governments can only take limited action in waste reduction. Provincial and Federal efforts must focus on *reducing* the volume of waste using product stewardship, extended producer responsibility, smart packaging.

KEY VARIABLES

Key variables that influence waste emissions are determined by the waste management strategy:³⁷

- Reduction by volume and type
- Re-use by volume and type
- Recycling by volume and type
- Composting by volume and type
- Anaerobic Digestion by volume and type
- Incineration by volume and type
- Landfill by volume and type (and the landfill management strategy)

STRATEGIC OPPORTUNITY

This strategy has five high level objectives with an emphasis on number one, given its OCP relevance:

1. **Zero Waste Neighbourhoods and Buildings:** Incorporate zero waste principles in new design
2. **CRD Engagement:** Collaborate to strengthen GHG reductions in current and future Management Plans
3. **Composting:** Continue to extend beyond CRD's plans municipally in composting
4. **Recycling:** Extend beyond CRD's plans municipally in recycling
5. **Senior Government Engagement:** Encourage Senior Governments to strengthen *reduction* targets, policies and actions

These objectives should be re-worked into a strategy that speaks more specifically to Victoria. This strategy could include meaningful bold objectives like establishing Victoria as a Zero Waste city. Given the activity is not part of a traditional OCP, planning and development priorities would likely be deferred to other planning processes.

POLICY AND ACTION OPPORTUNITIES

Solid waste is not typically addressed in an OCP. A municipal strategy for implementing the CRD Solid Waste Management Plan is a more intuitive framework for comprehensively addressing waste versus the OCP. It is, therefore, recommended that waste be addressed at a high level, and specifically develop policies that are relevant from the OCP's land use and development oriented focus. The OCP could direct development of policies and actions for integration into future waste management planning.

POTENTIAL POLICIES

Recycling and Composting Space: Use zoning or development permits to require space for 4-stream waste separation in commercial, institutional and multi-unit buildings (including organics) | *preliminary priority*

³⁷ These strategies are *roughly* in order of full life cycle GHG reduction potential. However, given variation within a management strategy, the impossibility of managing all waste across all strategies, and extenuating circumstances (e.g. varying downstream transportation emissions), it is not possible to steadfastly generalize.

Upstream Emissions: To support more sustainable decision making, ensure full life cycle of waste is considered as well traditional emission calculations.

Diversification Incentives: Explore development of appropriate incentives and disincentives, e.g.

- Pay as You Throw user fees
- Fines for contaminating waste containers with recyclables and vice versa
- Incentivize waste management companies with premiums for compost and recyclables over waste
- Encourage small scale composting through sponsoring workshops and subsidizing container cost

POTENTIAL ACTIONS

Education & Outreach: Prepare educational materials for residents and commercial tenants on how to reduce and reuse, compost, and utilise recycling facilities and services, as well zero waste principles and benefits.

Demolition and Construction Waste: Develop an effective program, including on-site reuse of materials such as soil, trees, rock or timber. Demolition/construction waste management plans could reduce fees.

Mandatory Composting: Require all commercial, institutional and MURBS, to include recyclable and compost pick up along with waste removal; phase in periods can be established for older buildings

Backyard Composting: Encourage backyard composting in single family homes.

Commercial and Institutional Food-Related Composting: Require commercial and institutional sector with significant food to compost food waste.

Packaging Reduction: Phase out the use of wasteful packaging, such as plastic bags and poly-styrene, in stores

Waste Bin Size Reduction: Reduce waste bin size and frequency of pick up, and increase recycling and composting bin size and establish weekly pick up

Resource Depot: Establish space for a materials exchange network with drop off centres for businesses and residents, and investigate extending this with area local governments. | *preliminary priority*

Senior Government Engagement: Encourage senior government engagement in mandating reductions in packaging, extended producer responsibility, product stewardship, and creating industry standards and greater product compatibility (e.g. cell phone chargers) to reduce waste and duplications.

Waste To Energy Analysis: In the event, waste to energy (WTE) is pursued, the following considerations should be made:

- Incorporate full upstream and downstream GHG analysis in determining optimal management approach for each waste stream
- Acknowledge WTE is at the bottom of the waste management hierarchy and other strategies (with the exception of land filling) are superior in extracting value from waste and/or avoiding waste
- Design flexible WTE systems that assume municipal solid waste volumes will decline and be displaced with other feedstocks (e.g. waste wood or sewage heat) as higher order strategies are strengthened
- Ensure WTE systems generate heat as well as power and are integrated into land use contexts that take advantage of this heat, e.g. residential, mixed use, and/or industrial contexts. | *preliminary priority*

Box 5. Waste to Energy and Climate Change

There is growing interest in waste to energy (WTE) to address the mounting waste volume crisis, generate revenue from energy production, and in theory reduce greenhouse gas emissions. From a climate, energy and resource perspective, WTE can make sense for *some* waste streams. There are others, however, that are so valuable because of their embodied upstream energy and GHGs from extraction, processing and transportation, they should not be used. Embodied CO₂e per tonne of waste differs significantly by waste type. Low: plastic (2 t) and dimensional lumber (2.5 t). High: copper wire (8 t) and office paper (9 t). Very high: PCs (60 t)!³⁸

If WTE is being considered, upstream GHGs should be integrated into waste management policy and planning. Such analysis would help identify SW materials:

- for WTE feedstock
- to eliminate or phase out as WTE feedstock
- for first order waste management strategies, e.g. reduction, re-use and recycling

While waste to energy has the potential to be done sustainably, the immense volume of materials destined for many of today's WTE systems should be understood as a shortcoming in higher order waste management strategies, i.e. reduction, re-use, and recycling. Senior governments must begin to *reduce* waste through smart packaging, extended producer responsibility and product stewardship. Energy recovery is at the bottom of the waste management hierarchy.

Sustainable WTE Design

To maximize sustainability, WTE systems should not be over built, but designed with the expectation of a *decrease* in waste volume. Given the upstream emissions associated with waste, a robust program of reduction, re-use and recycling would amount to GHG emission reductions several fold larger than the emissions currently assigned to the waste sector. All top order strategies are essential to meeting a sustainable zero waste goal and more importantly a long term zero carbon imperative.

Flexibility should be designed into WTE systems to allow other potential inputs as municipal solid waste volume decreases, e.g. biomass from waste wood, integration of solar thermal, and/or sewage heat recovery. To maximize the energy value and minimize GHGs, all systems should mandatorily generate heat and power.

³⁸ US EPA WARM model is the best source for these emission factors. Environment Canada has a similar model with some better factors, but it isn't as regularly updated. http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

H. CLIMATE MITIGATION AND SUSTAINABLE ENERGY OCP CHECKLIST

PROCESS SUGGESTIONS

The following suggestions are illustrated by phase in a plausible process map in Section 2.A, *Figure 2: OCP Climate Integration Process*.

- **Education/Launch:** Engage and inform the community and key stakeholders, examining the action imperative, accomplishments, action areas, and developing a vision
- **Analysis:** Develop a list of potential best practices and conduct a preliminary cost-benefit analysis
- **Options:** Working with stakeholders and public, examine and evaluate targets, policies and actions.
- **Writing:** Articulate a compelling energy and emission management framework to supplement and integrate into existing City activities.

These are additional process suggestions:

- Given its size and sophistication, the City should develop a number of defensible targets on a community-wide and sectoral basis. Targets should provide policy guidance, and support measurement and monitoring.
- The City should build on its baseline modeling and mapping to explore the energy and emission implications of different land use and development OCP scenarios.

POLICY AND ACTION OPPORTUNITIES

A short list of preliminary priorities has been identified for exploration based on their consistency with traditional OCP activity, their potential impact, and/or relevance for Victoria. It would, nevertheless, be prudent to examine the broader list of opportunities. Some may be appropriate to inform high level direction for other policy and planning activity.

Land Use Policies

- **Official Community Plan:** The key elements of an OCP should maximize energy and emission management.
 - Location, density, and building types of residential and commercial growth
 - Location, nature and connectivity of transportation networks
 - Location of public institutions and parks
- **Zoning Bylaw:** Use Zoning to enable land use mix, building types, and concentrated development to maximize building, transportation and energy supply opportunities.
- **Development Permit Area Guidelines:** Articulate how development and design should meet land use and climate protection at a site or neighbourhood level.
- **Density Bonusing:** Advance efficiency and onsite renewable energy in exchange for greater development density through the rezoning process.

Land Use Actions

- **Low Carbon Quarters & Low Carbon Corridors:** Build on Victoria's Dockside Green achievement. Identify several representative neighbourhoods or zones to support development of ultra low carbon projects.

Transportation Policies and Actions

It is likely these won't be developed in the OCP but provide direction to transportation planning processes.

- **Integrated Transportation Plan:** Enrich the existing Plan, and consider
 - Enhanced Transit
 - Multi Modal Transportation Hubs and Nodes
 - Community Car Sharing
 - Transportation Demand Management
- **Bicycle Master Plan:** Enrich the existing Plan, use Development Permits where appropriate, and consider:
 - Commercial/Institutional and Residential End of Trip Facilities
 - Enhanced Network and Infrastructure
- **Pedestrian Master Plan:** Enrich the existing Plan, use Development Permits where appropriate, and consider:
 - Enhanced Network and Infrastructure

Building Policies

- **Development Permit Areas:** Address energy efficient site and building design, notably passive elements, and begin to explore powers allowing “special features” to promote GHG reductions
- **Rezoning Process:** Establish premium performance standards, including an energy retrofit of the existing building for additions.
- **Occupancy Permit:** Grant an occupancy permit only upon a building meeting the energy requirements of the current building code through a test such as blower door.
- **Development and Building Permit:** This process can be used to incentivize renewables or efficiency by fast-tracking permits. The process can be coupled with a sustainability checklist.
- **Density Bonusing:** Extra density can be considered if certain efficiency requirements or renewable energy is being used.

Building Actions

It is likely none of these actions are developed during the OCP, but they could be directives coming out of the OCP.

- **Low Carbon Education and Outreach:** Develop new building, retrofit and renewable programs targeted to residents and builders
 - Fuel Furnace Replacement: Form a partnership to create a fuel-oil furnace replacement program
- **District Energy Strategy:** Establish the groundwork for expanding district energy throughout the City by a) scoping governance options, and b) assessing district energy demand and supply across the City

Waste Policies and Actions

- **Recycling and Composting Space:** Require space for waste separation, including organics in buildings
- **Resource Depot:** Establish space for a materials exchange network with drop off centres
- **Waste To Energy Analysis:** In the event, waste to energy is considered, require rigorous climate sensitive analysis to evaluate the opportunity, and if it moves forward, use the analysis for design.

4. CLIMATE IMPACTS AND ADAPTATION

Victoria faces a number of climate change impacts with wide-ranging estimates of magnitude and probability, notably sea-level rise, changing frequency and intensity of precipitation and weather events, major hydrological changes, and reorganization of ocean ecosystems. This section provides guidance on evaluating vulnerability and risk from climate change impacts, developing adaptation policies and actions, including the identification of preliminary priorities. The section includes:

- A high level profile of impacts and vulnerabilities
- A risk assessment and adaptation planning framework
- A series of process suggestions to develop an adaptation plan in a good OCP Update process
- A list of policy and action opportunities, including a rudimentary screen of preliminary priorities

A. VICTORIA CLIMATE CHANGE IMPACT AND VULNERABILITY PROFILE

Victoria faces a number of climate change impacts with wide-ranging estimates of magnitude and probability. While adequate data does not exist to assess most impacts quantitatively, a high level discussion is useful for planning and a starting point for in-depth investigation. Within the broader ecological and climatic context, Victoria will face sea-level rise, changing frequency and magnitude of precipitation and extreme events, major hydrological changes and reorganization of ocean ecosystems. The expected major impacts include:

- Damage to critical infrastructure and property (roads, parks, private property, power lines, drinking water, storm and wastewater infrastructure) from sea level rise and extreme weather
- Contamination of drinking water supply from spread of waterborne contaminants and erosion caused by fires in the watershed
- Food security
- Local economic impacts

Some of these key impacts are discussed in further detail below along with a brief discussion of Sea Level Rise.

Infrastructure and Water Supply

Extreme weather events, changes in El Nino Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO), and sea level rise will result in new risks to and increased vulnerability of City infrastructure and private property. Increased intensity of rainfall and wind will result in larger maintenance and insurance costs and undermine the integrity of some existing design standards. In particular, water supply systems, storm water and wastewater infrastructure will face changing climate conditions and increasing population growth. Victoria should plan for:

- Decreased water supplies during summer and fall
- Increased demand on drinking water (CRD) and sewage treatment (future) with population growth
- Increased loading of storm water systems as a result of more frequent and more intense precipitation
- Increased danger of fire, which could threaten Sooke Reservoir's watershed.

In the CRD, availability of surface water and water storage in reservoirs is significantly influenced by the PDO over the long term and ENSO over the short term.³⁹ In response to drought and population growth, the CRD raised Sooke Reservoir 6 metres in 2002. This is expected to meet projected demands 2023.⁴⁰

³⁹ Walker, I.J. and Sydneysmith, R. (2008): British Columbia; in *From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p.329-386.

NRCan has concluded that seasonal climate forecasts incorporating ENSO and PDO effects are useful for year-to-year operational planning, but are currently underutilized by local governments.⁴¹ In addition, local climate and weather data that is often used to compute trends and probabilities of an extreme event occurring are frequently too short and assume static conditions, which leads to poorly informed decision making.

Human Health

Globally, diseases spread by water are expected to increase as a result of increased precipitation and flooding. The Walkerton E. Coli outbreak happened in the wake of an intense precipitation event. Half of all waterborne disease outbreaks in the US follow such events.⁴² Across BC, 29 waterborne outbreaks have occurred since the 1980s due to parasites, bacteria and viruses in drinking water systems.⁴³ The CRD does not use a disinfection system for drinking water, making it more vulnerable to elevated turbidity. In November 2006, Greater Vancouver Regional District medical health officers issued a boil-water advisory that affected almost 1 million people for 12 days following an extreme rainfall event that led to elevated turbidity.⁴⁴

Energy Security

The growing population will be vulnerable to potential electricity shortages in BC, as province-wide demand is expected to grow by 33-60% by 2025 under a business-as-usual scenario.⁴⁵ Increasingly strict provincial building codes and demand management programs will meet a large portion of this demand increase. Decreasing reservoir levels at hydro-electric facilities due to climate change could contribute new electricity supply constraints to the equation. As discussed above under Energy Security in *Section One*, increased electrical transportation penetration has not been considered in forecasts and will intensify electricity demand.

Food

Food prices could increase significantly as global agricultural and food systems are impacted by changing climate, water availability, soil conditions, and the cost of energy. As the vast majority of food and other goods that are consumed in Victoria originate outside of Vancouver Island, the City's residents will be vulnerable to these impacts.

Local Economy

Fish species abundance is highly variable and affected by numerous factors—some poorly understood. The tourist and commercial fishing industry will be affected by the shifts in abundance and range of species. Economic and social stresses in fisheries-dependent communities are likely to increase as ocean and land conditions change.⁴⁶

⁴⁰ Capital Regional District Water Services (2004): 2004 review of the strategic plan for water management; Capital Regional District Water Services, Victoria, BC, 161 p.

⁴¹ Walker, I.J. and Sydneysmith, R. (2008)

⁴² Curriero, Frank et al. (2001) "Analysis of the association between extreme precipitation and waterborne disease outbreaks in the US, 1948–1994," American Journal of Public Health. 91:1194–1199

⁴³ Mullens, A. (1996): I think we have a problem in Victoria: MDs respond quickly to toxoplasmosis outbreak in BC; Canadian Medical Association Journal, v. 154, no. 11, p. 1721–1724.

⁴⁴ GVRD (2006) *Media release: GVRD residents are advised of deteriorating water quality*. Nov 16, 2006, <<http://www.gvrd.bc.ca/media/2006/2006-11-16-Media-ReleaseResidentsAdvisedWaterQuality.pdf>>.

⁴⁵ BC Hydro Long Term Acquisition Plan

⁴⁶ Walker, I.J. and Sydneysmith, R. (2008)

Box 6. The Science of Sea Level Rise

Sea level rise (SLR) in Victoria will be determined by a combination of global and local factors. Sea level rise estimates are highly variable and the most controversial aspect of the Intergovernmental Panel on Climate Change's (IPCC) recent Fourth Assessment Report. The 2007 report estimated global sea level rise to be 18-59 cm by 2100.⁴⁷ Because of recent observed trends and scientific analysis that suggests current global climate models may be underestimating future sea level rise, HB Lanarc currently recommends *coastal BC communities prepare for a sea level rise of approximately one metre by 2100*. Due to local natural and geological processes SLR projections vary amongst communities.

BC Ministry of Environment, Fisheries and Oceans Canada and Natural Resources Canada recently completed a meta-analysis of SLR (see Table 4 summary below). Because of new evidence, it is recommended that Victoria currently use the *extreme high estimate* of this analysis.⁴⁸

Location	Sea Level Rise based on extreme low estimate of global sea level rise (m)	Sea Level Rise based on mean estimate of global sea level rise (m)	Sea Level Rise based on extreme high estimate of global sea level rise (m)
Prince Rupert	0.10–0.31	0.25–0.46	0.95–1.16
Nanaimo	-0.04	0.11	0.80
Victoria	0.02–0.04	0.17–0.19	0.89–0.94
Vancouver	0.04–0.18	0.20–0.33	0.89–1.03
Fraser River Delta	0.35	0.50	1.20

Table 5: Relative Sea Level Rise for Select Locations. Because of emerging science, discussed below, HB Lanarc currently recommends using the extreme high estimate.⁴⁹

Local and Regional Factors

Three principal local/regional factors will affect SLR in Victoria:⁵⁰

- As a result of *post-glacial rebound* Victoria will experience sea level rise that is 0 to 0.1 metres *lower* than the global mean SLR (0.9 to 1.0 metre rise).
- The west coast of Vancouver Island will experience sea level rise that is between 0.3 to 0.2 metres less than global average (0.7 to 0.8 metre rise) due to *tectonic uplift*.
- An extreme (magnitude 9) earthquake could reverse the uplift of Vancouver Island resulting in an instantaneous *lowering* of the land by 0.2 metres in Victoria and 0.5 to 2.0 metres along Western Vancouver Island (resulting in a rise in relative sea level). There is a 5-10% probability that an earthquake of this magnitude will occur in the next 50 years.

⁴⁷ IPCC 2007. Summary for Policy Makers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S. et al (eds)].

⁴⁸ Thompson, R. E. et al 2008. *An examination of the factors affecting relative and absolute sea level in coastal British Columbia*. Fisheries and Oceans Canada, Institute of Ocean Sciences, Sidney, British Columbia.

⁴⁹ Ibid

⁵⁰ Ibid

Atmospheric Forces

Other shorter-term atmospheric conditions influence sea levels. These occur seasonally like the wintertime Northward wind that can elevate sea level on the outer coast 0.5 metres over summer levels.⁵¹ The El Niño cycle typically lasts 6-18 months, and the Pacific Decadal Oscillation normally occurs over 20-30 years. Both alter water temperature, storm intensity and sea level. In recent decades, El Niño has occurred more frequently, more intensely and longer, raising sea level 0.3 to 0.4 metres over normal seasonal values for most coastal areas, and up to 1 metre above normal sea level for low lying areas like the Fraser Delta.

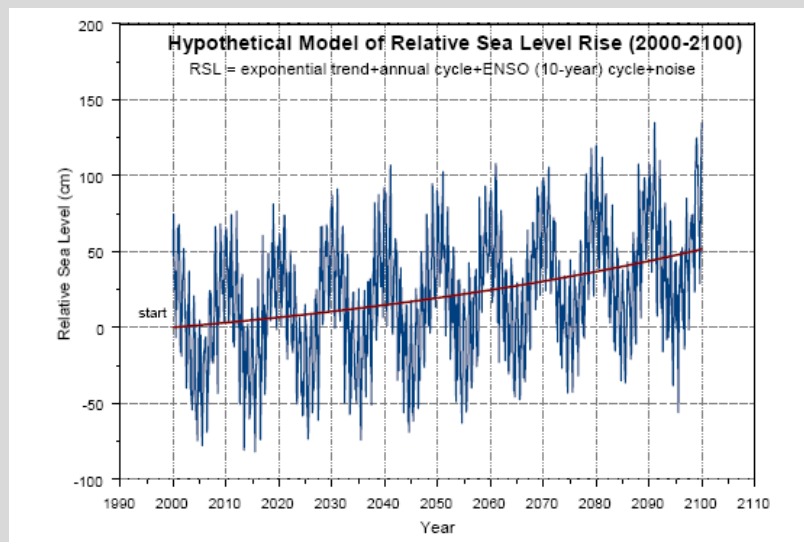


Figure 10 – This graph illustrates results of a *hypothetical model of monthly relative sea level rise consisting of an increase in mean sea level of 50 cm by 2100*. The red line shows the mean annual sea level. The blue line shows monthly variation due to seasonal variation in wind patterns, storms, and the periodic effects of El Niño (every ten years), all of which could become more intense. This underscores that coastal communities should be prepared for changes in sea level due to seasonal variations in addition to rise in mean sea level.⁵²

New Scientific Evidence

Many of the world’s most reputable SLR and modeling experts felt the IPCC underestimated the magnitude of global SLR under future climate change scenarios. One of the reasons for this underestimate was the report was not able to introduce new evidence into a multi-year process where peer-reviewed publications are subjected to a series of rigorous reviews. The IPCC report, in fact, said, “real-world evidence was specifically excluded because it is not yet included in the models.”⁵³

⁵¹ Ruggiero, P. et al 2005. Seasonal to interannual morphodynamics along a high-energy dissipative cell. *Journal of Coastal Research*, 21(3):553 – 578.

⁵² Thompson, R. E. et al 2008. *An examination of the factors affecting relative and absolute sea level in coastal British Columbia*. Fisheries and Oceans Canada, Institute of Ocean Sciences, Sidney, British Columbia, p. 21.

⁵³ New evidence includes studies showing:

- Accelerated erosion of the Greenland and West Antarctic Ice Sheets and land-based glaciers.
- Positive feedbacks and tipping points whereby as the atmosphere warms, ice caps will not melt in a consistent, gradual fashion. For example, snow and ice reflect sunlight and reduce global warming. But as the temperature increases and ice sheets and polar ice caps melt, there is less ice to reflect sunlight and more dark water to absorb it making the planet warmer, accelerating ice cap erosion.

B. STRATEGIC APPROACH: KEY CONSIDERATIONS

OVERVIEW OF ADAPTATION METHODOLOGIES

Consistent with climate change mitigation science, there has been a rapid evolution of tools for adaptation. The analytical and planning approach has been influenced by risk and vulnerability analysis frameworks from areas such as secure livelihoods, food security, natural hazards, disaster risk management, public health, and global environmental change. A number of approaches are currently in-use by international, national and local governments and agencies. Similarly, a large number of processes for conducting climate vulnerability analysis have been developed. A synthesis has been developed drawing on the strengths of each for municipal application.

ADAPTATION FRAMEWORK – “VULNERABILITY AND RISK ANALYSIS”

Reducing *vulnerability* and *risk* is the ultimate goal of climate change adaption planning. Analyzing the context and taking action is based on understanding the determinants of vulnerability and risk and designing measures that address the determinants, and the vulnerabilities and risks themselves.

Figure 11 is a Risk Assessment and Adaptation Planning Framework. Assessing *vulnerability* and *risk* involves evaluating local *climate variability*, *exposure* and *impacts*; understanding the *non-climatic drivers* that influence climate *sensitivity*; and assessing the *adaptive capacity* of systems to climate variability. With this understanding, policies and actions can be effectively designed (i.e. the Adaptation Plan) to reduce exposure, sensitivity and impacts, while increasing adaptive capacity. Definitions for these terms are provided below the figure.

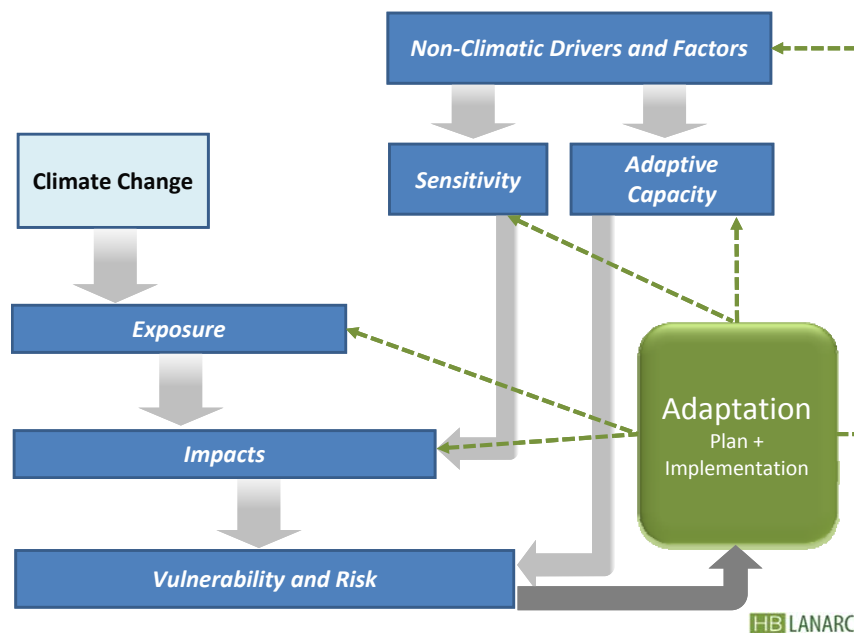


Figure 11 - Adapted from: Fussler, H.-M., and R.J.T. Klein 2006. *Climate change vulnerability assessments: An evolution of conceptual thinking*. *Climate Change*, 75: 301-329, Figure 6.

PROCESS SUGGESTION

Take a methodical approach to qualitatively assessing vulnerability and risk to inform development of policies and actions to reduce vulnerability and risk to climate change.

Adaptation Planning Definitions

The end goal of adaptation planning is to reduce vulnerability and risk.

Vulnerability – The susceptibility of a system to harm from climate change. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed and the system’s *sensitivity* to climate and the *capacity* of that system to adapt to climate changes.”⁵⁴

Risk – Risk is determined by the severity x probability of impact. It can be evaluated in a qualitative sense by considering the probabilities of various climate change impacts in absolute and relative terms.⁵⁵

		Probability of Impact		
		Low	Medium	High
Severity of Impact	High	Yellow	Red	Red
	Medium	Light Blue	Yellow	Red
	Low	Light Blue	Light Blue	Yellow

Evaluating and reducing vulnerability and risk, depends on exposure, sensitivity and adaptive capacity.

Exposure – The degree to which a system is subject to stress associated with climatic changes and extreme weather events. Exposure is determined by geography and the prevalence of assets that are sensitive to climatic changes and extreme weather events.⁵⁶

Sensitivity – “Sensitivity reflects the responsiveness of a system to climatic influences, and the degree to which changes in climate might affect it in its current form. Sensitive systems are highly responsive to climate and can be significantly affected by small climate changes. Understanding a system’s sensitivity requires an understanding of the thresholds at which it begins to exhibit changes in response to climatic influences, whether these system adjustments are likely to be ‘step changes’ or gradual, and the degree to which these changes are reversible.”⁵⁷

Adaptive Capacity – “The ability of built, natural and human systems associated with a given planning area to accommodate changes in climate with minimum disruption or minimum additional cost.”⁵⁸ The adaptation can either be planned or occur autonomously.⁵⁹

⁵⁴ Based on: Houghton, J. T., Ding, Y., Griggs, D. J., Noguera, M., van der Linden, P. J., and Xiaosu, D. (eds.): 2001, *Climate Change 2001: The Scientific Basis*. Cambridge University Press, Cambridge. AND Snover, A.K. et al 2007. Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments. In association with and published by ICLEI – Local Governments for Sustainability, Oakland, CA.

⁵⁵ Snover, A.K. et al 2007.

⁵⁶ Henstra, D. and G. McBean 2009. *Summary Report: Climate Change Adaptation and Extreme Weather*. Adaptation to Climate Change Team, Simon Fraser University. September 9, 2009.

⁵⁷ Ibid, p21.

⁵⁸ Snover, A.K. et al 2007.

⁵⁹ Allen Consulting Group 2005. *Climate Change Risk and Vulnerability: Promoting an efficient adaptation response in Australia*. Australia Government, Department of Environment and Heritage, Australian Greenhouse Office. March 2005.

ADAPTATION PLANNING IN THE OCP PROCESS

Integrating adaptation into an OCP process typically involves learning and applying some novel concepts – many of which are intensely cross cutting in nature, and are most effective integrated into existing planning areas. The following process, shown graphically in Section 2.A, *Integrating Climate into an OCP*, articulates key objectives and elements at the typical stages of an OCP process.

EDUCATION/LAUNCH PHASE PROCESS SUGGESTIONS

Objectives

- Engage the community and key internal and external stakeholders. Accessible and engaging presentations/materials on the following topics are recommended:
 - High-level impacts of climate change on Victoria. (More detailed delineation of impacts, vulnerabilities, and risks will come later.)
 - Potential climate impacts on planning areas. (Adaptation planning will be most effective when it is integrated into each of the City's planning areas, rather than as a separate initiative. Giving the public a sense for how climate impacts could change the planning and decision making process at an early stage of the process will set the stage for deeper discussion of goals and policies later.)

Key Elements:

- Engaging and accessible presentation on high-level climate change impacts and how climate change adaptation could be incorporated into different planning areas.
- Key departmental directors/managers and key community stakeholders preliminarily examine climate change impacts on planning areas.

ANALYSIS PHASE PROCESS SUGGESTIONS

Objective

- Complete a qualitative assessment of risk and vulnerability for all potential impacts and planning areas and major systems, identifying the most vulnerable.

Key Elements

- Draw on external and internal expertise to conduct a vulnerability and risk assessment for major planning areas for each identified climate impact. Because of the likely time constraints and lack of detailed analysis for some planning areas, it will likely be necessary to deal with risk and vulnerability qualitatively. Active participation and engagement of key planning area experts and community stakeholders will help.
 - The Pacific Climate Impacts Consortium (PCICS), located at the University of Victoria, has offered to conduct a climate impacts report for the City of Victoria as a part of the climate adaptation planning process
 - In 2010, the BC Ministry of Community and Rural Development (MCRD) and the Ministry of the Environment will be partnering to create a program that provides guidance to local governments on climate change adaptation. The City of Victoria should look for opportunities to engage Ministry staff as they are able to contribute to the process or analysis.
- Information, both quantitative and qualitative, will be necessary in order to inform the analysis.

OPTIONS PHASE PROCESS SUGGESTIONS

Objectives

- With stakeholders:
 - Create a small group of preliminary goals relating to adaptation planning
 - Develop policy and action options to address priority planning areas and services
- With the public:
 - Inform the public, gauge opinion and gain input on the climate change risks and vulnerabilities and policies and actions to address them

Key Elements

- Continued active participation of key planning area experts and stakeholders
- Sufficiently granular analysis in the previous phase in order to inform the formation of policy options
- Successfully communicating how the proposed policy options will affect the community and the cross-linkages among planning priorities and areas.

WRITING PHASE PROCESS SUGGESTIONS

Objectives

- Articulate a coherent framework for climate change adaptation with policies and actions that provide, clear strategic guidance for action.

Key Elements

- Successful integration of policies and actions across planning and goal areas

C. TAKING ACTION

Adaptation opportunities are organised by civic planning area. These opportunities have emerged based on a rudimentary application of the *Risk Assessment and Adaptation Planning Framework* described above. It is on this basis along with a recognition of the traditional activity of the OCP that *preliminary priorities* have also been identified. This high level screening has been done to facilitate decision making because it is unlikely the City is able to advance all these opportunities. A *high level qualitative vulnerability and risk assessment* would refine these priorities, a key process recommendation discussed above.

While some of these opportunities would be logical to address *during* the OCP update, e.g. Development Permit Area Guidelines, others may be more appropriately addressed as directives integrated into the City's ongoing policy and planning renewal process, subsequent to the OCP update.

Because land use practices on privately held land are affected by and in turn affect numerous planning areas, the policy tools described in this area end up being powerful mechanisms for influencing change. Many of these tools are directly related to official community plans.

OVERARCHING AND CROSS-CUTTING

Crossing cutting opportunities that do not pertain to any key planning area could include:

- Completion of a vulnerability and risk assessment (if this is not done during the OCP update process)

- Guidance on updating major service/planning area plans following completion of a vulnerability and risk assessment and completion of the OCP.
- Guidance on forming partnerships and collaborating with the Capital Regional District and neighbouring local governments to address regional issues such as transportation, water, food and ecological health.

LAND DEVELOPMENT

Because Victoria is a largely built-out city, the majority of land development going forward will be in the form of re-development. As such, the City will need to use policy mechanisms targeted at existing buildings and land uses to move forward with community climate change adaptation. Many of the same policy tools that are used for advancing other sustainability priorities can be applied for climate change adaptation. They include:

- Development permit area guidelines for building and site design, e.g. rainwater management, landscaping and passive solar design. | *preliminary priority*
- Sustainability checklist for development and re-development permits
- Revitalisation tax exemption by-law
- (Re)development and building permit fast-tracking
- Assess the suitability of using vulnerability zoning for sea-level-rise to shape development and re-development in different areas of the City. | *preliminary priority*

STORMWATER, RAINWATER, WASTEWATER AND POTABLE WATER MANAGEMENT

These three critical systems have major overlapping infrastructure and management components. Because there are several remaining combined stormwater and sewer systems in Victoria, when there is a major rain event, system overflow can contaminate Victoria's waterfront and beaches. This problem can be addressed in part by infrastructure upgrades, but illustrates the shortfalls of traditional infrastructure solutions in a changing climate.

- The Provincial government is formulating a "purple pipe" policy in 2010 for reusing water in buildings. Victoria should consider what activities it will undertake in order to facilitate the rollout of this new policy. There will be a marked increase in interest in rainwater capture as a result of the purple-pipe policy. The OCP could be revised to include guidance on rainwater capture, addressing both diversion to toilets and landscaping. In Victoria it will be necessary to provide guidance for new and existing buildings. | *preliminary priority*
- As the City redevelops its mixed-use areas it will be important to improve the management of onsite water through promoting reuse, creating checklists and guidelines for storm water best practices, such as the use of bio-swales and other techniques. | *preliminary priority*
- Victoria would ideally create integrated watershed management plans for all watersheds within its city boundaries. Currently, the only management plan is for Bowker Creek. This plan can be used as a model for the other watersheds in the community. | *preliminary priority*
- Expand the number of storm water best management practices to encompass more activities and business types. | *preliminary priority*
- Partner with the CRD to address drinking water source protection
- Continue to look for new opportunities for advancing water conservation

BUILDING ENERGY SUPPLY & DEMAND

- The OCP should recognise the risk of future energy shortages and escalating energy prices and the related need to develop local renewable energy sources that are climate resilient. See the Building & Energy Supply sub-section under Mitigation.
- See the Stormwater sub-section above for other building-related opportunities.

TRANSPORTATION AND ACCESSIBILITY

- As a part of a cross-sectoral approach to increasing energy security and reducing vulnerability to fossil fuel price fluctuations and supply constraints, sustainable transportation options should be advanced. See the Transportation and Land Use sub-sections under Mitigation.
- Update the City's engineering standards for roads and other types of infrastructure to reflect anticipated climate change impacts, notably intense precipitation events. | *preliminary priority*

HUMAN HEALTH

- The OCP could identify a collaborative process for conducting an assessment of human health impacts, risks and vulnerabilities from climate change

ECOLOGICAL HEALTH

- See Stormwater, Rainwater, Wastewater and Potable Water Management sub section above.
- Continue to promote and expand the street tree program, which has important water quality and quantity benefits for stormwater (and forest carbon benefits). | *preliminary priority*

LOCAL ECONOMY AND TOURISM

- The OCP could identify education and outreach plan for educating local businesses and the tourism industry about the impacts and risks of climate change in Victoria.

HERITAGE

- Conduct a vulnerability assessment of the City's heritage buildings. Provide direction to make appropriate changes to development permits and zoning in order to mitigate against impacts.

LOCAL FOOD SUPPLY

- Provide guidance for development of a community food and agriculture strategy, potentially working in partnership with other municipalities in Southern Vancouver Island on a regional strategy. | *preliminary priority*

FINANCIAL MANAGEMENT

To manage municipal, and in turn, resident and business risk, the following opportunities could be adopted:

- Update the procurement and tendering process for capital projects to consider climate change impacts and adaptation. | *preliminary priority*
- Require an impact and adaptation assessment for internal capital projects. | *preliminary priority*

RESILIENCE

- Currently, Victoria's OCP addresses resilience from the perspective of public safety and health. This treatment could be expanded to include a broader definition of resilience. Resilience is the capacity of a system (such as city or region) to withstand stress and/or undergo change and still maintain its basic functions. Stresses can take many forms including sudden changes in ecological, economic and social conditions, such as major disasters, economic shocks (e.g. the withdrawal of a major employer in the region), or substantial increases in energy prices. One of the many key determinants of community adaptive capacity and resilience is high social capital, notably strong community networks and relationships. Communities that are sustainable must also be resilient. | *preliminary priority*

D. ADAPTATION OCP CHECKLIST

PROCESS SUGGESTIONS

- Take a methodical approach to qualitatively assessing vulnerability and risk to inform development of policies and actions to reduce vulnerability and risk to climate change.

The following suggestions are illustrated by phase in a plausible process map in Section 2.A, *Integrating Climate into an OCP*, Figure 2.

- **Education/Launch:** Engage the community, and key internal and external stakeholders on high level local and planning area impacts.
- **Analysis Phase:** Work with key internal and external stakeholders conduct a qualitative assessment of risk and vulnerability for all potential impacts and planning areas and major systems.
- **Options Phase:** Work with stakeholders to develop a portfolio of policies, and actions to address priority planning areas and services; and engage the public to assess concerns, and evaluate and gain input on options.
- **Writing Phase:** Articulate a coherent framework for climate change adaptation with policies and actions that provide clear strategic guidance for action that successfully integrate priorities across planning areas.

POLICY AND ACTION OPPORTUNITIES

A short list of preliminary priorities emerged based on rudimentary application of the *Risk Assessment and Adaptation Planning Framework*. They would be refined, ideally through a *high level qualitative vulnerability and risk assessment* as part of the OCP Update. While some opportunities would be logical to address *during* the OCP process, others may be more appropriately addressed as directives integrated into ongoing policy and planning renewal process, subsequent to OCP adoption. *Preliminary priorities* are:

- Develop adaptation-oriented Development Permit Area guidelines for building and site design, e.g. rainwater management, landscaping and passive solar design.
- Assess the suitability of using vulnerability zoning for sea-level-rise to shape development and re-development
- Include guidance on rainwater capture, addressing both diversion to toilets and landscaping as part of the Province's "purple pipe" implementation.
- As the City redevelops its mixed-use areas, improve the management of onsite water through promoting reuse, creating checklists and guidelines for storm water best practices, such as the use of bio-swales.
- Establish integrated watershed management plans for all watersheds, using Bowker Creek as a model.
- Expand the storm water best management practices to encompass more activities and business types.
- Update the City's engineering standards for roads and other types of infrastructure to reflect anticipated climate change impacts, notably intense precipitation events.
- Continue to promote and expand the street tree program, which has important water quality and quantity benefits for stormwater (and forest carbon benefits).
- Provide guidance for development of a community food and agriculture strategy, potentially working in partnership with other municipalities in Southern Vancouver Island on a regional strategy.
- Update the procurement and tendering process for capital projects to consider impacts and adaptation.
- Require a climate impact and adaptation assessment for capital projects.
- Update the OCP's resiliency statement to acknowledge the need to adapt to climate impacts, such as extreme precipitation, water shortages and droughts. One determinant of adaptive capacity and resilience is social capital, notably strong community relationships.

FOR MORE INFORMATION



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