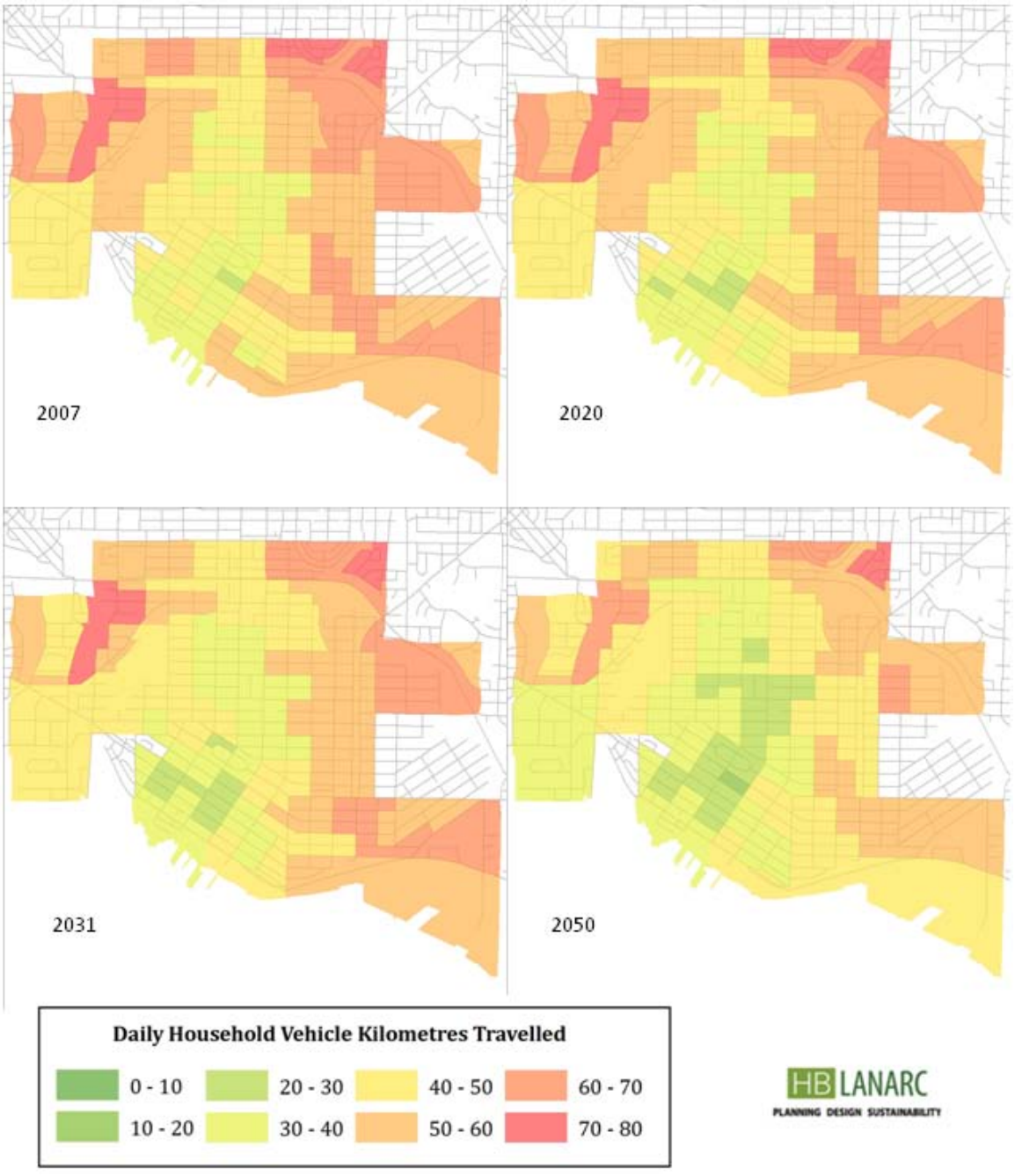
Taking Action on Climate Change:
Modeling Energy and Emissions Reductions in the City of North Vancouver

"Climate change is a universal challenge that requires action at all levels. The City of North Vancouver's Community Energy and Emissions Plan offers a strategic response to this challenge, integrating analysis and targets with government policies, while encouraging community engagement. The City has developed a Low Carbon Energy and Emissions Path that will guide us toward the carbon-neutral future presented in the 100 Year Sustainability Vision."

Mayor Darrell Mussatto
City of North Vancouver

Summary

The City of North Vancouver is taking decisive action on Climate Change by actively working to manage energy and reduce greenhouse gas emissions from buildings, transportation and waste. In 2009 the City established a cross-departmental Climate Action Task Force to oversee the creation of the City's Community Energy and Emissions Plan (CEEP) to meet the Provincial requirement to add targets, policies and actions in the Official Community Plan by May 31, 2010. The City hired HB Lanarc



for their expertise in modeling the impact of a range of aggressive climate action policies and actions. Our main goal in this exercise was to update of the City's existing Local Action Plan, strengthen buy in, integrate priorities into existing business activities, and develop defensible, meaningful targets to inform the statutorily required OCP Amendment.

Background

We had as our broadest goal the investigation of a path to meet our net zero common vision for the future.

The City of North Vancouver is a small, dense urban municipality, located at the base of the North Shore Mountains. Supporting a population of 48,000 and workspaces for more than 23,000 jobs, the City covers a land area of only 12 square kilometres. The City's compact urban form and good balance of jobs to residents has produced some of the lowest emissions per capita in the Province (5 tonnes per capita vs 6.5 tonnes per capita as the average for BC's communities) and some of the shortest trip distances by vehicles.

The City has been guided by energy management policies since the adoption of its 2002 Official Community Plan and has been pursuing specific targets for GHG reduction based on its Local Action Plan for Energy Management and GHG Reduction of 2005. The City has been looking ahead through the lens of its 100 Year Sustainability Vision toward a net zero carbon future. The City envisions being net zero by its 200th birthday in 2107.

The CEEP project was initiated at the staff level in response to Provincial legislation (Bill 27 – the *Local Government (Green Communities) Statutes Amendment Act* but builds on a long history of being an early adopter of energy planning initiatives. As the City's community emissions profile does not include large emissions sources, such as marine and air emissions or heavy industrial sources, the City has found it faces significant challenges in achieving sizable reductions commensurate with the Provincial aspirations. Deep emission reductions are likely possible in very large single industrial point sources – individual sources that are greater than the thousands of tiny distributed sources across the City.

Despite these challenges the City chose to pursue aggressive reductions. In its development of targets, policies and actions for the City's OCP. We determined to build upon our early adoption of a GHG Local Action Plan (2005) with a more rigorous modelling approach to produce challenging but achievable targets for the community.

The approach, through our consultants at HB Lanarc, involved identifying the variables that influence emissions, and adjusting values into the future based on set of policies and actions that impact those variables. Through an iterative modeling effort involving active staff, council and stakeholder input, ambitious yet achievable emissions reduction targets were established. We wished to create a plan with short and longer term targets while projecting past 2050 toward net zero carbon by 2107, as envisioned in the 100 Year Sustainability Vision.



Policy Framework

With the 100 Year Sustainability Vision of net zero carbon foremost in mind, the targets, policies and actions of the CEEP were enshrined in an OCP amendment, providing the highest level of direction for staff and Council's pursuit of climate and energy initiatives. This formal OCP Amendment strengthened many of the existing policies in the City's Long Term Transportation Plan, complemented the City's contribution towards regional waste reduction efforts along with the activities of active groups such as the Energy Efficient Buildings Working Group. It also provided direction for cross cutting activities like the annual budget process. The CEEP not only provides an on the ground plan of action out to 2050 but lays the foundation for energy and climate considerations in the forthcoming overall update to the City's Official Community Plan (entitled OCP 2021 & Beyond).

Approach

To achieve significant energy conservation and GHG reduction in the community, HB Lanarc helped the City continue along our way to a Low Carbon Path. This included development of a vision and overarching goals along with sector-specific goals, policies and actions. This exercise melded rigorous quantitative analysis and realistic local and senior government policy considerations with meaningful engagement, while being informed by existing City of North Vancouver plans and policies. The Low Carbon Path was shaped by the following overarching goals:

- Intensification of major energy and emissions policies and actions undertaken by the City within its sphere of influence as a local government;
- Engagement with senior governments on realistic policies and measures within their sphere of influence; and
- Pursuit of the City's 100 Year Sustainability Vision of reducing carbon emissions to zero by 2107.

Our work resulted in an achievable path towards net zero carbon, informed by policies and actions undertaken across all sectors – buildings, transportation, and waste. We set the following three milestones to achieve progress towards our low carbon future.

A. 2020 (Provincial and International climate milestone)
B. 2030 (the OCP horizon)
C. 2050 (another important climate milestone)

The steps for developing the path included the following:

1. Map future land use changes adhering to direction set by the City's current OCP over the first two milestones and continue that trend on a path to carbon zero;
2. Map future transportation infrastructure and service improvements as laid out by the City's Long Term Transportation Plan;
3. Translate proposed senior government policies and actions into impacts on the emission and energy profile of the City of North Vancouver;

4. Through consultation with Council, staff, stakeholders and the public, identify opportunities for building on current local and senior governments plans to achieve deeper emission reductions across all sectors:
    a. Land use
    b. Transportation
    c. Buildings
    d. Energy Supply
    e. Solid Waste

5. Model the Low Carbon Path, and fine-tune strategies to achieve a balance of deep emission reductions with efficient efforts across each sector.

The Tool

The Energy and Emission Scenario Modeling and Mapping work that HB Lanarc performed for the City of North Vancouver was used to answer a number of important questions pertaining to community planning. The modeling can be applied in planning applications from the neighbourhood to regional scale. In the most general terms, the HB Lanarc model provides a quantitative foundation on which challenging yet achievable targets, policies and action plans can be developed. Additional features of the modeling include:

- The ability to connect targets with practices and technologies over which local governments have authority and influence;
- The opportunity to map the emissions reduction potential of specific combinations of policies and actions over time;
- The ability to identify the energy use and GHG emission impact of individual policies and actions;
- The delineation of the energy and emissions reduction opportunities within the spheres of senior and local levels of government;
- The integration of energy and emission planning into all aspects of existing local government land use, transportation, solid waste and infrastructure planning.

The model is useful for estimating future GHG emissions and energy use for each of the major sources of emissions in a community. The major limiting factor for all sectors is the availability of data. Sectors that are typically included in the modeling are listed below:

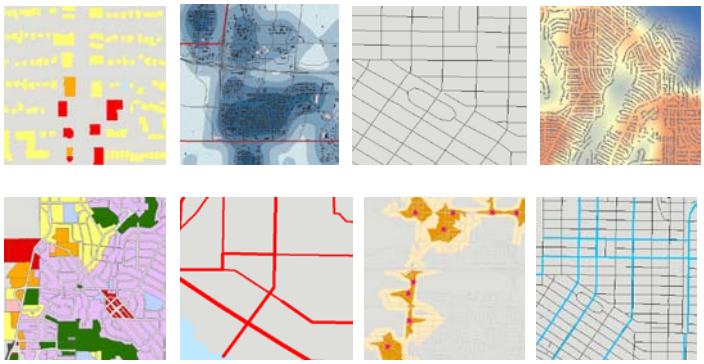
Emission Category	**Included in Model**
Transportation	
▪ Private Vehicles	✓
▪ Transit	✓
▪ Commercial Vehicles	-
▪ Active Transportation	✓

Buildings ▪ Residential ▪ Commercial ▪ Institutional ▪ Municipal ▪ Industrial o Energy use o Process emissions	 ✓ ✓ ✓ ✓[1] -
Solid Waste ▪ Direct emissions ▪ Downstream emissions ▪ Upstream energy consumption from manufacturing ▪ Upstream transportation emissions	 ✓ ✓[2] ✓ -
▪	

Model Inputs
The following provides an overview of the model inputs.

Community Profile
- Socioeconomic data including Census data.

Land Use Mix and Density
- Land Use Mix
- Location of residences and jobs
- Location of key destinations, such as grocery stores, schools and retail commercial



Transportation Network, Mode and Efficiency
- Speed, service hours and headway of transit system
- Walking and cycling paths and trails

[1] Subject to utility commission confidentiality rules. The energy provider may not be able to disclose data for some users and sectors.
[2] HB Lanarc calculates downstream emissions occurring from solid waste that is taken to a disposal facility outside of a community's jurisdiction using a modified version of the US EPA's "Methane Commitment" method.

- The number, type and estimated kilometres driven of cars and commercial vehicles
- The efficiency and energy source of transit
- Type density and connectivity of the road network



Building Type and Performance

- Floor area of each building sub-type
- Energy type mix within residential, commercial and industrial buildings
- Retrofit rate for each building sub-type
- Building-scale renewable energy technology use



Energy Supply

- Supply distribution of grid-scale energy
- Greenhouse gas emission sources
- Local renewable energy generation (electricity and heat)

Solid Waste Management

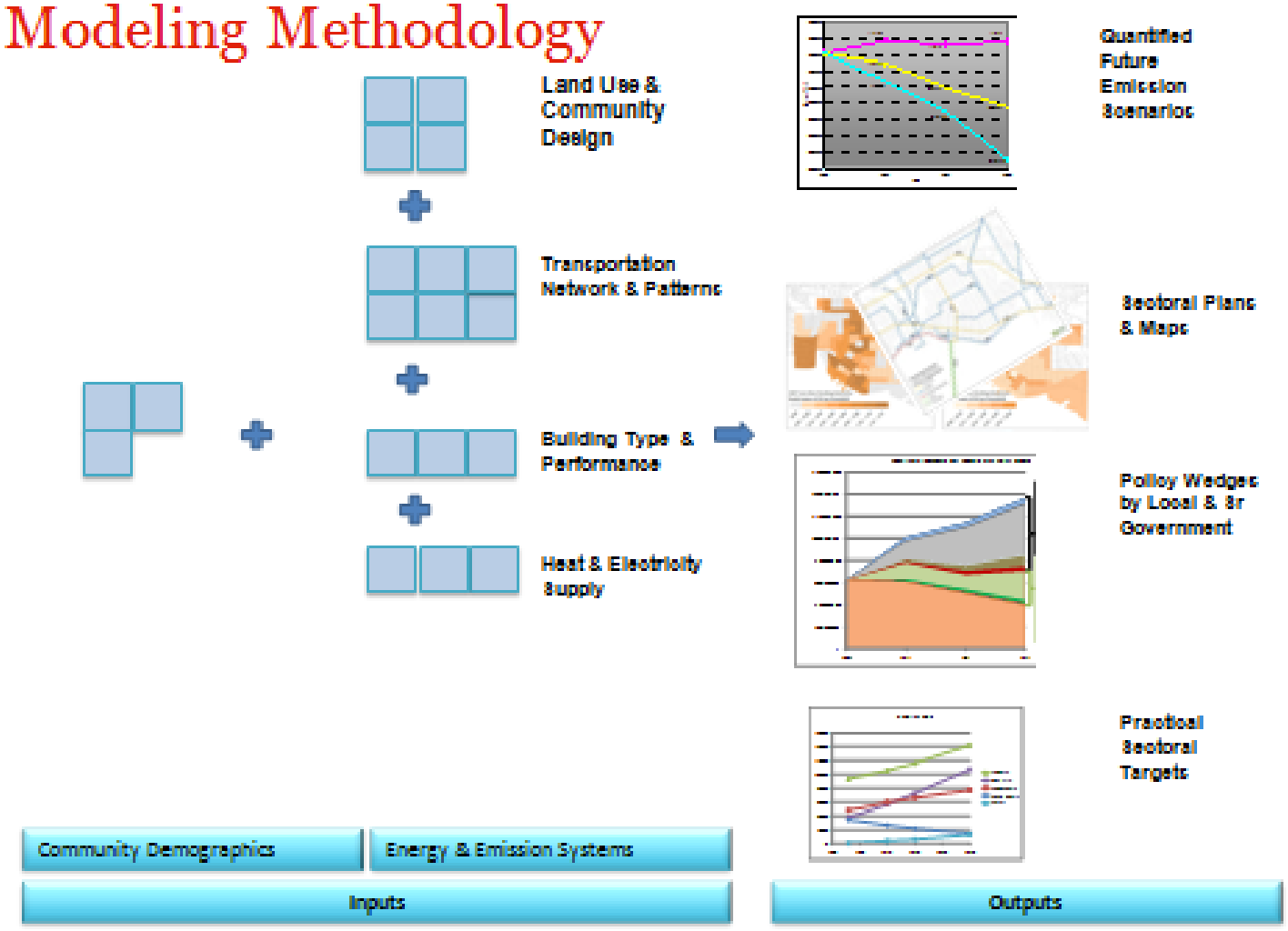
- Mass and composition of solid waste generated
- Division of solid waste generated by disposal and diversion technology
- Management practices



Community Forests and Agriculture (although HB Lanarc can model these activities, this was not part of this project scope)

- Forest type and area
- Agriculture type and area

Modeling Methodology



Assumptions

A detailed explanation of the modeling methodology is included as Appendix B (Detailed Modeling Results, pages 77 to 94) and Appendix C (Technical Description of Modeling, pages 95 to105) of the Community Energy and Emissions Plan, which is available at the following URL: www.cnv.org/climateplanupdate. Assumptions include a population growth, based on regional projections, of 1% per annum compounded, and the achievement of up to 1.6 jobs per new resident by 2050.

As with any data set or modeling process, we needed to assume that the base information provided in the Provincial inventory (2009 CEEI) and trip diary studies and other information collected was accurate. In addition, we made assumptions about the causal relationships between population, land use and transportation for use in our estimations. Average sizes for building types and standard energy use numbers for building archetypes used also require assumptions to be made, based on reasonable projections of current trends.

Other assumptions included estimating the uptake of building retrofits, a reasonable increase in use of renewable energy on site for developments, an eventual connection of all new and government-owned buildings to Lonsdale Energy Corporation and this district energy system's decarbonisation over time – all within the time lifetime of the CEEP: by 2050. Through the sensitivity analysis, involving further focussed modeling of unique policies and in turn variables, these assumptions were further refined.

Model Process

First, HBL built a Spatialised Baseline which involves mapping GHG emissions by dissemination area / traffic zone / census block to produce a spatial summary of energy use and GHG emissions.

In the next step, an excel-based model with a dynamic GIS software connection was used to quantify the impact of various potential policies and actions compared with a business as usual approach. Following analysis of the local context, and decisions involving the City and stakeholders on a preliminary list of emission and energy reduction strategies, one future scenario was modeled. The outputs included maps, charts and tables that summarised the results of the analysis. The effect of each modeled policy/action on energy and emissions was estimated as a part of the outputs. Although this modelling can produce options for scenarios (i.e, low, medium and high emissions targets) given the City's lean carbon status and previous experience with its GHG Local Action Plan (2005) along with limited budget the City chose to explore one aggressive reduction scenario, leading to one recommended set of challenging yet achievable targets for inclusion in the OCP amendment.

The final step involved conducting sensitivity analysis on policies and actions, and further adjusting variables in the model to refine the details of the emissions reduction path.


Energy & Emission Baseline
E&E trends, profiles, E&E maps

Analyze Local Situation
Complementary policies, community priorities, challenges/opportunities

Explore Energy & Emission Strategies
Opportunity mapping, qualitative scenarios, case studies

Model Future Scenario
model & map energy and emission future path

Review Scenario & Sensitivity Analysis
refine targets, policies and actions, and identify key policies to evaluate

Refine Preferred Path
Policy and action development, implementation strategy, implementation costing

Strategies

A summary of the overarching strategies for reducing emissions in each sector are included below as an overview of some of the key elements involved and actions required to achieve the desired energy and emissions reductions:

Land Use Planning

- Major driving factor in future energy use and emissions reduction.
- Increasing density and integrating residential and commercial uses in key zones.
- OCP Update process will determine how these land uses would be amended.

Buildings

- Constructing and retrofitting buildings to be more energy efficient.
- Maximizing opportunities for renewable energy sources and usage.

Transportation

- Making walking, bicycling and transit easier.
- reducing distance driven by cars
- making private vehicles and transit less GHG intensive.

Energy Supply

- decreasing carbon intensity of the energy supply through efficient systems.
- expansion and decarbonization of Lonsdale Energy Corporation's district energy systems.
- pursuing onsite renewable energy opportunities.

Solid Waste

- reducing the volume of waste and recyclables that enter the waste stream.
- diverting waste from disposal through composting and recycling.

Urban Agriculture & Landscape

- expand community gardening and urban agriculture to reduce emissions associated with today's food supply.
- expand urban forests and plant more trees to improve carbon sinks.

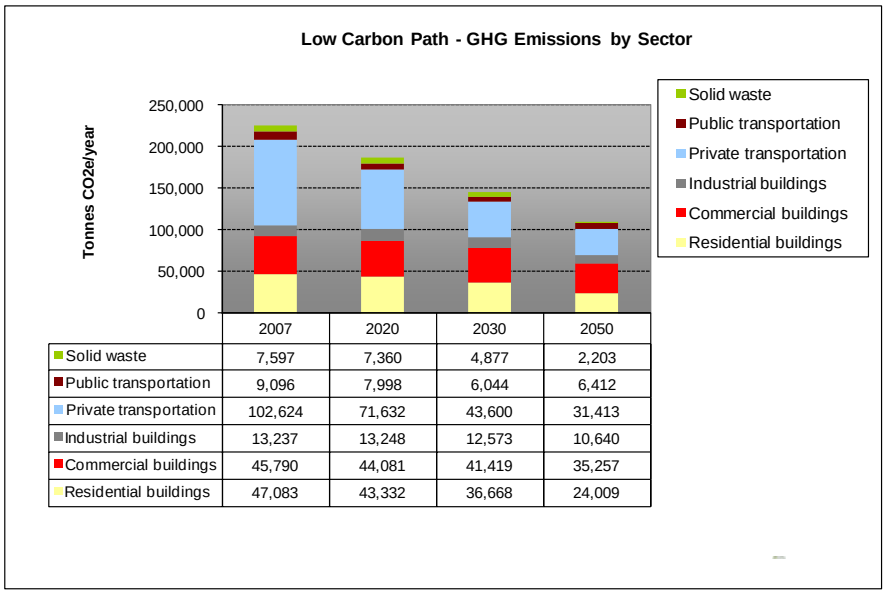
Education and Outreach

- increasing general awareness of climate change and sustainable energy.
- deepening and sustaining lifestyle and behavioural choices through education and outreach to support emission reduction policies.

**Community Energy and Emissions Plan (2010), page 26.*

Results

When the strategies outlined above are modeled out along the Low Carbon Path (as shown in the graph below) it becomes clear that the benefits of many actions, applied rigorously over time, produce significant reductions in emissions even in a relatively carbon lean community like the City.



	2007	2020	2030	2050
Solid waste	7,597	7,360	4,877	2,203
Public transportation	9,096	7,998	6,044	6,412
Private transportation	102,624	71,632	43,600	31,413
Industrial buildings	13,237	13,248	12,573	10,640
Commercial buildings	45,790	44,081	41,419	35,257
Residential buildings	47,083	43,332	36,668	24,009

City of North Vancouver Low Carbon Path – Modeled Emissions by Sector

Annual Vehicle Emissions per Household in the Low Carbon Path

When mapped spatially (shown above) for vehicle emissions, the effect of these cumulative actions out to 2050 is a decrease in emissions – with deeper reductions (light colour) in the higher density, mixed use areas of the community.

The table below shows the results of the Low Carbon Path from a quantitative perspective - the implementation of the CEEP will see a 15% reduction in emissions over 2007 levels by 2020 and a 50% reduction by 2050 (both rounded down) for a total reduction of 115,000 tonnes. On a per capita basis the reduction from 5 to 1.58 tonnes per capita nets a 68% reduction by 2050.

Low Carbon Path	**Annual Emissions – Tonnes CO_2e/yr**			
	2007	**2020**	**2030**	**2050**
Residential buildings	47,083	43,332	36,668	24,009
Commercial buildings	45,790	44,081	41,419	35,257
Industrial buildings	13,237	13,248	12,573	10,640
Total buildings	**106,110**	**100,661**	**90,414**	**69,742**
Total buildings per capita	2.35	1.96	1.59	1.01
Private transportation	102,624	71,632	43,600	31,413
Public transportation	9,096	7,998	6,044	6,412
Total transportation	**111,720**	**79,630**	**49,644**	**37,825**
Total transportation per capita	2.47	1.55	0.87	0.55
Solid waste	**7,597**	**7,360**	**4,877**	**2,203**
Solid waste per capita	0.17	0.14	0.09	0.03
Community Total	**225,426**	**187,651**	**144,935**	**109,770**
Total change over baseline (tonnes)	0	-37,775	-80,492	-115,656
Total change over baseline (%)*	**0.0%**	**-16.8%**	**-35.7%**	**-51.3%**
Total per capita	4.99	3.65	2.55	1.58
Per capita change over baseline (tonnes)	0.00	-1.34	-2.44	-3.41
Per capita change over baseline	0.0%	-26.9%	-48.9%	-68.3%

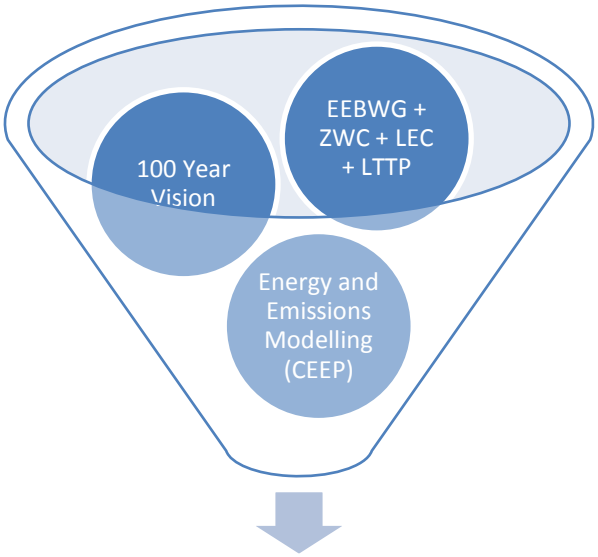
Appendix B– Table 10–Modeled Annual Emissions by Milestone, Sector + Community-wide
*Page 77 CEEP
Note: 2007 GHG emissions according to 2009 CEEI inventory.

From a qualitative perspective, key benefits of rigorous energy and emissions modeling in the City include a much broader, comprehensive understanding of climate and energy use and strategies for reduction across the organization. The CEEP and its modeling process produced an on the ground action plan to guide the City and put us on a path to achieving our vision of a carbon neutral future by 2107. The results of this exercise will support a variety of related sustainability planning efforts including the development of mixed use projects and the expansion of the City's bike lane network. The CEEP and OCP amendment process has highlighted climate and energy deliberations for the update of the Official Community Plan (OCP 2021 + Beyond) currently in process. Finally, our City's CEEP provides a clear model that can be adapted and applied in another community.

Implementation - Target Setting

The tool that HB Lanarc developed for use in North Vancouver played a key role in the identification of the City's community wide targets, now secured in the OCP. The 100

Year Sustainability Vision had charted a path for us to achieve a zero carbon community. The CEEP supported this vision of the City's future with a rigorous quantitative modeling process which, when combined with the parallel and interlinked efforts of the City's Energy Efficient Buildings Working Group, the regional Zero Waste Challenge, the ongoing efforts of the Lonsdale Energy Corporation and the guidance of the existing Long Term Transportation Plan, enabled the identification of a community wide target for GHG reduction and a number of supporting, sector based targets as follows:



Target Setting

Official Community Plan GHG Reduction Targets (2010 Amendment):

City of North Vancouver Community Wide Target

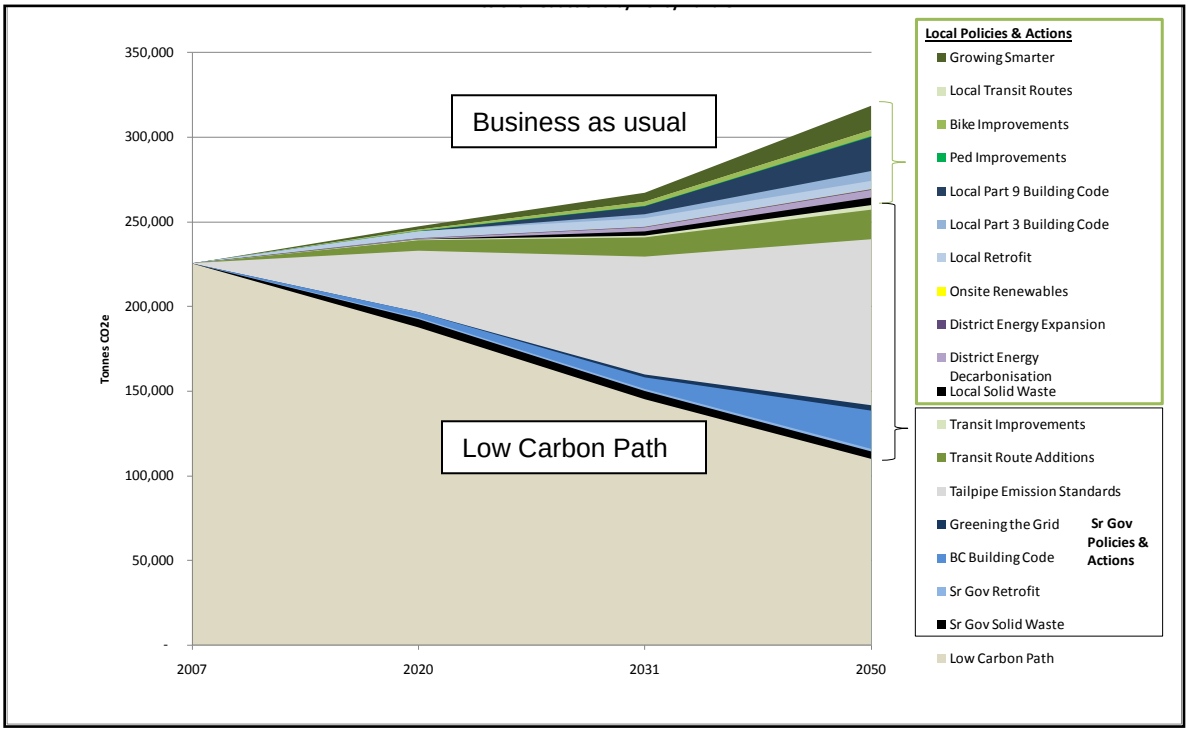
- 15% reduction below 2007 levels by 2020
- 50% reduction below 2007 levels by 2050
- On a path to zero emissions by 2107, the City's 200th Birthday

City of North Vancouver Sector Based Targets

- To pursue increasingly aggressive **energy standards** for new and existing buildings over time…with a goal of 20% better than the BC Building Code;
- To establish a **Building Retrofit Program** with a 3% retrofit rate/year out to 2020;
- To work with **Lonsdale Energy Corporation** to connect 100% of all City-owned, Provincial and Federal buildings by 2020;
- To reduce the number of **daily vehicle trips** per capita by 10% and increase **mode share** for non-auto to 30% by 2028.

Barriers & Breakthroughs

Key challenges, as with many communities, began with determining whether to select aspirational targets or to select targets based on defensibly quantified actions. Another key challenge was to access funds to acquire the specialized expertise (HB Lanarc) for energy emissions modelling necessary to take a bottom up, rigorous approach to setting targets. Other challenges included obtaining cross departmental and external data for use by the consultants for the model being used and coordinating input into a process with a fast approaching deadline. The City needed to liaise and strategize with the Lonsdale Energy Corporation, the City's energy utility, to ensure alignment of long term plans. All of these challenges were overcome through the use of a cross-departmental Climate Action Task Force to better coordinate the City's efforts.



One key barrier beyond the control of the City and indeed the local government realm is the scope of power and influence that senior levels of governments enjoy in relation to the bulk of the energy use and GHG emissions that we wish to reduce. The above chart illustrates emission reductions by policy wedge for the City of North Vancouver. Wedges are organized by Level of Government. As one can see by the graph, a significant proportion of the City's reduction efforts to achieve our emissions targets rely on senior government policy changes and funding.

The CEEP plan, based on the modelling by HB Lanarc, was endorsed in principle by Council in April 2010, while the associated targets, policies and actions were incorporated into the OCP in May. As the implementation of the CEEP begins, what is clear is that it represents a change from business as usual. An Implementation Strategy, currently in development, will seek to provide full costs and prioritization of the policies and actions identified in the CEEP . We know we will need to realign existing capital

priorities and build strategic external funding/partnership efforts in order to achieve our aggressive targets. Future decisions by the City will be viewed through the lens of the CEEP and its Implementation Strategy, and considered for their contribution toward the specified targets.

Engagement and Governance

The CEEP project was initiated at the staff level in response to strong Council climate change interest and Provincial legislation (Bill 27 – the *Local Government (Green Communities) Statutes Amendment Act)*. A cross-departmental Climate Action Task Force involving staff secondments was created to oversee the update of the CEEP and the OCP Amendment. This approach proved highly effective. A Community Energy Manager position has been created, in partnership with BC Hydro, to facilitate the implementation of the CEEP.

An important part of the process involved engaging key stakeholders including representatives of local business associations, community groups and advisory body members and staff. HBL, the energy and planning consultants, were key to this engagement process. BC Hydro, Translink and Metro Vancouver also provided input. A series of Council Workshops, Council Meetings, Community Stakeholder Workshops, Open Houses, a Joint City Advisory Committees' Workshop, Climate Action Task Force and broader staff Steering Committee meetings were held throughout the process providing continual feedback and input into this iterative process.

Conclusion – "the New Normal"

The use of this tool and its rigorous modeling of energy and emissions is highly effective in that it produced specific measurable targets and outlined key actions to reasonably achieve these targets. When supported by a strong foundation of guiding OCP policies and tied to a long term vision of carbon neutrality (100 Year Sustainability Vision) this model of setting energy and emissions targets creates an antidote to business as usual. The secret ingredient to its success, however, will be effectively engaging the community in understanding and embracing 'the new normal' of energy conservation and a low carbon lifestyle – and for the municipality, a 'new normal' will result in better engaging residents in key policy initiatives. Meanwhile, the City will continue to pursue an urban form that supports compact, complete communities, with more energy efficient buildings and better transit, all with an eye to creating a zero carbon future and a more sustainable community.

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