GREEN ENERGY PLAN

SHAPING OUR FUTURE

ABBOTSFORD

Preface

This Green Energy Plan is one in a series of plans and strategies being prepared as part of the City of Abbotsford's Community Sustainability Planning Initiative (CSPI). The CSPI describes the City's ongoing effort with our community partners to grow and function in an integrated way to support the community's fiscal, economic, environmental and social needs today and in the future.

The intent of the CSPI is to develop high-level plans and strategies that support the community in moving toward sustainability. As high-level documents that identify sustainability opportunities and potential responses to opportunities (e.g. initiatives, actions, policy, approaches, etc.), CSPI plans and strategies do not commit the City or community partners to specific actions or outcomes. Implementation of initiatives, actions, etc. will require participating organizations to consider a variety of factors (e.g. available resources, priorities, work plans, strategic plan alignment, timelines etc.) before committing to action.

The CSPI is guided by the Community Sustainability Strategy which establishes Abbotsford's sustainability vision and supporting framework for integrating sustainability into City policy, plans, strategies, and decision-making, and supports community sustainability efforts. The Green Energy Plan sets out to help achieve the vision of the CSS by outlining strategies to make Abbotsford a greener community where energy use and greenhouse gas emissions are reduced without comprising air quality.

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EXECUTIVE SUMMARY

Objectives

The City of Abbotsford has developed a Green Energy Plan. The objectives of the Plan are to:

- identify a set of strategies to reduce energy use, electricity use, and carbon emissions between the present and 2040;
- identify potential air quality implications of the energy and carbon strategies;
- meet the City's commitments to the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) program requirements (milestone 2-3 of community stream), of which the City is a signatory; and
- work to achieve the City's community level commitments under the BC Climate Action Charter, of which the City is a signatory.

Where are we now? - Baseline Energy and Emissions

Energy use in the community is divided approximately equally between buildings (48% of community energy use) and transportation (52% of community energy use).

The total energy consumption is in the range of 18,100,000 GJ annually of energy. This energy consumption has an approximate retail value of $460,000,000 annually.

Carbon emissions are related to the energy used in buildings (29% of community emissions), transportation (69% of community emissions), and solid waste decomposition (2% of community emissions).

Air emissions generated within the City boundary are generally slightly more than a proportionate share (based on population) of the emissions in the Lower Fraser Valley (LFV). With 4.5 % of the Valley's population, activities in Abbotsford generate 6.0% to 9.0% of the emissions of carbon monoxide (CO), nitrogen oxides (NOx), fine particulate matter (PM2.5), volatile organic compounds (VOCs), and carbon emissions (GHGs). Sulfur emissions are proportionately low (1.0%). Notable is that ammonia emissions – responsible for white haze – generated within the City are 33% of the total emitted in the LFV.

There is a connection between energy and air emissions in that many of the air contaminants are the result of fuel combustion – and so reducing energy can reduce air emissions.

Where are we going? Forecasted Population, Energy Use and Emissions

Further growth is forecasted for the City. From now to 2040 a business-as-usual scenario will result in:

- An estimated increase of 54% in population,
- A 17% increase in energy use which translates to a 28% decrease on a per-capita basis,
- A 19% increase in carbon emissions which translates to a 27% decrease on a per-capita basis, and
- Forecasts for air contaminants are not available for the City itself, but for the Lower Fraser Valley as a whole anticipated changes from 2010 to 2030 include: a 15% increase in carbon monoxide emissions (CO), a 15% decrease in nitrogen oxides (NOx), a 10% to 20% increase in particulate (PM, PM10, and PM2.5), a 35% increase in sulphur emissions (SOx), a 2% increase in VOCs (Volatile Organic Compounds), and an 18% increase in ammonia emissions.

Vision, Goals, Strategies, and Actions

A vision for Abbotsford's "energy future" draws upon the currently approved direction in the Official Community Plan (OCP), the Strategic Directions (strategic plan) and the vision of the Community Sustainability Strategy (CSS). With a focus on energy, the Community Energy Vision for Abbotsford in the year 2040 is:

> Abbotsford Community Energy Vision for 2040…..
>
> *In 2040, Abbotsford is a model community of energy efficiency and alternative energy generation. Through innovation and commitment, we have reduced our spending on energy across the community and have minimized our carbon emissions without compromising our air quality.*

The Green Energy Plan sets a direction to achieve the energy vision. It is grouped around five themes: land use and transportation, buildings, solid waste, agriculture, and the economy. Within these, a total of seven goals were defined. The Plan developed 13 strategies – each with a number of specific actions.

Implementation

This Plan outlines strategies that can be taken to support and promote greenhouse gas and energy use reductions in Abbotsford. Some strategies will be relatively easy to put into place, because they require little change and will cost little to implement (e.g. Promoting programs) while others will require more significant change (e.g. neighbourhood plans). Fundamentally important to the successful implementation of the GEP is the understanding that it is a community plan and its success will ultimately depend on inspired community action. This includes identifying opportunities for the businesses, community stakeholders, and the City to work collaboratively to reduce energy use and greenhouse gas emissions for the community. Success will require that stakeholders of Abbotsford understand, value and practice principles of sustainability, and strong sustained leadership from all parts of the community is paramount.

Scenarios: Business-as-Usual and a Reduction Scenario

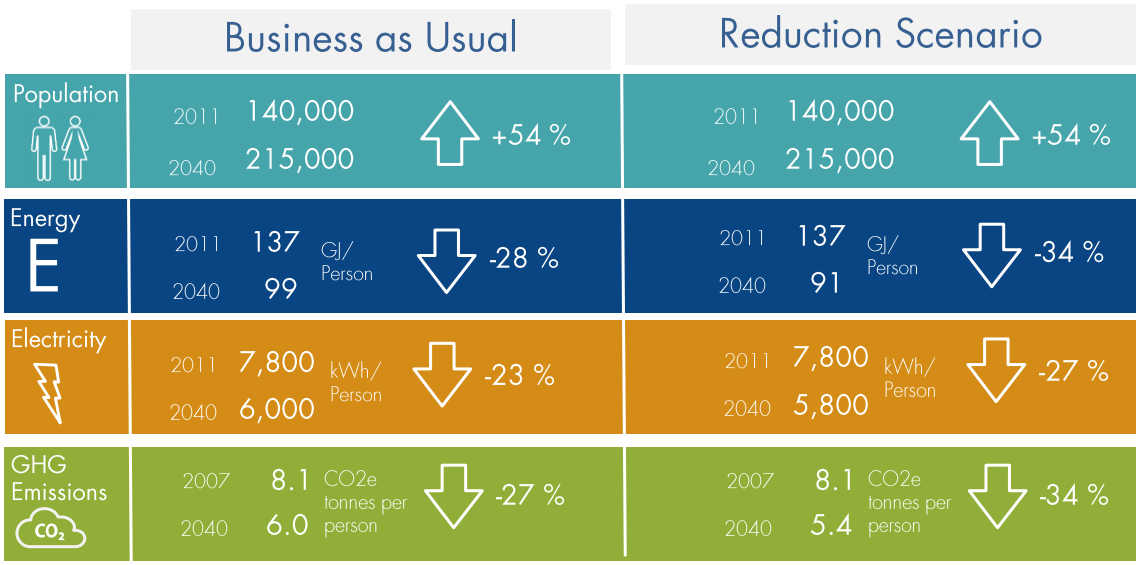
Two scenarios were developed. The first scenario assumes continued activity "as is" – a business-as-usual scenario. The second is a reduction scenario. Key features of the reduction scenario are the encouragement of neighbourhood plans to focus additional development to the transit corridor. As well, some additional support and encouragement are provided to energy conserving activities.

Results

A summary comparison for the two scenarios is shown below (Figure S-1). Under the business-as-usual scenario, most of the reductions occur due to senior government activities such as vehicle standards and the building code. The reduction scenario depicts a more active role for the community and correspondingly greater savings in energy and emissions.

The actions in this plan are consistent with the objectives defined in the OCP, and implementation will establish a path towards achieving these goals.

Figure S-1: Scenario Comparison



Note: The reductions shown are on a per capita basis.

Implementation: Goals, Strategies, and Actions

Theme: Land Use & Transportation

Goal 1: Establish neighbourhoods with increased density, and mixed use transit-oriented urban form, which promotes walking, cycling and transit use

Strategy 1: Focus new residential growth in the city core

- Action 1-1: Ensure the OCP land use densities support the proposed transit network
- Action 1-2: Consider creating neighbourhood plans for areas identified for focused growth
- Action 1-3: Encourage innovative infill housing in growth areas
- Action 1-4: Consider creating a Sustainability Checklist for new developments to use as a reference

Strategy 2: Improve infrastructure for pedestrians and cyclists

- Action 2-1: Consider updating design guidelines and engineering standards for infrastructure to prioritize walking and cycling

Strategy 3: Work with BC Transit to advance long term transit planning

- Action 3-1: Concentrate transit frequency along core transit routes in the Transit Future Plan
- Action 3-2: Consider incorporating transit priority measures into transportation and roadway planning and design standards
- Action 3-3: Encourage transit use in the transit priority areas

Strategy 4: Implement Transportation Demand Management (TDM) measures

- Action 4-1: Consider creating a TDM strategy appropriate for Abbotsford
- Action 4-2: Explore working with BC Transit to provide a neighbourhood transit pass option in transit-oriented neighbourhoods

Strategy 5: Provide infrastructure for alternative (low carbon) vehicles

- Action 5-1: Consider installing EV charging stations at key community locations and encourage in new developments

Theme: Buildings

Goal 2: Encourage energy efficiency of existing and new buildings

Strategy 6: Promote energy efficiency retrofits in the existing building stock

Action 6-1: Consider promoting existing programs that provide incentives for green renovations

Strategy 7: Create highly efficient new residential and commercial buildings

Action 7-1: Consider creating an education program to promote highly energy efficient new buildings and technologies

Strategy 8: Promote use of alternative energy in homes and commercial buildings

Action 8-1: Consider promoting alternative renewable energy sources

Strategy 9: Identify and support opportunities for district energy

Action 9-1: Research the potential district energy systems through the neighbourhood planning process

Action 9-2: Encourage "District Energy ready" heating systems in identified district energy opportunity areas

Theme: Solid Waste

Goal 3: Promote waste reduction, increase diversion and maximize recovery

Strategy 10: Divert organics from the waste system

Action 10-1: Complete implementation of curbside organics diversion

Action 10-2: Assess commercial and multi-family organics diversion

Theme: Agriculture

Goal 4: Promote the reduction of agricultural methane released from livestock manure

Goal 5: Maximize the use of our agricultural waste as an energy source

Strategy 11: Encourage the development of anaerobic digestion facilities for agricultural wastes

- Action 11-1: Contribute to the Ministry of Agriculture draft bylaw development process for on-farm anaerobic digestion systems
- Action 11-2: Consider revising the Zoning Bylaw proactively to include Anaerobic digestion provisions
- Action 11-3: Consider promoting energy conservation in agricultural operations

Strategy 12: Enhance connections between farms and residents

- Action 12-1: Consider supporting promotion of local food systems

Theme: Economy

Goal 6: Establish Abbotsford as a centre for green business, where our resources are used efficiently and environmental impact is reduced

Goal 7: Create local employment opportunities to reduce the need to drive outside the community for work and services

Strategy 13: Promote a "green economy" as a key City objective

CONTENT

APPENDICES

FIGURES

TABLES

Acronyms, Abbreviations and Definitions

CO	Carbon monoxide is a poisonous gas emitted from vehicle tailpipes that burn fossil fuels. It is also emitted from burning wood. CO can have significant impacts on human health.
CO2e	Carbon dioxide equivalents are a measure for how strong a greenhouse gas is relative to the emission of carbon dioxide. For example, emitting 1 tonne of methane gas has the equivalent impact of emitting 25 tonnes of carbon dioxide.
CAC	Common air contaminants are a group of pollutants that air quality management traditionally seeks to reduce because their presence, and interactions, results in smog and acid rain. The six contaminants include: particulate matter (PM), nitrogen oxides (NOx), sulphur oxides (SOx), volatile organic compounds (VOC), carbon monoxide (CO), and ammonia. Ground-level ozone (O3) and secondary particulate matter are also referred to with CACs because they are by-products of interactions between CACs.
GHG	Greenhouse gases are gases that trap heat in the earth's atmosphere. The dominant greenhouse gas resulting from human activity is carbon dioxide (from fossil fuel combustion), followed by methane (from solid waste and agriculture).
LFV	The Lower Fraser Valley airshed is an area of shared air that encompasses Metro Vancouver, the Fraser Valley Regional District, and parts of Whatcom County in the U.S.
NH3	Ammonia is a gas that is emitted from livestock waste management and fertilizer application. It has a strong odour, can irritate eyes, nose and throat, and can interact with other gases to form secondary particulate matter, which has harmful effects on human health and the environment.
NOx	Nitrogen oxides are gases formed from burning fuel, and from air in the combustion process. Nitrogen oxides can have adverse effects on human health and the environment.
O3	Ozone is a colourless, reactive gas that occurs naturally in the upper atmosphere – where it protects the earth's surface from damaging wavelengths of solar ultraviolet radiation. Ground-level ozone is a secondary pollutant that forms from the interaction between NOx and VOCs in sunlight. Elevated concentrations of ground-level ozone typically occur downwind from sources of the ozone precursors and generally occur during the warmer months of the year when light intensity and duration is greatest (i.e. summer months). It leads to 'smog', is highly irritating and can cause significant human health impacts. It also decreases productivity of crops and vegetation.
OCP	Official Community Plans are developed by municipalities in BC and provide a long term vision for the community. It guides decisions about land use, planning, and general purposes of local government. OCPs are usually developed with significant public consultation.

PM	Particulate Matter is airborne particles, and are often split into two categories: PM2.5 (fine particulate) and PM10 (courser particulate). They are also categorized as primary (directly emitted) or secondary (formed in the air by interaction between other compounds). PM is linked to numerous human health and environmental concerns.
SOx	Sulphur oxides are gases emitted from combustion and refining processes of coal, oil and other ores. Sulphur oxides can have adverse effects on human health and the environment.
VOC	Volatile Organic Compounds are fumes and vapours from gasoline and solvents. There are also natural sources of VOCs such as coniferous forests. Some VOCs have direct toxic effects on humans. Some VOCs react with nitrogen oxides to form ground-level ozone that leads to smog and formation of secondary particulate matter; both of which have harmful effects on human health and the environment.

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Community Sustainability Strategy - Steering Committee		
	Name	**Title**
1.	Jim Gordon	General Manager, Engineering & Regional Utilities
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7.	Ray Eldridge	PCL
8.	Jacquay Foyle*/Mark Raymond/Michael Schwalb	Ministry of Agriculture
9.	Ryan Huston	CHP Architects
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11.	Nova Hopkins	Resident
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  - City Industry Development Advisory Committee
  - Environmental Advisory Committee
  - Economic Development Advisory Committee
  - Mission Abbotsford Transit Commission
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- Survey respondents
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1 | INTRODUCTION

1.1 Energy and Local Governments

Energy is the lifeblood of modern communities. Our increasing energy use over the recent decades has been closely linked with our economic growth. Through our use of energy we have achieved unparalleled improvements in our standard of living and quality of life.

Historically, energy has been inexpensive and widely available – delivered to us by reliable utilities and an efficient marketplace. Any negative impacts of our energy use have typically been considered minimal and acceptable.

Whether we can continue into the future as we have is highly uncertain and perhaps unlikely. Energy supplies of all types are more challenging and more expensive to develop. A stable long-term supply of energy at today's relatively affordable pricing is a near impossible challenge.

Other concerns also impact our energy use. We understand the connection between fuel combustion and air quality much better today; we know that an increasing population in the Lower Fraser Valley is consuming more energy and potentially creating more emissions in our airshed, new supplies of clean electricity are contentious to develop, and as a whole, we are coming to appreciate the need for managing our carbon footprint to control global climate change.

For years communities have provided their residents and businesses with reliable water, sewer, waste and other services. These are familiar roles for municipalities. As energy becomes a more precious commodity globally communities are seeing the importance of being proactive to define their own 'energy future'. This is a role that is unfamiliar to most local governments, but one that most communities in BC are starting to address in the interests of their residents and local economies.

1.2 What is a Green Energy Plan?

An energy plan provides a strategic direction for the community to move towards a desired future. It indicates key areas of focus that are aligned with the Community Sustainability Strategy (CSS) and other planning documents, in particular the Official Community Plan (OCP).

This Green Energy Plan (GEP) answers the following questions:

- **Where are we now? - Baseline Energy and Emissions.** Residents, businesses and organizations in Abbotsford consume energy in order to heat and power buildings, and to move goods and people around. Because a lot of the energy we consume comes from burning fossil fuels (e.g. gasoline, diesel, natural gas), these activities also result in

the release of GHG emissions. A profile of how energy is currently used in Abbotsford on an annual basis provides us with an understanding of where and how much energy is consumed. This can help identify areas where we can become more efficient in our energy consumption. We can also better understand how much GHG emissions we generate and what types of energy sources (fossil fuels, hydro-electricity, alternative energy, etc.) we use.

- **Where are we going? - Forecasted Population, Energy Use and Emissions.** Abbotsford is growing, with a population expected to grow by 75,000 by 2040. As population grows, so does demand for energy. A "business-as-usual" (BAU) forecast tells us how much energy we will need, and how big our 'carbon footprint' will be under our current patterns of development and energy use.
- **Where do we want to be?** To ensure Abbotsford continues to be a place we want to live, work and play in, it is important to define our long-term vision and goals for the city. A clear understanding of where we want to be helps us make better decisions with respect to planning, developing, and programming for our community. This GEP defines a vision and sets goals to help guide the City towards reaching its City-wide energy reduction targets. The goals focus on Land Use and Transportation, Buildings, Solid Waste, Agriculture, and Economy.
- **How will we get there?** With a long-term vision, it is important to develop measures that will help us ensure we are on track for success. The GEP identifies numerous actions and tools to consider, from education campaigns to policies enabling energy efficiencies (e.g. anaerobic digestion). To fully achieve the vision and goals of this plan, residents, businesses and organizations in Abbotsford will each need to do their part.

1.3 Alignment with City Plans and Initiatives

The GEP is one component of the Community Sustainability Planning Initiative (CSPI), which includes three other projects: the Community Sustainability Strategy, Green Community Plan and Green Economic Investment Study. The Community Sustainability Strategy establishes a sustainability vision for the community through a series of 'future states' that describe what a sustainable Abbotsford looks like and how the City and its community partners can collectively move toward the desired 'future states'. The Strategy includes a sustainability vision and the following desired 'future states' for the City:

- Our community is healthy and enjoys a good quality of life
- Our community's resources and assets are managed effectively and efficiently
- Our natural environment thrives
- Our local economy is prosperous
- Our community is compact, connected and complete

The GEP supports each of these future states in helping the City achieve its vision to grow and function through an integrated approach where the community's, fiscal, economic, environmental and social needs are met today and in the future.

1.4 Green Energy Plan Objectives

This Green Energy Plan was developed as part of the Community Sustainability Planning Initiative (CSPI) to provide a roadmap for community energy use, carbon reduction, and reduction in air pollutant emissions. This work was undertaken to:

- provide an understanding of current energy use and GHG emissions that result from activities in Abbotsford;
- identify a set of goals for addressing energy use and GHG emissions between the present and 2040;
- design a suite of strategies that will enable the City to meet its City-wide per-capita reduction targets;
- educate and engage community members in the development of these strategies;
- identify potential air quality implications of the energy and carbon strategies;
- comply with the Federation of Canadian Municipalities Partners for Climate Protection (PCP) program requirements (milestones 2-3 of community stream), of which the City is a signatory; and
- comply with community level commitments under the BC Climate Action Charter, of which the City is a signatory.

1.5 How was the Green Energy Plan Developed?

The Abbotsford Green Energy Plan was developed as part of a group of four projects funded through the City, BC Hydro, Community Futures South Fraser and the Green Municipal Fund (GMF) of the Federation of Canadian Municipalities (FCM).

It included a combination of input from staff, residents and organizations in the community. Data collection, modeling and technical analysis was used to define opportunities and develop a business-as-usual scenario and a potential reduction scenario.

An important part of the process has been consultation with stakeholders, staff, and a steering committee that included City senior management and a council member.

1.5.1 Consultation and Input

Obtaining input to the GEP was an important part of the process. Local stakeholders and residents provide valuable knowledge, ideas and expertise to the project. As well, municipal staff input helps define how the City can implement actions.

The overall project was guided by a Steering committee composed of City senior management and one council member. Several meetings were held with an advisory group – composed of staff and relevant stakeholders (external to the City). As well, two directed workshops were held with residents and staff to solicit ideas and input. Following the workshops, the concepts of the GEP were shared with the public at an open house to gather their input.

1.6 Drivers for Action

1.6.1 Energy Costs and Scarcity

In recent years energy costs have fluctuated greatly. Concerns over energy security and pricing are becoming more common. Gasoline and diesel prices fluctuate dramatically on a seasonal scale but are well above prices of a decade ago. These increases have exceeded the inflation rate. Electricity prices are expected to rise substantially in the next three years.

Stable supplies and affordable prices for energy have been a component of our economic prosperity over the past decades. We may not be able to rely on price stability or low prices into the future. In light of this energy uncertainty, communities are beginning to appreciate their role to help prepare our communities by being efficient energy consumers.

1.6.2 Climate Change

There is increasing scientific evidence that global climate change resulting from emissions of carbon dioxide and other greenhouse gases (GHGs) is having an impact on the atmosphere and ecology of the planet. Climate change is expected to have serious negative impacts on global economic growth and development. In 2006, the UK government commissioned an independent economic review called the Stern Review, which estimated that the "costs of stabilizing the climate are significant but manageable; delay would be dangerous and much more costly."

1.6.3 Air Quality

Our energy use is intrinsically linked to air quality. All fuel combustion – fossil fuels or biofuels – create emissions of air pollutants. Reducing or maximizing the benefits of this energy use could reduce air emissions.

Some pollutants are not related to energy use directly – for example ammonia is emitted from manure and results in 'white haze' in the valley. The emissions do not come directly from energy

use. However, the development of new energy sources such as anaerobic digestion of manure can provide an alternative energy source while reducing ammonia emissions.

Air pollutants are directly linked to respiratory and other negative health impacts – specifically ozone and particulates. These include:

- Ozone (ground level ozone) which causes irritation of the respiratory tract, aggravation of existing respiratory conditions (i.e. asthma, bronchitis, pulmonary emphysema), and eye irritation.
- Particulates which cause irritation of the respiratory tract, aggravation of existing respiratory conditions (i.e. bronchial asthma, pulmonary emphysema), and contribution to the development of chronic bronchitis. The finest particulates (PM2.5) are able to travel the deepest into the lungs. For this contaminant it has been shown that some impact occurs at even the lowest exposure levels.

Air quality is an issue that must be addressed at the scale of the entire airshed and cooperative research and programs are being implemented by the Fraser Valley Regional District (FVRD), Metro Vancouver, and Whatcom County (in the US).

The regional or airshed scale needed to address air quality does not reduce its importance to the City. Rather the importance of air quality to the residents means that this energy plan must be aligned to achieve positive air quality objectives and not risk impairment of air quality for the benefit of reducing fossil fuels or electricity consumption.

1.7 Senior Government Policy and Regulations

Senior levels of government have made commitments to reducing energy consumption and GHG emissions, and have developed policies, programs and initiatives to meet those commitments.

1.7.1 Federal Initiatives

In January 2010, the federal government set a national target to reduce GHG emissions by 17%, relative to 2005 levels, by 2020.

In 2010, the federal government announced proposed Passenger Vehicle and Light Truck *Greenhouse Gas Emission Regulations* under the *Canadian Environmental Protection Act* to create national vehicle efficiency standards that harmonize with the US standards. When implemented, new vehicles sold in 2016 are expected to be 40% more fuel efficient than vehicles sold in 2008. Actions are taken to improve the efficiency of heavy duty vehicles but efficiency gains will not be as dramatic.

Overall, these transportation initiatives will have a dramatic effect on reducing the carbon 'footprint' of the transportation sector.

1.7.2 Provincial Initiatives

Since 2007, the Province of BC has been a leader in developing policy and legislative measures to reduce energy use. Specific measures include:

- *Greenhouse Gas Reduction Targets Act* (Bill 44, 2007) establishes a province wide reduction of GHG emissions to a target of 33% below 2007 levels by 2020, and a reduction of 80% by 2050. Interim reductions targets were subsequently established as 8% by 2012 and 18% by 2016.
- BC Climate Action Plan: Developed to support Bill 44, the plan's actions are estimated to achieve 73% of the reductions required to meet the reduction target. Most notable in this plan is the introduction of a carbon tax.
- *Clean Energy Act*: In 2010 BC adopted the Clean Energy Act that defines several energy objectives for BC, including achieving electricity self-sufficiency, meeting 66% of the increase in demand by 2020 through conservation and demand management.
- *Local Government (Green Communities) Statutes Amendment Act* (Bill 27, 2008) which amends the Local Government Act to require that "an official community plan must include targets for the reduction of greenhouse gas emissions in the area covered by the plan, and policies and actions of the local government proposed with respect to achieving those targets (by May 31, 2010)".
- BC Climate Action Charter: A provincial initiative introduced in September 2007 to encourage local governments to become carbon neutral in their local government operations by 2012.
- BC Greening of the Building Code: An ongoing initiative which is currently focused on reducing energy and water use in buildings. New requirements include solar hot water ready homes (where practical) and energy performance improvements in homes, multi-unit residential buildings, industrial, commercial and institutional buildings.

2 | CONTEXT, BASELINE, AND FORECAST

2.1 Community Context

2.1.1 Geography

Abbotsford is a city in the country, surrounded by farmland and rural communities. Approximately 74% of the land is located within the Agricultural Land Reserve (ALR)[1], with the remaining land forming a relatively continuous urbanized area.[2] The City is located in the Lower Fraser Valley (LFV), 70 km southeast of Vancouver (Figure 1). The combination of physical and meteorological conditions makes the LFV airshed susceptible to episodes of reduced air quality. The LFV is framed by the converging Coast Mountains to the north and Cascade Mountains to the south and is approximately 100 kilometres (km) wide at its western extent (i.e. Strait of Georgia) and narrows to 8 km wide at its eastern extent (i.e. Hope, BC). These topographic conditions, combined with episodic meteorological conditions in the summer months (e.g. high temperatures, prevailing winds that transport pre-cursor pollutants eastward through the valley, and stagnant conditions that prevent vertical displacement of air pollutants), can contribute to elevated levels of ground-level ozone and fine particulate matter in the LFV. During the winter months when the Fraser River is typically at its lowest levels, strong outflow winds from the east mountain valleys can mobilize fines and sand from exposed river banks and gravel bars contributing to increased levels of coarse particulate matter in the LFV. Therefore, investigation of new energy sources must consider potential impacts on air quality in the LFV airshed.

[1] The ALR is a provincial zone in which agriculture is recognized as the priority use. In the ALR, farming is encouraged and non-agricultural uses are controlled under provincial policy that seeks to preserve agricultural land.
[2] A Landscape Buffering Strategy for the Agricultural Urban Interface, CoA, 2008

Figure 1: Location Map of Abbotsford in the Lower Fraser Valley

Source: www.bcrenovation.ca/

2.1.2 Population

The City of Abbotsford is considered a high growth community, a trend that has a significant impact on the community's energy consumption. The population was approximately 140,000 in 2011, making it the fifth largest city in British Columbia. BC Stats 2012 population projections indicate that there could be more than 75,000 new residents by 2040 (i.e. a population of 215,000).

2.1.3 Economy and Employment

Abbotsford's diverse economy includes activities in manufacturing, agriculture, commercial (retail/office), health and social services, construction, educational services, and transportation and warehousing. These economic activities have an impact on the community's energy use and GHG emissions. Current policy supports exploring new alternative energy sources within the agricultural and manufacturing sectors.

The 2006 census reports 65,545 jobs in the city, and current growth scenarios predict 40,000 more jobs by 2040. The largest employers in the city include the Fraser Health Authority, the School District, Correctional Services of Canada, the University of the Fraser Valley, and the City of Abbotsford.

There are several large employers in the City. The top 10 employers (by number of employees) are:

- Fraser Health Authority (2,550+)
- School District #34 (2,500+)
- Correctional Services of Canada (1,200+)
- University College of the Fraser Valley (1,400+)
- City of Abbotsford (900+)
- Cascade Aerospace/IMP Group Limited (500+)
- Prospera Credit Union (500+)
- Vedder Transport (450+)
- Walmart (450+)
- Conair Group (350+)

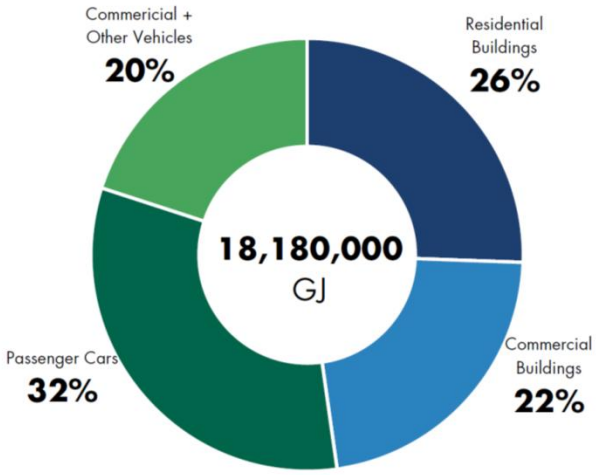
2.2 Where are we? – 2007 Energy and Emissions Baseline

Energy use for 2007 in the community is divided approximately equally between buildings and transportation (Figure 2).

- **Buildings (48%):** Energy is consumed to heat, cool and power our buildings using natural gas and electricity. In residential buildings (houses, townhomes, apartments) about 42% of the energy is electricity and 58% is natural gas. In commercial and small/medium industrial buildings, about 45% is electricity and 55% is natural gas.
- **Transportation (52%):** Energy is consumed by vehicles to move people and goods. This energy primarily comes from burning gasoline, diesel and propane. Passenger vehicles account for the majority of the community's estimated transportation fuel use.

This total energy consumption is an expenditure of approximately **$460,000,000** annually. Virtually all of this money leaves the community (to energy utilities, oil and gas companies, and Provincial and Federal taxes). Much of this expenditure leaves the province as well.

Figure 2: Annual Energy Use in Abbotsford (2007)



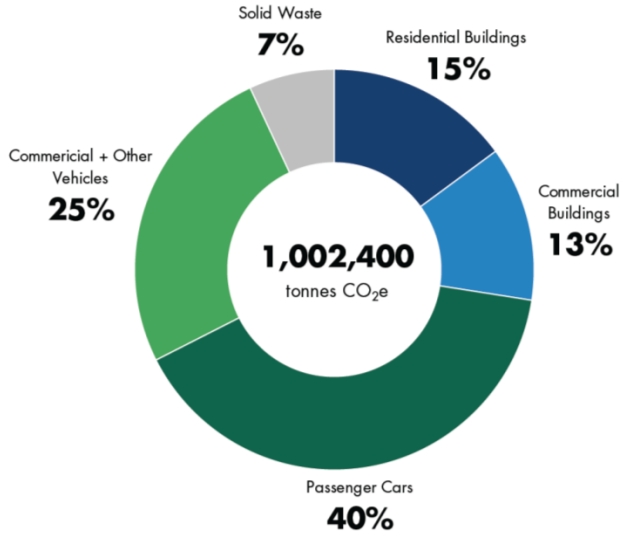
2.2.1 Community GHG Emissions Baseline

Carbon emissions are related to the energy used in buildings and transportation, but also include emissions for waste decay in landfills – which creates methane gas emissions (Figure 3).

- **Buildings (29%):** Using electricity and natural gas in our buildings leads to 29% of the community's GHG emissions. Most of the GHGs result from natural gas use.
- **Transportation (69%):** Using gasoline, diesel and propane for transportation leads to approximately 69% of the community's GHG emissions. Our community inventory includes only vehicles registered in Abbotsford.
- **Solid waste (2%):** Waste goes to landfills where it decomposes and releases methane gas, a potent GHG.[3]

[3] Each greenhouse gas has a different potency. These are all converted into their equivalent as carbon dioxide called a 'carbon dioxide equivalent' or CO2e. The 2% for landfill methane is the CO2e of the emitted landfill gas.

Figure 3: Annual Greenhouse Gas Emissions in Abbotsford (2007)[4]



2.2.2 Air Emissions (2007)

Air contaminants are often addressed at a regional scale – and there have been joint efforts by the Metro Vancouver Regional District (MVRD), the Fraser Valley Regional District (FVRD), and Whatcom County, Washington, to work collaboratively. This has included quantifying the emissions generated from a range of sources, and their location of origin.

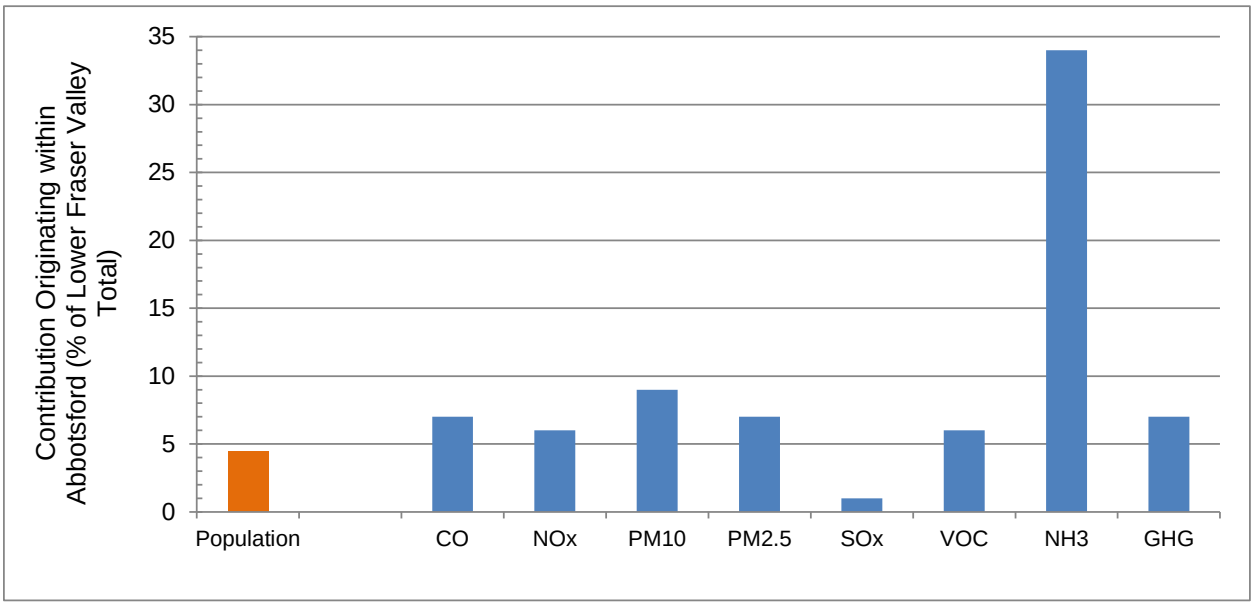
Figure 4 shows the share of air pollutant emissions that originate within the Abbotsford boundaries. Abbotsford has about 4.5% of the population of the LFV and the community contributes between 6% and 9% of the LFVs carbon monoxide (CO), nitrogen oxides (NOx), particulate (PM10 and PM2.5), volatile organic compounds (VOCs) and carbon (GHG) emissions.

Sulfur emissions (SOx) are lower, at about 1% of the LFV total – due to the absence of heavy industry or marine activities.

Most notable is that fully one-third of the LFV's ammonia emissions originate within the City. This is a result of the intensive agricultural activity within the City. Ammonia emissions in Abbotsford are primarily from agriculture – manure management and fertilizer application. The ammonia reacts with nitrogen oxides (NOx from combustion exhaust) to create a 'white haze' in the spring and summer.

[4] This carbon footprint is slightly modified from the CEEI data released by the Province in 2010 (for the 2007 year) to account corrections to the waste emissions estimate made by Abbotsford.

Figure 4: Contribution of Abbotsford based emissions to the Lower Fraser Valley



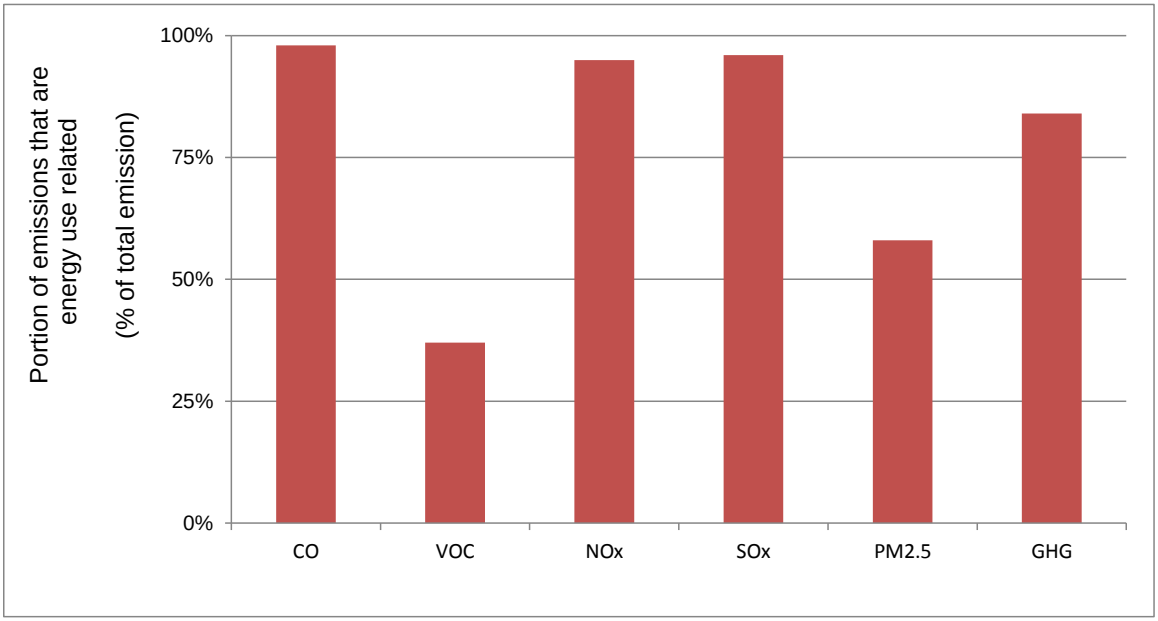
Note: Contribution fractions estimated from Metro Vancouver air emissions inventory data for the Lower Fraser Valley.

2.2.3 Connections Between Energy and Air Emissions

For most air pollutants and GHG emissions, a significant component of the emissions are related to combustion of fossil fuels (Figure 5). Therefore, energy management (in particular fossil fuel-based energy) is an important step that impacts both carbon (GHG) and air emissions simultaneously.

Ammonia emissions are not primarily the result of direct energy use – though the 'white haze' formation is the result of ammonia and NOx interacting – and NOx is a combustion related emission.

Figure 5: Portion of Air Pollutants that are Related to Energy Use



Source: GVRD, Phase 2: Harmonized Measures for Reducing Greenhouse Gases and Air Pollution in the LFV, November 2001

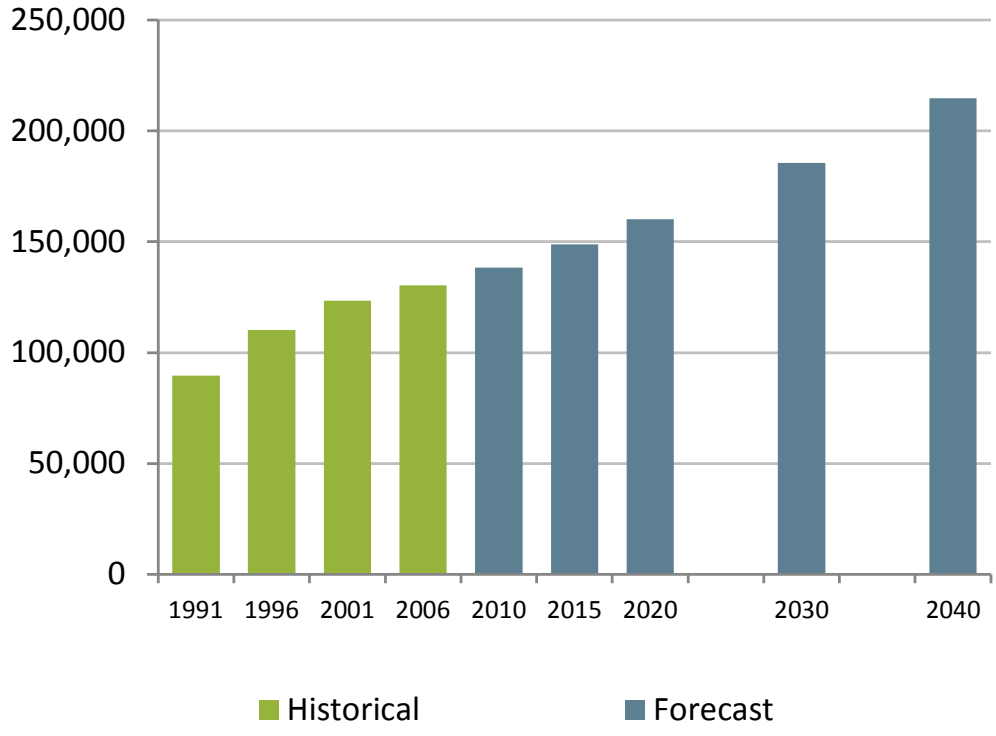
2.3 Where are we going?

2.3.1 Population Forecast

Abbotsford has had periods of exceptional growth in the past, most notably between 1966 to 1981 when the city grew by 6.9% annually, and between 1986 to 1996 when the city grew by 4.8% annually. However, between 2001 to 2011, the city grew by 1.2% annually. BC Stats has projected Abbotsford's population to grow at a rate of 1.5% annually from 2011 to 2036.

Forecasting population, particularly for the long term to 2040, is difficult to do reliably. For this exercise a growth rate of 1.3% annually was used to project the population from 2036 to 2040 based on BC Stats 2012 population projections. At this rate, the population will grow by approximately 75,000 residents from 2011 to 2040 (Figure 6) resulting in a total population of approximately 215,000 people.

Figure 6: Population Forecast to 2040



Housing will grow along with population. Because the ALR surrounds the city (limiting the developable land base), approximately half of the housing units built in the core area of Abbotsford since the 1990s have been multi-family. Based on this trend, accommodating the population growth described above will result in approximately 35,000 new housing units by 2040. By 2040, the total housing stock will be over 75,000 units, containing a relatively balanced mix of single-family houses, duplexes, town houses and apartments.

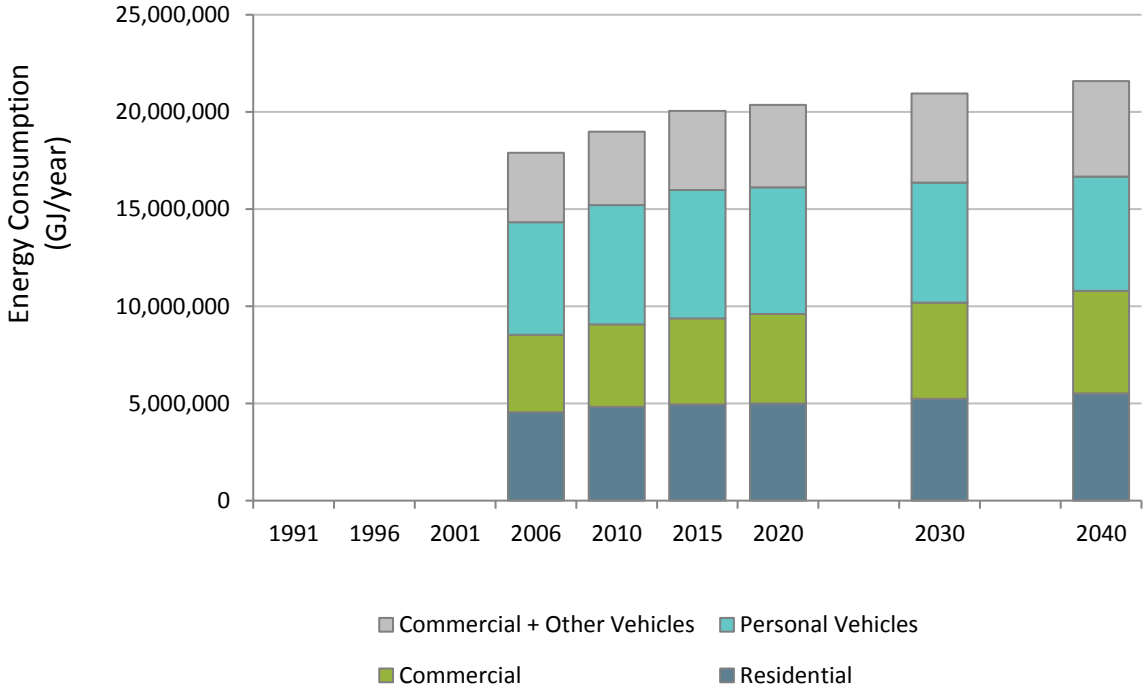
2.3.2 Energy, Carbon, and Air Emissions Forecast

As Abbotsford's population continues to grow, so does the demand for energy. A simple extrapolation by population of the amount of energy used in Abbotsford today to an Abbotsford in 2040 would result in an increase in energy demand matching their population growth. However, with the introduction of energy efficient technologies into our vehicles and homes, our overall energy demand per person is expected to decrease over the next 25 years. Taking these efficiency improvements into account, the energy demand in Abbotsford is forecast to increase by approximately 30% relative to today – a slower rate than population growth. This forecast is represented in Figure 7 and includes the following assumptions:[5]

- Residential buildings are 20% more efficient by 2020 due to the greening of the BC Building Code
- Commercial buildings are 9% more efficient by 2020 due to the greening of the BC Building Code
- Personal vehicle fleet average is 25% more efficient by 2030 due to Federal fuel economy standards and general fleet turnover
- Commercial vehicle fleet average is 10% more efficient by 2030 due to Federal fuel economy standards

[5] These assumptions are based on the desired targets of the BC Buildings Plan, and indicated impact of Federal vehicle standards for fuel efficiency.

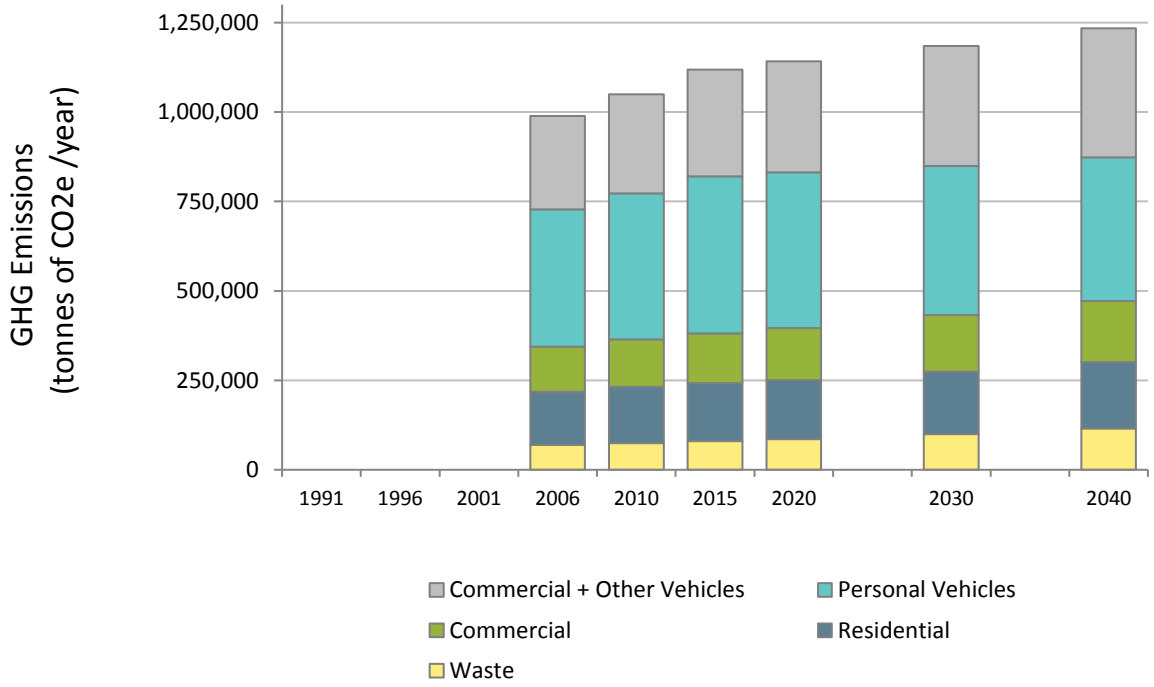
Figure 7: Energy Use Forecast to 2040



Additional assumptions about potential future energy efficiency improvements beyond those already stated in regulation or policy were necessary to create a forecast of energy demand to 2040. These improvements are estimated to improve efficiency by an additional 10 to 15% by 2040. These are summarized in Appendix B.

The total amount of carbon emitted from the forecast growth in energy consumption is shown by sector in Figure 8, and increases by almost 30% relative to today. On a per capita basis, carbon emissions are expected to decrease by over 20%.

Figure 8: Carbon Emissions Forecast to 2040



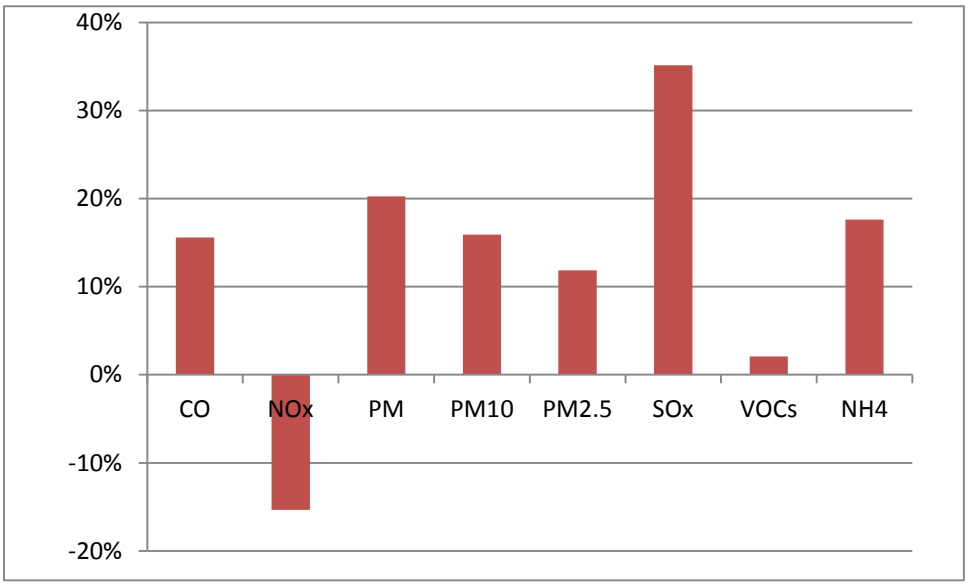
Air emissions are not expected to increase as quickly as population, energy, or carbon emissions. This is because there is more active management planning underway and new technologies are dramatically reducing pollutant emissions.

Estimates are not available for the City alone, but for the entire LFV. From 2010 to 2030 it is forecast that there will be (Figure9):

- a 15% increase in carbon monoxide emissions (CO),
- a 15% decrease in nitrogen oxides (NOx),
- a 10% to 20% increase in particulate (PM, PM10, and PM2.5),
- a 35% increase in sulfur emissions (SOx),
- a 2% increase in VOCs, and
- an 18% increase in ammonia emissions.

While one trend is downward (NOx), all the others are showing expected increases. As a result, it is expected that the current air quality issues will remain into the future.

Figure 9: Forecasted Change in LFV Air Emissions (2010 to 2030)



Source: Extracted from 2005 Lower Fraser Valley Air Emissions Inventory & Forecast and Backcast, 2007.

While the City's overall energy demand and carbon emissions are expected to decrease on a per person basis between now and 2040, this reduction is not sufficient to allow the City to meet its OCP GHG per capita reduction targets. The Community Energy Vision, goals, strategies and actions described in this Plan will assist the City in moving towards its GHG reduction targets.

3 | ENERGY AND EMISSIONS VISION, GOALS AND TARGETS

3.1 Vision for Abbotsford's Energy Future

A vision for Abbotsford's "energy future" draws upon the currently approved direction in the Official Community Plan (OCP), the Strategic Directions (strategic plan) and the Community Sustainability Strategy (CSS). With a focus on energy, the Community Energy Vision for Abbotsford in the year 2040 is:

> Abbotsford Community Energy Vision for 2040.....
>
> *In 2040, Abbotsford is a model community of energy efficiency and alternative energy generation. Through innovation and commitment, we have reduced our spending on energy across the community and have minimized our carbon emissions without compromising our air quality.*

3.2 Goals for Abbotsford's Energy Future

Based on the Community Energy Vision above, the following GEP goals describe the intended energy consumption and community GHGs in the sectors where a reduction in energy use and GHG emissions can have the greatest community impact. Implicit in these goals is the dual-benefit of improved air quality as community GHG emissions are reduced.

Table 1: Green Energy Plan Goals

Themes (Sectors)	Goals
Land Use and Transportation	• Establish neighbourhoods with increased density and mixed use transit-oriented urban form which promotes walking, cycling and transit use
Buildings	• Encourage energy efficiency of existing and new buildings
Solid Waste	• Promote waste reduction, increase diversion and maximize recovery
Agriculture	• Promote the reduction of agricultural methane released from livestock manure • Maximize the use of our agricultural waste as an energy source
Economy	• Establish Abbotsford as a centre for green business, where our

	resources are used efficiently and environmental impact is reduced • Create local employment opportunities to reduce the need to drive outside the community for work and services

3.3 Targets for Reducing GHG Emissions

In April 2010, Abbotsford updated the OCP to include GHG emissions reduction policies and targets, committing the City to achieve a:

- 20% per capita reduction below 2007 emission levels by the year 2025, and a
- 45% per capita reduction below 2007 emission levels by the year 2040.

These per capita GHG reduction targets reflect the expected growth of 75,000 additional people and 37,500 additional jobs by 2040. These targets are broken down by sectors within which specific reduction potential is assessed and summarized in Table 2

In addition to the OCP approved GHG reduction target, this pan also defines energy and electricity reduction opportunities (sec section 0).

Table 2: Abbotsford OCP Carbon Targets (per capita, relative to 2007)

Target Year	City-Wide	Buildings	Transportation	Solid Waste	Agriculture
2025	20%	15%	20%	20%	25%
2040	45%	35%	50%	40%	50%

3.4 Related Initiatives of the City of Abbotsford to Date

The City of Abbotsford has been proactive in making a commitment to sustainable community development for many years. In 2003 it adopted a Charter of Sustainability which outlines 17 principles in the areas of Responsible Growth, Pollution Prevention and Resource Conservation, Social Well-Being and Shared Responsibility. In addition to the Charter, the City has been proactive in a number of initiatives and strategies that align with the vision and goals of this energy plan, including:

- Signatory of the Provincial Climate Action Charter, with a commitment to move toward carbon neutrality in government operations by the end of 2012
- Corporate Energy Policy that aims to achieve 15% reduction in corporate energy consumption by 2012, compared to 2008 levels
- Vision for the development of the U District that is compact, mixed use and transit oriented

- Continued expansion of the transit system, including addition of 12,000 hours and five new buses in 2011
- Collaboration with BC Transit to develop a Transit Future Plan that provides a network vision for the next 25 years, including identification of rapid and frequent transit networks
- Water conservation program that provides education, irrigation and landscape assessments, water audits and rebates for high efficiency fixtures
- Partnership with BC Housing to develop a LEED Gold social housing apartment building[6]
- Curbside collection and composting of food waste to reduce waste going to the landfill in pilot stage and currently being expanded to cover the whole community
- Corporate green team activities, including carpool program, bike-to-work week, encouragement of composting at City facilities
- Bicycle Master Plan and the creation of several kilometres of bicycle lanes along the road network

Many of these initiatives offer the co-benefits of reducing energy consumption, reducing carbon emissions, and improving air quality in the Fraser Valley. Specific examples of how current policy supports reduced energy use and GHG emissions will be given in each sector strategy. Implementation of these policies will not only help to achieve city-wide GHG reduction targets but they also help to achieve multiple planning goals including improving quality of life, economic development, and environmental and social sustainability.

[6] LEED is the "Leadership in Energy and Environmental Design" a program of the Green Building Council that includes a rating and recognition system for building design and construction.

4 | MODELED SCENARIO AND RESULTS

A key objective for the City in undertaking this Green Energy Plan was to answer the following questions:

- **What steps need to be taken to achieve the community greenhouse gas emission targets?**
- **How much impact can the community have on energy consumption and emissions?**

To answer these questions, a set of key strategies were identified through the energy planning process, and the potential impacts of these strategies were quantified.

Green energy strategies were identified through workshops and discussions with City Council, City staff, community representatives on an Advisory Group, community stakeholders and through research on best practices in municipal actions to influence energy consumption and GHG emissions in the community. These strategies were assessed for their potential impact and estimates were made for the expected extent of implementation across the community. This section provides a summary of the potential outcome of implementing the identified "Reduction scenario" relative to a "Business-As-Usual (BAU) scenario".

4.1 BAU Scenario

Future development approximates the existing types of development. There is a slight increase in the relative number of dwellings built in the central area resulting in some increased density. Other features include:

- Transit ridership continues to increase along key routes in the central area.
- An organics waste diversion program is successfully implemented for single family as well as the commercial sectors.
- There is modest interest in further anaerobic digestion installations – with approximately a doubling of the currently installed capacity.
- The City does not engage in any initiatives to promote energy efficiency in buildings or development.

4.2 Reduction Scenario

A large portion of the development occurs in the central area of the City (80% of the new dwellings are built in the central area and 20% in the remainder). This housing stock has a higher proportion of apartments making the overall building stock more efficient.

- Through development, pedestrian and cycling paths and other pedestrian-friendly enhancements are incorporated into roadways in the core areas.
- Transit ridership increases substantially along the proposed rapid transit route and additional increases are experienced along the frequent transit corridors.
- New buildings incorporate passive design
- The City builds one district heating system that accommodates up to 10% of the new residential and commercial floor space within the zones defined as district energy candidates.
- An organics waste diversion program is successfully implemented for single family as well as the commercial sectors.
- There is substantial progress in further anaerobic digestion installations – with the equivalent of five to 10 facilities capturing about half of the dairy farm manure.

The following figure provides a summary of the key land use /development features of the two scenarios.

Figure 10: A Comparison of Development under "BAU Scenario" vs. "Reduction Scenario"

	Current Situation	2040 Business-As-Usual	2040 Reduction Scenario
New homes:			
% growth in core	n/a	40%	80%
% growth outside core		60%	20%
All homes:			
% homes in core	34%	37%	56%
% homes outside core	66%	63%	44%
Housing form:			
% single family / semi-attached	48%	35%	29%
% attached / row-housing	26%	22%	22%
% low rise apartment	23%	38%	40%
% high rise apartment	2%	5%	9%
Non-residential floor space (sqft):			
Commercial	7,588,000	11,307,000	11,307,000
Institutional	4,062,000	4,966,000	4,966,000
Industrial	6,991,000	14,883,000	14,883,000

Note: The total Commercial, Institutional, and Industrial floor space are not anticipated to vary between scenarios because the total population and employment growth assumptions remain the same in each.

4.3 Scenario Results

The BAU and Reduction scenarios were modeled using a spreadsheet analysis and GIS mapping. Both scenarios used the same assumptions about the impacts of higher levels of government action (to improve the building code and vehicle fuel efficiency).

Results for these scenarios include:

- Detailed results forecasts shown in Table 3 and Table 4;
- A scenario comparison (Figure 1);
- A carbon 'wedge' presentation for the BAU scenario (Figure 2);
- Thermal energy density mapping for the BAU scenario (Figure 3). This mapping shows the heating load expected by 2040. Primarily this analysis is used to discern opportunities for District Energy. As a total thermal load, it is the sum of residential and commercial loads – a useful summation because mixed use development – which is typically required to make a DE system viable, is best represented by this combination of factors;
- A carbon 'wedge' presentation for the Reduction scenario (Figure 4); and
- Thermal energy density mapping for the Reduction scenario (Figure 5).

The wedge diagrams show how the carbon footprint is reduced through the implementation of many actions. Each "wedge" represents the reductions in a subsection of the energy and carbon footprint over time.

The top line indicates the trajectory if no action is taken by any governments. Below this is a reduction wedge that results from the activities of higher levels of government – the Federal and Provincial initiatives on building codes and vehicle standards. The resulting line is what happens if the City takes no action.

Below this point are a number of reduction wedges that result from the actions initiated and facilitated by the City. The resulting lowest line is the combination of all the actions.

Note that the 'wedge' presents the total emissions of carbon – and that the reductions shown are in spite of population growth. The results of this analysis indicate that the recommended set of strategies in the Reduction Scenario will achieve a per capita reduction of 34% in GHG emissions by 2040. This will put Abbotsford on the path to achieving the targets that have been identified in the OCP.

Overall, implementing the reduction scenario is forecast to achieve by 2040 from 2007 levels:

- GHGs: 34% per capita reduction (BAU = 27%)
- Electricity: 27% per capita reduction (BAU = 23%)
- Total Energy usage: 34% per capita reduction (BAU = 28%)

Table 3: BAU Scenario Results

			Scenario =		BAU Scenario
Growth Rate (estmated annual %)					**1.48%**
Year	**2007**	**2011**	**2020**	**2025**	**2040**
Population	132,450	140,460	160,299	172,508	215,000
Reduction Scenario: Estimated Reductions					
	2007	**2011**	**2020**	**2025**	**2040**
GHG Emissions (tonnes of CO2e)	**(baseline)**				
Total GHG Emissions	1,077,850	1,140,946	1,200,815	1,212,197	1,283,080
Change from Baseline (2007)	-	63,096	122,965	134,347	205,230
% change from Baseline (2007)	-	**6%**	**11%**	**12%**	**19%**
Per Capita Emissions (t/person)	8.1	8.1	7.5	7.0	6.0
% change per capita from Baseline (2007)	-	**0%**	**-8%**	**-14%**	**-27%**
Electricity Consumption (GJ)					
Total Electricity Consumption (GJ)	3,753,949	3,953,109	4,159,330	4,295,036	4,681,136
Change from Baseline (2007)	-	199,160	405,381	541,087	927,187
% change from Baseline (2007)	-	**5%**	**11%**	**14%**	**25%**
Per Capita Electricity Consumption (GJ/person)	28.3	28.1	25.9	24.9	21.8
% change per capita from Baseline (2007)	-	**-1%**	**-8%**	**-12%**	**-23%**
Total Energy Consumption (GJ)					
Total Energy Consumption (GJ)	18,178,038	19,212,510	20,196,204	20,510,528	21,355,569
Change from Baseline (2007)	-	1,034,472	2,018,166	2,332,490	3,177,531
% change from Baseline (2007)	-	**6%**	**11%**	**13%**	**17%**
Per Capita Energy Consumption (GJ/person)	137.2	136.8	126.0	118.9	99.3
% change per capita from Baseline (2007)	-	**0%**	**-8%**	**-13%**	**-28%**

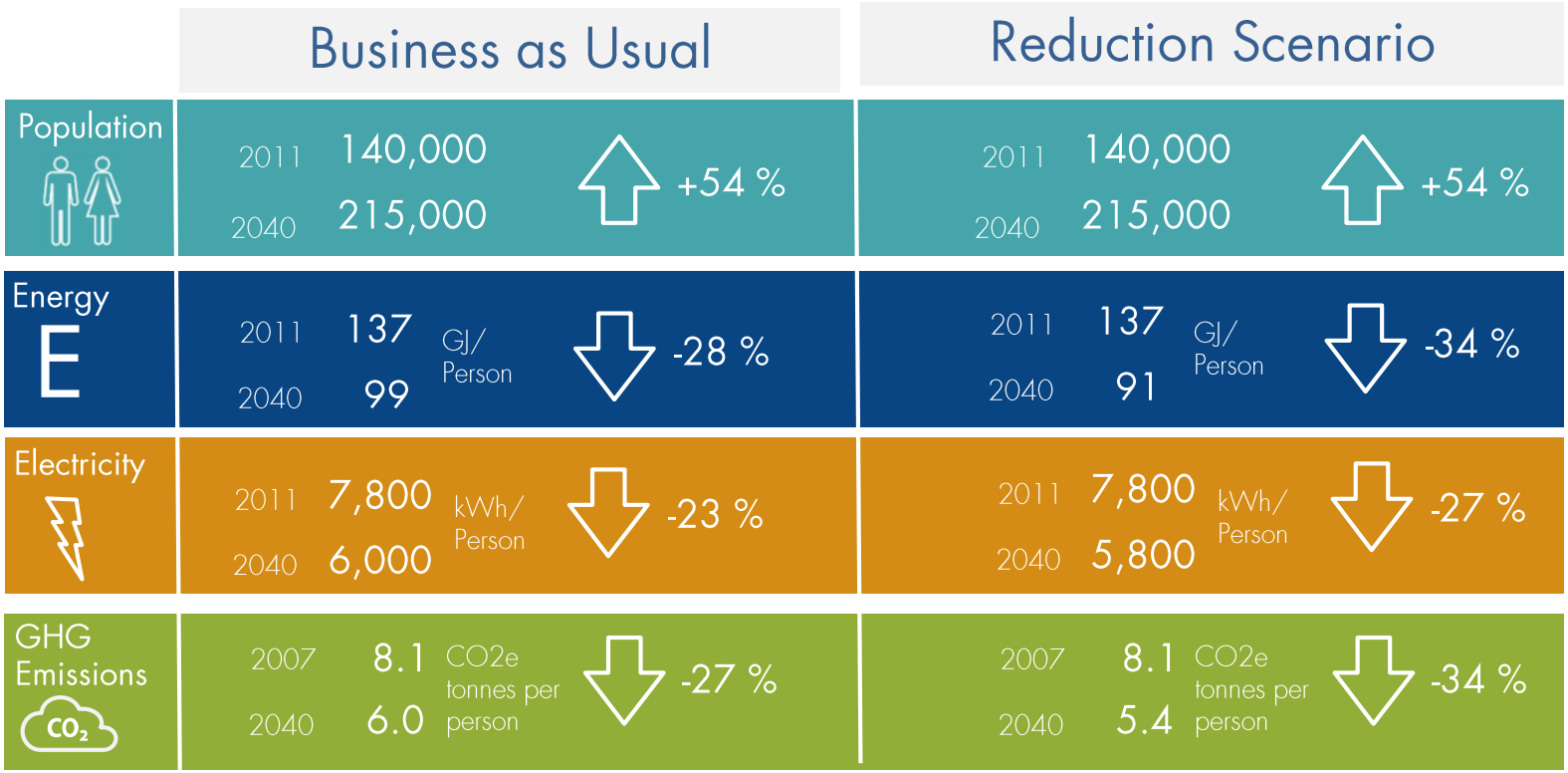
Note that electricity values are expressed as GJ in this table rather than kWh. 1 GJ = ~278 kWh.

Table 4: Reduction Scenario Results

			Scenario =	Reduction Scenario	
Growth Rate (estmated annual %)					**1.48%**
Year	**2007**	**2011**	**2020**	**2025**	**2040**
Population	132,450	140,460	160,299	172,508	215,000
Reduction Scenario: Estimated Reductions					
	2007	**2011**	**2020**	**2025**	**2040**
GHG Emissions (tonnes of CO2e)	**(baseline)**				
Total GHG Emissions	1,077,850	1,140,946	1,135,275	1,111,357	1,153,039
Change from Baseline (2007)	-	63,096	57,425	33,507	75,188
% change from Baseline (2007)	-	**6%**	**5%**	**3%**	**7%**
Per Capita Emissions (t/person)	8.1	8.1	7.1	6.4	5.4
% change per capita from Baseline (2007)	-	**0%**	**-13%**	**-21%**	**-34%**
Electricity Consumption (GJ)					
Total Electricity Consumption (GJ)	3,753,949	3,953,109	4,054,799	4,141,113	4,458,115
Change from Baseline (2007)	-	199,160	300,850	387,164	704,166
% change from Baseline (2007)	-	**5%**	**8%**	**10%**	**19%**
Per Capita Electricity Consumption (GJ/person)	28.3	28.1	25.3	24.0	20.7
% change per capita from Baseline (2007)	-	**-1%**	**-11%**	**-15%**	**-27%**
Total Energy Consumption (GJ)					
Total Energy Consumption (GJ)	18,178,038	19,212,510	19,225,770	19,052,287	19,575,829
Change from Baseline (2007)	-	1,034,472	1,047,732	874,249	1,397,791
% change from Baseline (2007)	-	**6%**	**6%**	**5%**	**8%**
Per Capita Energy Consumption (GJ/person)	137.2	136.8	119.9	110.4	91.1
% change per capita from Baseline (2007)	-	**0%**	**-13%**	**-20%**	**-34%**

Note that electricity values are expressed as GJ in this table rather than kWh. 1 GJ = ~278 kWh.

Figure 11: Scenario Comparison Summary



Note: The reductions shown are on a per capita basis.

Figure 12: BAU Carbon Reduction 'Wedge'

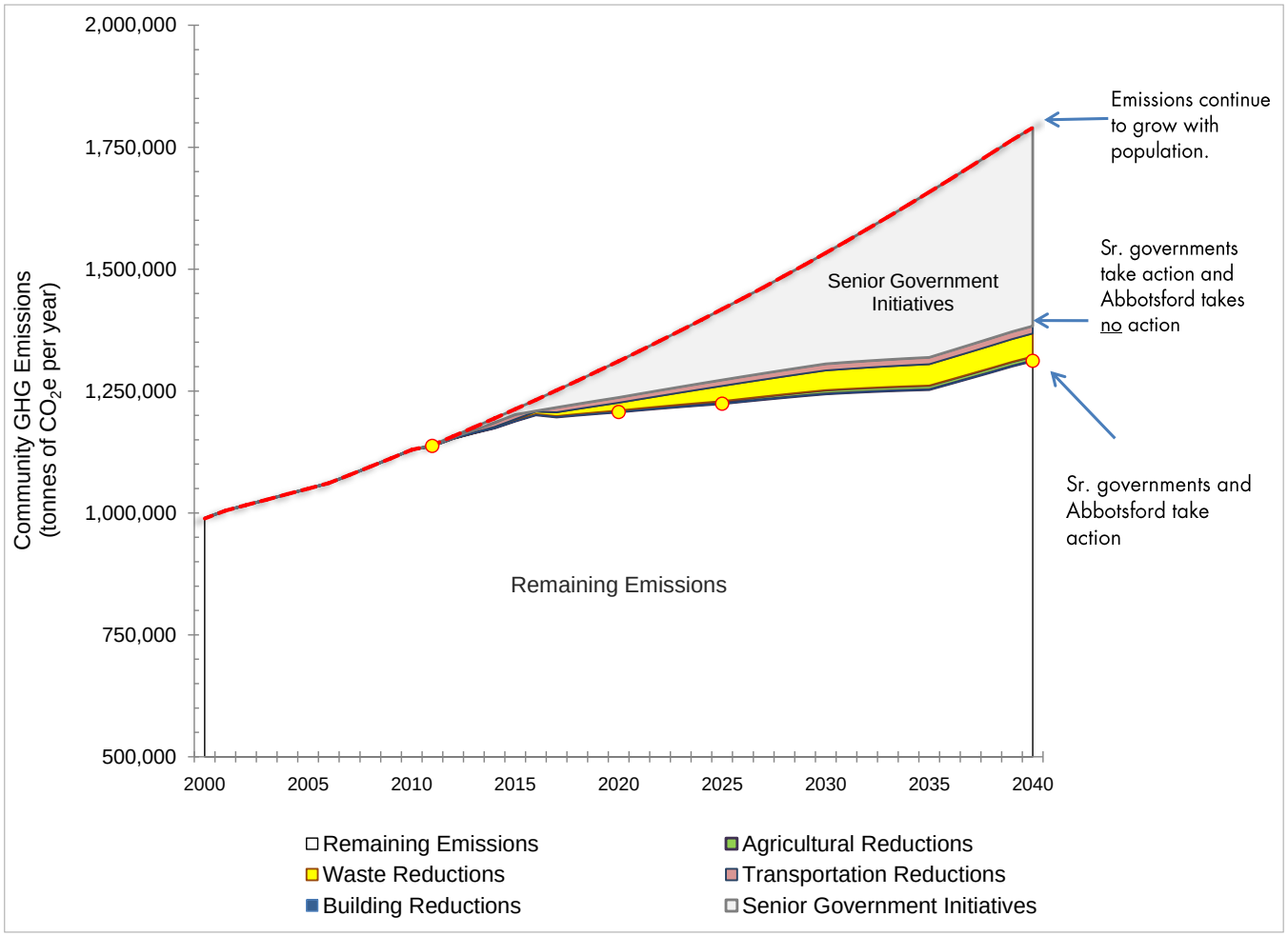


Figure 13: BAU Thermal Energy Demand in 2040

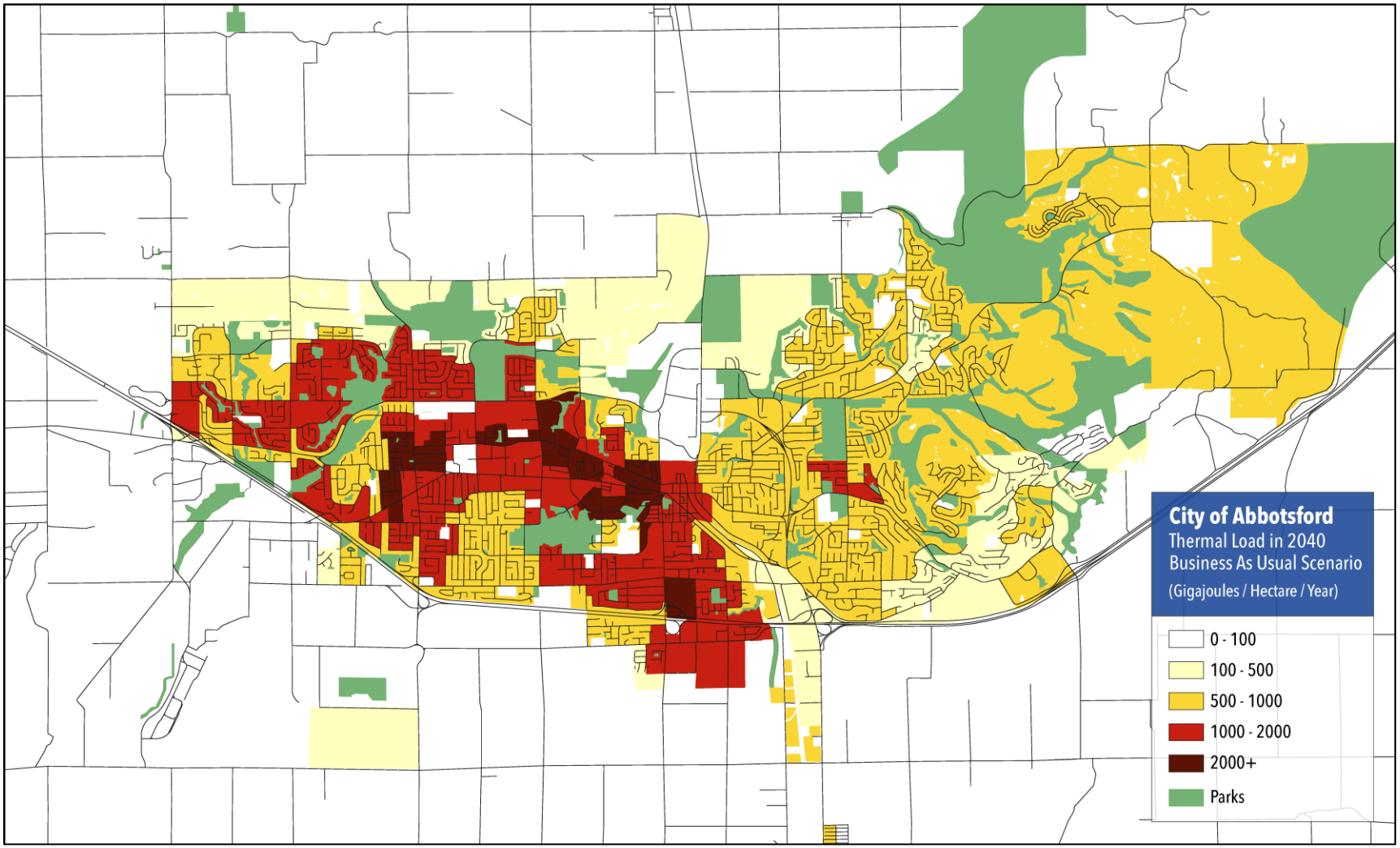


Figure 14: Reduction Scenario Carbon Reduction 'Wedge'

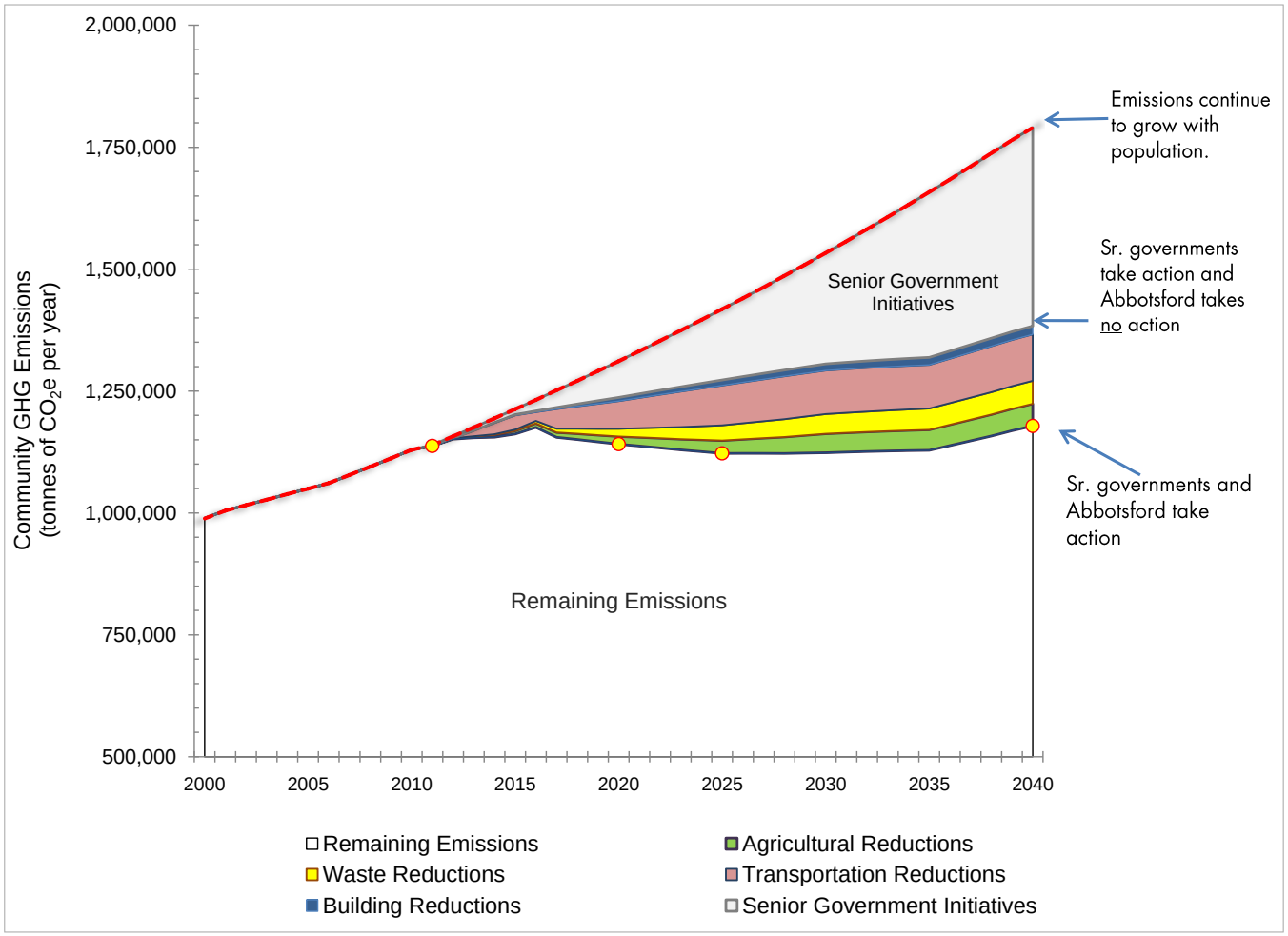
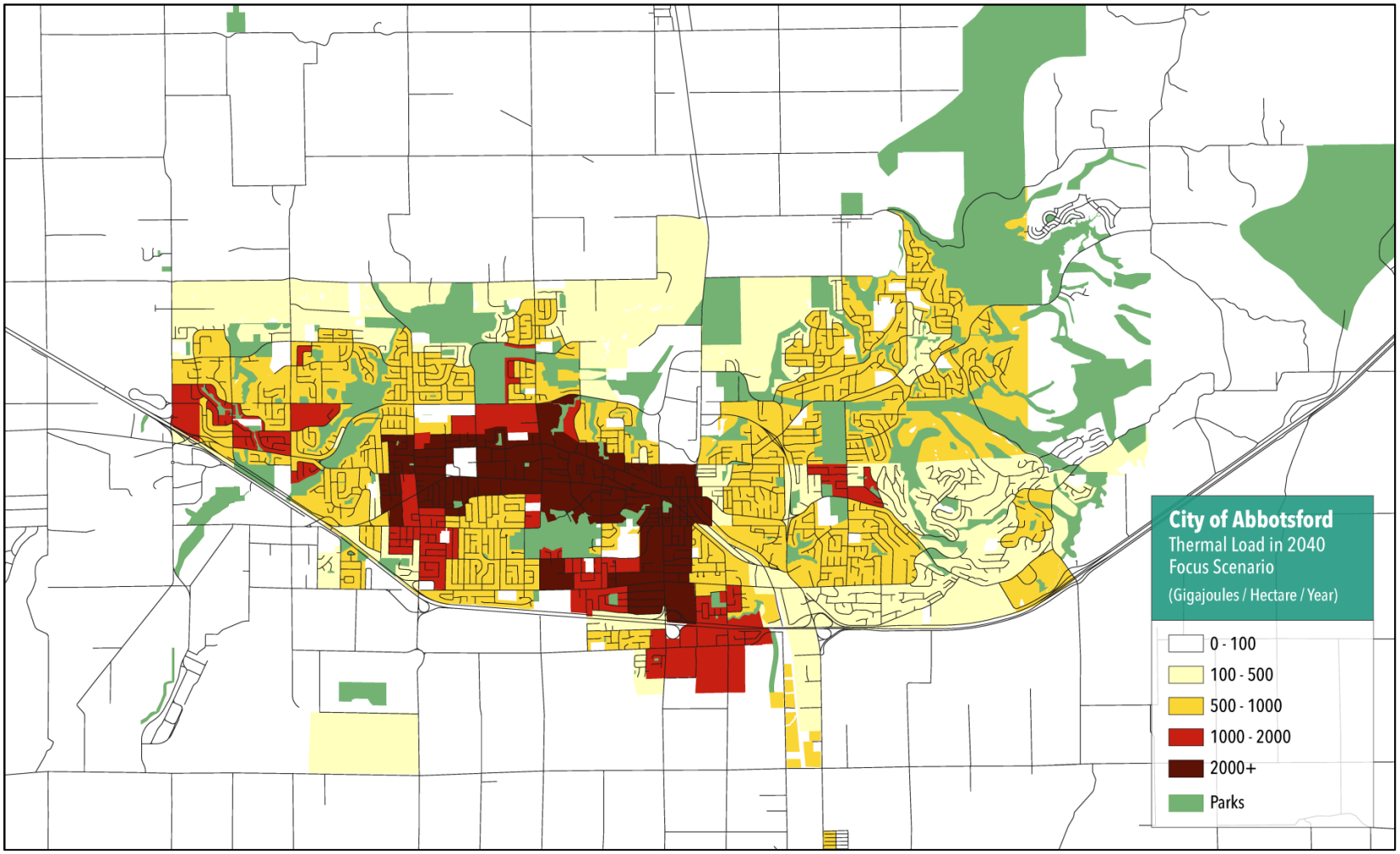


Figure 15: Reduction Scenario Thermal Energy Demand in 2040



5 | STRATEGIES AND ACTIONS DETAIL

The Reduction Scenario outlined above provides one path towards achieving Abbotsford's Community Energy Vision and Goals. This chapter describes each of the reduction strategies proposed under the five themes. Each strategy includes a description of the key actions required to implement it, as well as an assessment of its potential impact on a number of important factors, including:

- Impact on energy consumption (including electricity)
- GHG reduction potential
- Potential impacts to air pollutant emissions
- Effort and ease of implementation
- Co-benefits for community priority areas (e.g. local job creation, business opportunities, public support, impact on water quality, green space and agriculture land preservation, community equity and costs, potential for funding, breadth of reach).

Theme: Land Use & Transportation

Goals	Goal 1: Establish neighbourhoods with a high density, mixed use transit-oriented urban form, which promotes walking, cycling and transit use
OCP Targets	Reduce emissions from transportation by: • 20% per capita by 2025 and • 50% per capita by 2040, from 2007 levels
Recommended Strategies	1: Focus new residential growth in the city core 2: Improve infrastructure for pedestrians and cyclists 3: Work with BC Transit to advance long term transit planning 4: Implement Transportation Demand Management measures 5: Provide infrastructure for alternative (low carbon) vehicles
Supportive Senior Government Regulation	*Federal Passenger Vehicle and Light Truck Greenhouse Gas Emission Regulation* *Federal Heavy Duty Vehicle Regulation* Fraser Valley Regional Growth Strategy
Supportive City Plans	Official Community Plan (2005) • Strategy 1: Create a complete community (1.1, 1.2, 1.3, 1.4) • Strategy 2: Protect our natural environment (2.3) • Strategy 3: Build a healthy, inclusive community (3.2) • Strategy 4: Make better connections (4.1, 4.2, 4.3, 4.5) • Strategy 5: Strengthen our city centre (5.2, 5.3, 5.4, 5.5) Moving Forward – Transportation Master Plan (2007) Abbotsford Bicycle Master Plan (2003) Affordable Housing Strategy (2011) Community Sustainability Strategy (2013)
Estimated Impacts of these Strategies	GHG emissions: Reductions of 93,000 tonnes per year by 2040 Energy consumption: Reductions of 1.47 million GJ per year by 2040 Electricity Consumption: No reductions.[7]
Co-benefits	• Reduced travel distances for basic amenities • Preservation of green space and agricultural land • Increased housing affordability • Improved air quality • Increased physical activity resulting in improved health • Reduced costs for transportation • Increased accessibility

[7] Note that changes to electricity consumption due to electric vehicle use are recorded under building energy consumption as this electricity would be metered at buildings.

Land Use & Transportation: Context

The largest segment of Abbotsford's community greenhouse gas emissions are a result of driving personal vehicles (37% of the total community emissions), and a further 24% result from commercial vehicles. Combined, transportation emissions account for over 60% of the community's emissions.

Link between Land Use and Transportation

The distance people drive is linked to the layout of the community. Communities with more dispersed land uses (i.e. greater distances between homes and jobs, schools, shops and amenities) have higher average distances driven. As Abbotsford grows, there is a great potential to significantly reduce the community's reliance on vehicles by focusing growth close to transit routes, diversifying land uses in community nodes, and prioritizing infrastructure to create safe, accessible pedestrian and cycling opportunities.

Mode of Travel – All Trips

In a survey conducted for the FVRD, 87% of all trips in the Fraser Valley use personal vehicles. Of the remaining trips, 7% are by walking or cycling, 2% are by transit, and 4% other[8]. The vast majority of trips by Abbotsford residents are within the city (81%). This indicates an opportunity to shift shorter in-city trips to alternative modes such as transit, walking and cycling.

Mode of Travel – Commuting

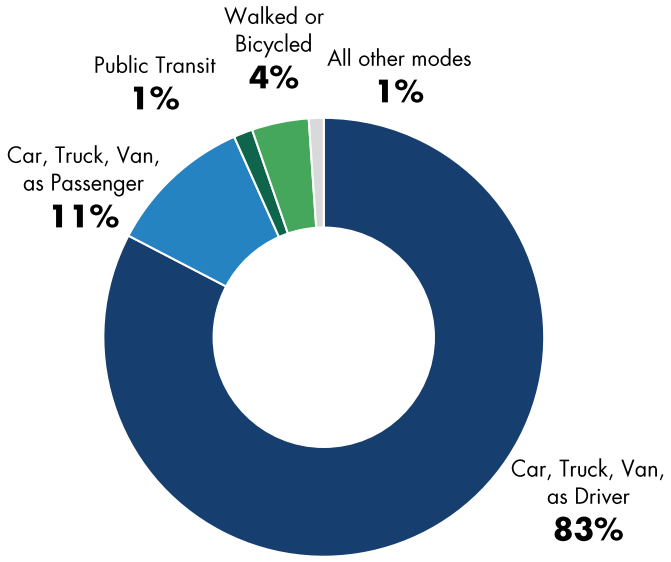
Daily commuting patterns in Abbotsford indicate that residents overwhelmingly use private vehicles to drive to work (83%), while the remaining commute by walking, cycling or public transit (shown in Figure 6). Due to the diversity of Abbotsford's economy, a high proportion of these commuters stay within the city for work. This also indicates there is an opportunity to shift to a higher proportion of alternative modes.

Transit

Although transit currently comprises only 2% of all trips in the FVRD and 1% of commute trips in Abbotsford, annual ridership has been steadily increasing for several years. Total ridership increased 8% per year between 2004 and 2008 to a total of 1.7 million annual boardings[9]. During the same period, travel service hours increased less than 4% per year, on average. BC Transit, together with the City of Abbotsford and District of Mission, is currently creating a new vision for improving the transit system to provide more frequent service to core areas.

[8] *Fraser Valley Travel Patterns, Findings from the 2008 Trip Diary Survey.* Joint project by TransLink and Fraser Valley Regional District, July 2011.
[9] *Ibid.*

Figure 16: Mode of Transport to Work in Abbotsford



Source: Statistics Canada, 2006 Census [10]

Land Use & Transportation: Strategies and Actions

Strategy 1: Focus new residential growth in the city core

Creating more compact, complete and connected neighbourhoods that have well-placed amenities (shops, recreation, and services) is the most efficient and sustainable way to accommodate more people in a growing community. Mixed use neighbourhoods lead to more trips by walking, cycling and transit and reduced travel by vehicle. This also leaves more land for public park space and amenities, agriculture, open space and natural areas.[11]

Abbotsford is a growing community, and current projections estimate 75,000 more people will live in Abbotsford by 2040. It is important for the community to identify where and how that growth can be accommodated to ensure Abbotsford remains a highly livable community that minimizes energy consumption and emissions.

Action 1-1: Ensure the OCP land use densities support the proposed transit network

The *Local Government Act* requires that communities review their OCP documents periodically. Commonly this is done on a 5- to 10-year cycle (with occasional minor amendments). During the

[10] Data from the 2011 census is being released as it is processed. Some data has been released and is used in this document. Otherwise 2006 census data is used.
[11] *Policy Guide on Smart Growth*, American Planning Association, updated April 2012

next update the City could provide greater emphasis for land use planning that supports the proposed transit network. During this process the City could ensure:

- Frequent transit corridors have appropriate density allowance to accommodate the majority of new growth (currently being defined in the draft Transit Future Plan). This supports current OCP policy 4.1 (4) *Concentrate higher density housing and employment along transit routes.*
- Nodes outside the core have sufficient commercial to support basic local needs, reducing the need for car trips to access these services.

Action 1-2: Consider creating neighbourhood plans for areas identified for focused growth

Neighbourhood or Area plans provide an opportunity to define more specific planning and infrastructure objectives for a specific area so that appropriate tools can be applied in different areas of the city. There are several neighbourhoods in Abbotsford's core that can accommodate significant growth, if they are carefully planned to support infill, mixed uses, and alternative transportation. Priority should be placed on frequent transit corridors and nodes that are expected to accommodate significant growth, such as the City Centre, U District, South Fraser Way corridor, and McCallum corridor.

There are several policies in the City's existing OCP that are relevant for inclusion in higher growth neighbourhood plans, including:

- 1.4 (6) Support multi-family developments, small residential lots, and other innovative housing forms
- 5.2 (1) Identify areas that are appropriate for sensitive infill near the core, adjacent to neighbourhood centres and along transit streets
- 5.3 (4) Accelerate transit-oriented development
- 5.3 (5) Discourage single-story commercial developments along primary transit priority corridors
- 5.4 (2) Encourage buildings 'on the street', with parking underground, on the street, and/or at the backs of buildings

Well-planned focused growth can also create opportunities for shared energy systems (district energy), and a neighbourhood plan can ensure supportive policies are in place. See Strategy 9 for more details on this opportunity.

Action 1-3: Encourage innovative infill housing in growth areas

Infilling existing neighbourhoods with new forms of housing types provides numerous community benefits where the infill is located in areas that have commercial services, basic amenities and access to transit. This supports the City's Affordable Housing Strategy (policies 1.1 and 2.3).

Action 1-4: Consider creating a Sustainability Checklist for new developments to use as a reference

A sustainability checklist could be used a reference for developers to assess their development's contribution to sustainability. The checklist could outline a balanced criteria of environmental, economic and social components, such as urban design, energy and water conservation, stormwater management, green building, transportation, green space protection, good neighbour features, affordable housing, etc. The checklist assessment would indicate how well a proposed development performs relative to the checklist and help identify where improvement may be possible. Sustainability checklists in many municipalities are a mandatory part of the development approvals process. In this case, it would be used for information purposes for the applicant to consider.

Strategy 2: Improve infrastructure for pedestrians and cyclists

On-road transportation accounts for almost 70% of Abbotsford's community carbon emissions. Many of the trips are short and could be replaced by walking or cycling. However, our communities have grown and developed with the use of motorized vehicle transportation as the primary mode of getting around. Despite the significant benefits of walking and cycling, there has not traditionally been sufficient focus on building safe, accessible infrastructure that encourages walking and cycling.

While senior levels of government are responsible for major roadways (e.g. Highway 1, Highway 11), municipalities have the responsibility for planning and maintaining the local road network, and cycle and pedestrian infrastructure. In an effort to encourage more walking and cycling, municipalities need to focus planning efforts to consider pedestrians and cyclists in the overall design of our roads.

Action 2-1: Consider updating design guidelines and engineering standards for infrastructure to prioritize walking and cycling

Poorly designed or insufficient pedestrian access to shops, amenities and services can be a barrier to choosing alternative transportation. Improving access requires an integrated approach between the City's planning and engineering departments. The City of Kelowna recently received

recognition for updating its design guidelines to prioritize sustainable transportation. The new guidelines include[12]:

- separating pedestrian and cycling paths from roads
- priorities for creating enough space for separated paths – e.g. where the right-of-way is insufficient, remove on-street parking
- improved design of intersections to improve safety

By providing safe routes to core areas, more residents will choose to walk or cycle for short trips. To support this action, the updated design guidelines could be incorporated into future neighbourhood plans for implementation through development proposals, and into the 2003 Abbotsford Bicycle Master Plan.

This action supports the following OCP policies:

- 3.2 (8) Street and sidewalk improvements that support access and way-finding
- 4.3 (2) Create intersection design standards for safer pedestrian crossings
- 4.3 (4) Develop street design standards for wide sidewalks and cycle lanes
- 4.3 (5) Increase number of benches and bus shelters
- 4.3 (6) Place pedestrian and cyclist-controlled traffic signals where designated cross-town bicycle and walking trails intersect major streets
- 5.4 (2) Encourage buildings 'on the street', with parking underground, on the street, and/or at the backs of buildings
- 5.5 (4) Develop a comprehensive plan for the 'greening' of major streets (…wide sidewalks, pedestrian-friendly intersections…to make the street safer and more attractive for pedestrians and cyclists)

Strategy 3: Work with BC Transit to advance long term transit planning

Public transit systems provide an efficient way to increase mobility options for all residents. To continue to increase transit ridership in Abbotsford, it will be necessary to both improve the built environment to ensure it supports transit use, while simultaneously investing in the transit network and service levels.

Built environment factors that influence transit ridership include: connection of starting places and destinations, proximity to transit stops, density of land use, diversity of housing and land uses (jobs and homes and services), and design of pedestrian-friendly infrastructure to access transit.[13]

[12] Personal communication with City of Kelowna transportation planning department, August 2012.

Investment in the Central Fraser Valley Transit System and service levels is led by BC Transit, with funding from the City of Abbotsford and District of Mission. BC Transit is currently working with the municipalities, residents and businesses of Abbotsford and Mission to develop a Transit Future Plan that establishes a vision of what the transit network will look like in 25 years. The Transit Future Plan is based on a three-tiered approach; local, regional, and inter-regional, with local investments being the first priority.

Action 3-1: Consider increased transit frequency along core transit routes in the Transit Future Plan

Figure 17 shows the proposed transit future network that has been developed to date[14]. Once finalized, the Transit Future Plan will distinguish areas of the city that will identify:

- Rapid transit: less than 15 minute frequency with priority lanes or right-of-ways. Shown in red.
- Frequent transit: less than 15 minute frequency with priority at key congestion points. Shown in blue.
- Local transit: connections between neighbourhoods. Shown in green.

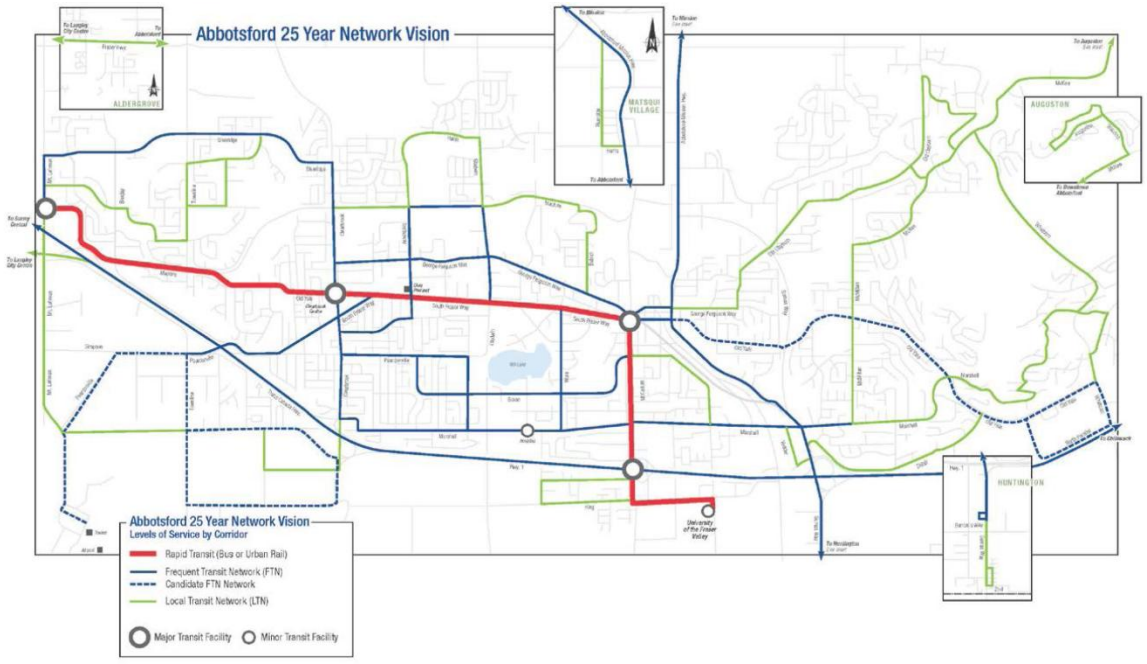
This is supportive of the following OCP policies:

- 4.1 (11) Improve transit service hours
- 4.1 (16) Develop a transit strategy

[13] *Transit-Oriented Communities, A literature review on the relationship between the built environment and transit ridership*, TransLink, 2010

[14] For a list of reports and presentations developed during the development of the network vision and plan, visit http://bctransit.com/transitfuture/cfv_reports.cfm.

Figure 17: Proposed Transit Future Network for Abbotsford (25-year vision)



Source: Transit Future Plan Abbotsford-Mission, December 2012, Final Draft, BC Transit

Action 3-2: Consider incorporating transit priority measures into transportation and roadway planning and design standards

In addition to supporting increased transit service levels along key corridors, the City could accommodate transit priority measures, such as transit priority lanes that factor the BC Transit proposed Transit Future Network (see Figure 17), into transportation and roadway planning and design standards. This will require collaboration between City departments to ensure the City's Transportation Master Plan and roadway planning allocates sufficient resources to support the transit network.

OCP policies that support this action include:

- 4.1 (12) Designate transit priority corridors
- 4.1 (14) Use transit priority measures on key corridors
- 4.2 (2) Ensure that long-term opportunities for rail transit links with the MVRD are not precluded

Action 3-3: Encourage transit use in the transit priority areas

In conjunction with improving transit service levels and communication of service, the City could implement complimentary policies in the transit priority areas that encourage transit use.

This action supports the following OCP policies:

- 4.1 (13) Relax parking requirements in transit priority corridors
- 4.1 (15) Support transit fare incentive programs for major employers
- 4.1 (17) Encourage TDM strategies with new developments

Strategy 4: Implement Transportation Demand Management measures

Transportation Demand Management (TDM) is a broad term to describe a range of policies, programs, services and products that influence people's travel behaviours to make travel more sustainable[15]. TDM considers the purpose of the trip (why?), the time of the trip (when?), the destination (where?), and the mode (how?). In addition to land use planning and infrastructure described in the strategies above, municipalities can also influence more sustainable travel choices through TDM using education and outreach.

Targeted TDM strategies typically achieve 5 to 15% reduced vehicle travel in the targeted group, with up to 30% reductions when significant financial incentives are provided[16]. The federal eco-MOBILITY program provides funding for select municipalities to undertake TDM initiatives with the goal of reducing GHG emissions. The program is forecasting a GHG reduction of more than 100,000 tonnes in 2012 across the 12 municipalities[17].

Action 4-1: Consider creating a TDM strategy appropriate for Abbotsford

Because many trips undertaken in Abbotsford are short (less than 5km), and because the majority of commuters stay within the city, there are opportunities to help promote trip reductions and alternative travel planning. Certain TDM measures are most appropriate for the Abbotsford context including:

- Major employer commute trip reduction programs
- Safe routes to walk and cycle to school
- Development of car-share opportunities through parking infrastructure (particularly new developments), once car-share programs become available in Abbotsford
- Encouraging commercial/industrial/institutional developments to include bike storage areas and change facilities

OCP policies that support this action include:

[15] Transport Canada, http://www.tc.gc.ca/eng/programs/environment-utsp-tdmintro-1039.htm, accessed September 2012.
[16] *Win-Win Transportation Emission Reduction* Strategies, Todd Litman, Victoria Transport Policy Institute, 2011.
[17] Treasury Board of Canada, http://www.tbs-sct.gc.ca/hidb-bdih/plan-eng.aspx?Org=85&Hi=64&Pl=336, accessed September 2012.

- 2.3 (4) Promote reduced dependence on private automobiles and support transit
- 4.1 (1) Make alternatives to single occupancy vehicle trips practical and attractive

Action 4-2: Explore working with BC Transit to provide a neighbourhood transit pass option in transit-oriented neighbourhoods

This action builds on the U-Pass program where transit passes are included in student fees at a significant discount. The neighbourhood transit pass program can be implemented in conjunction with focused development along transit corridors. Passes may be provided to residents by developers as part of reduced parking allowances. The development of the UFV area (U District) may be a candidate for this program. SFU's UniverCity neighbourhood has implemented this program.

Strategy 5: Provide infrastructure for alternative (low carbon) vehicles

The City can take a lead role in ensuring there is sufficient infrastructure in place to enable community members to choose low-carbon powered vehicles. While the focus of "low carbon" transportation frequently is assumed to be electric vehicles there is an opportunity for natural gas (NG) vehicles to play a role as a transitional (medium to long term) opportunity. Natural gas vehicles are still fossil fuel powered, but they can produce lower quantities of air pollutants. Adoption of NG vehicles can be used to highlight a 'path forward' for alternative fuels, demonstrate their cost competitiveness, and provide a visible example of a proactive action.

As a demonstration, the City can incorporate NG or electric vehicles into it's fleet. This would also reduce the City's own carbon footprint as desired by the Climate Action Charter.

Action 5-1: Consider installing EV charging stations at key community locations

Electric vehicles are starting to be introduced into the marketplace. With provincial assistance, some communities have been installing electric vehicle charging stations. In conjunction with Provincial assistance, the City could consider installing electric charging stations at prominent civic facilities for City vehicle and public use. This action has the benefit of:

- Highlighting the City's commitment to low pollution vehicles
- Demonstrating a new technology in the community
- Supporting the potential future adoption of OCP policy 2.3 (14) *Require new developments to include EV charging facilities*

The savings from this action alone may not be dramatic. However, it provides a sign of leadership, and can be catalyzing to the community.

Theme: Buildings

Goal	Goal 2: Encourage energy efficiency of existing and new buildings
OCP Targets	Reduce emissions from buildings by: • 15% per capita by 2025 and • 35% per capita by 2040, from 2007 levels
Recommended Strategies	6: Promote energy efficiency retrofits in the existing building stock 7: Create highly efficient new residential and commercial buildings 8: Promote use of alternative energy in homes and commercial buildings 9: Identify and support opportunities for district energy
Supportive Senior Government Regulation	Provincial – BC Greening of the Building Code
Supportive City Plans	Official Community Plan (2005) • Strategy 1: Create a complete community (1.4) • Strategy 2: Protect our natural environment (2.1, 2.3) Sustainability Charter (2003) and draft Community Sustainability Strategy (under development) Affordable Housing Strategy (2011)
Estimated Impacts of these Strategies	GHG emissions: reduce by 17,000 tonnes per year by 2040 Energy consumption: reduce by 580,000 GJ per year by 2040
Co-benefits	• Energy cost savings and reduced reliance on fossil fuels • Improved comfort in old and new buildings • Increased local economic activity in renovations and energy efficient building supplies • Improved building occupant health

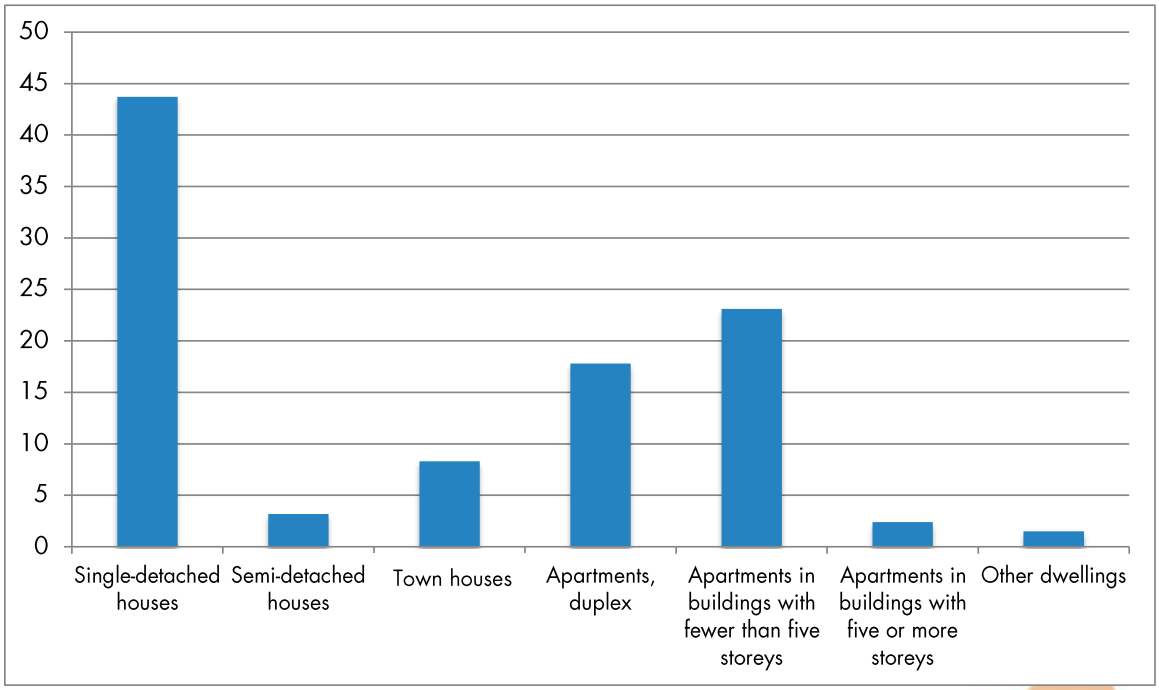
Buildings: Context

Buildings consume approximately half of the community's energy in Abbotsford (26% in homes and 22% in commercial and small industrial buildings) and produce approximately one-quarter of the community's GHG emissions. Natural gas is the primary fuel used for heat and hot water, while electricity provides power for lighting, appliances, and in some cases for heat and hot water.

The amount of energy consumed by a building is linked to the age of the building (older buildings are less energy efficient), the size of the building and whether it adjoins other buildings (attached walls have less heat loss), as well as the behaviour of the occupants.

Approximately half of the city's housing stock is over 25 years old. There is greater opportunity for large reductions in energy consumption if these older buildings are retrofitted. Abbotsford's residential building stock is comprised of a combination of housing types, but the primary form is single-detached homes (44%). As shown in Figure, the remaining homes are primarily low-rise apartments, duplexes, and town houses.

Figure 18: Housing Characteristics in Abbotsford, 2006



Source: Statistics Canada, 2006 Census.

Buildings: Strategies and Actions

Strategy 6: Promote energy efficiency retrofits in the existing building stock

Despite a growing population, the majority of energy consumption in buildings in Abbotsford in 2040 will be in buildings that are already standing now. Therefore, in addition to building highly efficient new buildings, it is very important to improve the efficiency of the existing buildings.

As noted above, half of the homes in Abbotsford are more than 25 years old. Older buildings that have not undergone renovations for energy efficiency can achieve significant energy savings through relatively straight forward renovations (e.g. installing a high-efficiency furnace and hot water tank, improving insulation, and sealing windows and doors). The City can play a role in expediting the rate of these renovations by providing information and highlighting the opportunities.

Action 6-1: Consider promoting existing programs that provide incentives for green renovations

Implement OCP policy 1.4 (3) Promote conservation and energy efficiency, and existing retrofit programs. Steps could include:

- Packaging and promoting existing Federal, Provincial and utility programs that provide rebates or other financial incentives to residential, commercial, and industrial clients.
- Informing building permit applicants about energy efficiency incentives and programs available from other agencies through a brochure.

Strategy 7: Create highly efficient new residential and commercial buildings

By 2040, approximately 30,000 residential units and 4 million square feet of commercial floor space is forecast to be needed to support the population in Abbotsford in order to accommodate new growth. The greening of the BC Building Code will ensure these new buildings are much more efficient than older buildings. However, the City can also play a role in increasing the efficiency of these new buildings beyond the current building.

Action 7-1: Consider creating an education program to promote highly energy efficient new buildings and technologies

In conjunction with the education program for improving energy efficiency in existing homes, the City could create an education program for new buildings that increases awareness about opportunities for energy efficiency when designing and constructing new buildings. This action could include:

- Promoting passive design techniques in new construction by creating and providing information with development / permit applications.
- Packaging and promoting existing senior government and utility programs to residential, commercial, and industrial building owners. This could be provided with all building permit applications.

Strategy 8: Promote use of alternative energy in homes and commercial buildings

In addition to creating a more efficient building stock that needs less energy, increasing the use of alternative energy sources can also lead to decreased GHG emissions, and increased energy self-sufficiency. The most readily available alternative energy sources in Abbotsford that reduce the use of fossil fuels are: air, water and ground-source heat exchangers, and solar hot water systems.

Many of these systems are becoming quite economical and can be used in both existing and new buildings of all types. The City can play a role in educating the community on available technologies through demonstration projects and promoting their use in all buildings.

Action 8-1: Consider promoting alternative renewable energy sources

Implement OCP policy 2.3 (3) Promote alternative renewable energy sources. This could involve:

- Working with partners to provide education on alternative energy options for buildings.
- Distributing information about available grants and rebates from senior government and utilities for the installation of alternative energy systems. This can be distributed during building permit processes.

Strategy 9: Identify and support opportunities for district energy

District energy (DE) systems provide an efficient way to generate and share heat across multiple buildings, instead of having individual heating systems in each building. DE systems can also offer opportunities to reduce carbon emissions by implementing systems with renewable energy supply (e.g. sewer heat recovery, geo-exchange), and they reduce the trend towards using electric baseboard heating in large new buildings which increases BC Hydro's electricity load.

The City recently completed a DE feasibility study for the Civic Precinct. Limited opportunities were identified at present; however, there may be potential future opportunities, particularly as new neighbourhood plans are developed.

Action 9-1: Consider identifying nodes that have potential to support future district energy systems

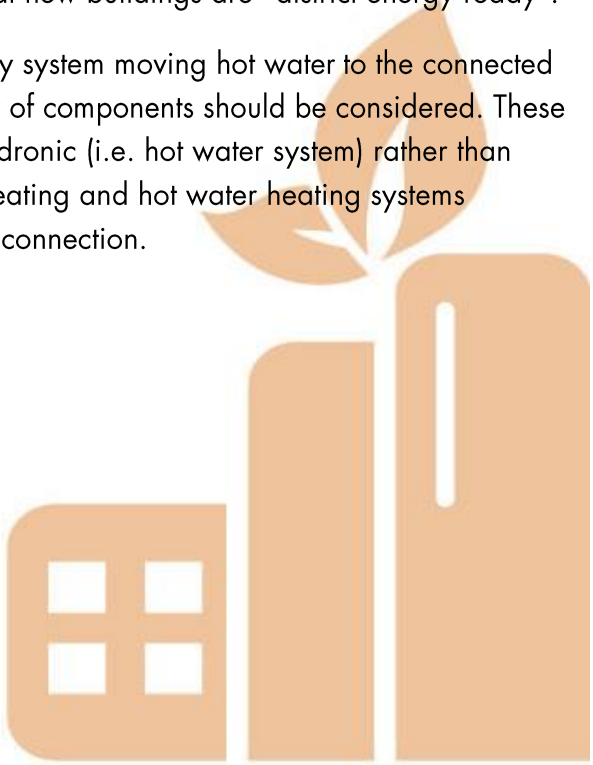
In conjunction with each of the upcoming neighbourhood planning processes, the City could undertake a pre-feasibility study to understand the future potential for DE in each planning area that has significant enough growth forecasts to support a potential system. DE potential was explored at a high level through the thermal energy mapping undertaken in this study (see map results in section 4.3). The best opportunities for DE, based on the modeled growth scenario, are located in the nodes with significant new multi-unit residential, and in some cases, combined with growth in commercial floor space.

There may be unique opportunities for industrial energy sharing. These are difficult to identify globally but may become apparent as new opportunities arise. For new industrial developments, it may be useful to encourage developers to assess alternative energy, or energy sharing opportunities in the vicinity of their development. Planning staff might be able to assist with their knowledge of local operations. Existing operations could be encouraged to explore energy sharing opportunities through the Abbotsford Chamber of Commerce, industrial networking opportunities, or trade associations.

Action 9-2: Encourage "District Energy ready" heating systems in identified district energy opportunity areas

In nodes where an opportunity for DE is identified, supportive policies for DE could be incorporated into neighbourhood plans to ensure that new buildings are "district energy ready".

A DE system provides heat to a building from a utility system moving hot water to the connected buildings. To make a building "DE ready" a number of components should be considered. These include designing the building to be heated by a hydronic (i.e. hot water system) rather than steam, or electric baseboards and positioning the heating and hot water heating systems appropriately in the building to allow ease of future connection.



Theme: Solid Waste

Goals	Goal 3: Promote waste reduction, increase diversion and maximize recovery
OCP Targets	Reduce carbon emissions from waste management. • 20% per capita by 2025 and • 40% per capita by 2040, from 2007 levels
Recommended Strategies	10: Divert organics from the waste system
Supportive Senior Government Regulation or policies	FVRD Regional Solid Waste Plan (draft) has targets to achieve by 2016: • a 25% reduction in the residential residual waste deposited at the curbside, and • an overall 70% diversion rate encompassing all waste sectors
Supportive City Plans / Activities	Engineering Department
Estimated Impacts of these Strategies	GHG emissions: reduce by 48,000 tonnes per year by 2040 Energy consumption: n/a Other air contaminants: reduction of ammonia
Co-benefits	• Reduced disposal costs for the City • Reduced hauling costs, and energy use • Extension of landfill life for remaining disposal • Improved air quality

Waste: Context

The City is playing an active role in material diversion from landfill. This is driven by a number of factors including the uncertainty of the future of disposal at Cache Creek, increasing tipping fees charged for access to the Metro Vancouver system, and a desire to meet resident's expectations.

Current and recent initiatives in waste have included:

- Pilot testing of single family organics (food waste) diversion (2009 to 2012);
- Full scale implementation of food waste composting (single family residential) beginning in 2013; and
- Mandatory recycling from the industrial, commercial, and institutional (ICI) sectors in 2013.

The City is working to maximize waste diversion levels. Staff expectations are that levels approaching 70% diversion may be possible with the implementation of food waste and commercial organics diversion.

The marketplace has been responding with green initiatives as well. Many large waste generators have been recovering recyclables for years, and recently the new waste collection contract with the City included collection vehicles powered by compressed natural gas – representing an economic choice by the bidders – but with an environmental benefit to the community, and a green promotion opportunity for the City.

Waste: Strategies and Actions

Strategy 10: Divert organics from the waste system

Action 10-1: Complete implementation of curbside organics diversion

Scheduled for 2013 after a successful pilot test from 2009 to 2012, this initiative will allow food waste to be collected with the existing yard and garden system (increased from biweekly to weekly collection), which will then be sent for composting. Garbage collection will be reduced from weekly to bi-weekly.

Action 10-2: Assess commercial and multi-family organics diversion

Staff will start consultation with the Industrial-Commercial-Institutional (ICI) sector in 2013 or 2014 regarding ICI organics diversion opportunities. Staff will assess opportunities, support, and financial impact of organics diversion programs for businesses. This diversion will capture organic waste from restaurant, grocery, and processing facilities and could be implemented as early as 2014 or 2015. Staff will also try to initiate several pilot projects at multi-family complexes in 2013 or 2014 to assess feasibility and logistics of a mandatory multi-family organics diversion program.

Theme: Agriculture

Goals	Goal 4: Reduce agricultural methane released from livestock manure Goal 5: Maximize the use of our agricultural waste as an energy source
OCP Targets	Reduce carbon emissions from agriculture: • 25% per capita by 2025 and • 50% per capita by 2040, from 2007 levels
Recommended Strategies	11: Encourage the development of anaerobic digestion facilities for agricultural wastes 12: Enhance connections between farms and residents
Supportive Senior Government Regulation or policies	BC Ministry of Environment Guidelines: "On-farm Anaerobic Digestion Waste Discharge Authorization Guideline", Draft, BC Ministry of Environment, May 14, 2010 [18] BC Ministry of Agriculture bylaw standard development for local governments. [19] BC Natural Gas Strategy BC Climate Action Plan
Supportive City Plans	Official Community Plan (2005) • Strategy 2: Protect our natural environment (2.5 (7-9)) City in the Country Plan (2004) Agricultural Strategy (2011) [20] Agriculture Enhancement Endowment Fund Precedents created by 2 previous anaerobic digestion projects within the City
Estimated Impacts of these Strategies	GHG emissions: reduce by 46,000 tonnes per year by 2040 Energy consumption: n/a Other air contaminants: reduction of ammonia
Co-benefits	• Better nutrient management on agricultural lands • Potential revenue stream for farm operators • Improved air quality • Improved surface and groundwater quality

[18] http://www.env.gov.bc.ca/epd/industrial/agriculture/digestion.htm
[19] http://www.al.gov.bc.ca/resmgmt/sf/anaerobic_digestion_in_ALR/index.htm
[20] http://www.abbotsford.ca/economic_development_and_planning_services/planning_services/agriculture/agriculture_strategy.htm

Agriculture: Context

Agriculture is a major part of the community of Abbotsford. By statistics, agriculture within the city: [21]

- Generates 34% of all agricultural revenues in the Lower Fraser Valley,
- Generates 21% of all agricultural revenues in the Province,
- Generates total economic activity of $1.8 billion annually, and
- ALR land covers fully 75% of the land area.

Agriculture: Strategies and Actions

Strategy 11: Encourage the development of anaerobic digestion facilities for agricultural wastes

Anaerobic digestion (AD) is the processing of organic material by bacteria to accelerate the stabilization of biodegradable material and to produce biogas. AD has a number of benefits including reducing nutrients in manure, reducing ammonia emissions, reducing methane emissions from manure, improving surface and groundwater quality, and producing an energy stream from a waste material.

Two ADs are located within the City and these are the first agricultural AD installations in BC.[22] The development of these installations was 'trail breaking' and was challenging for all parties involved as there were no precedents to follow, and the City, senior government agencies and the proponent had to 'learn as the process proceeded'.

The provincial government wishes to clarify the process, and several initiatives are working in this direction. The BC Ministry of Environment has created draft "On-farm Anaerobic Digestion Waste Discharge Authorization Guidelines", and the BC Ministry of Agriculture and Lands (MAL) has created a Discussion paper intended to lead to the development of bylaw standards. These criteria will define a standard set of criteria for lot size, non-farm and non-agricultural material, and record keeping etc.

[21] Source: Profile of Agriculture in Abbotsford: available at: http://www.abbotsford.ca/economic_development_and_planning_services/planning_services/agriculture/agriculture_strategy.htm

[22] These locations are the Bakerview EcoDairy and Catalyst Power.

Action 11-1: Contribute to the Ministry of Agriculture draft bylaw development process for on-farm anaerobic digestion systems

The City, through the Agricultural Advisory Committee and staff, could play a proactive role by contributing to the development of the MAL-led bylaw criteria for the regulation of AD on farmland in the ALR. Specific features of relevance to the City would be whether any requirements for set-backs and buffer areas might be relevant – given that the City has done previous work in buffer zone protection.

Action 11-2: Consider revising the Zoning Bylaw proactively to enable anaerobic digestion

Once the MAL has completed its process to develop bylaw criteria, the City could incorporate these provisions into the Zoning Bylaw. Special considerations relevant to the City may be required in addition to the Minister's criteria. For example there may be specific urban-agriculture interface areas that need to be addressed.

Action 11-3: Consider promoting energy conservation in agricultural operations

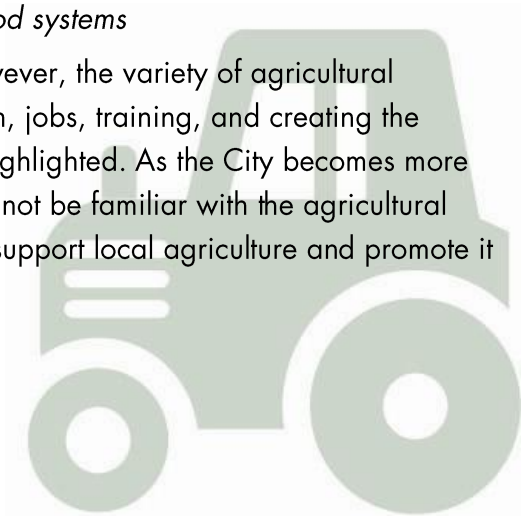
Energy use in agriculture is an area that the City or the Province has not been involved with historically. The Province is currently exploring whether renewable energy technologies might be applicable to agriculture – e.g. solar thermal heating, solar walls, etc. The City could play a role as a facilitator and promoter to highlight successful implementation.

Strategy 12: Enhance connections between farms and residents

Connecting people to agriculture was a repeated theme during the stakeholder consultation sessions. While recognizing that these actions may not make large savings in energy or emissions by themselves, these connections were felt to foster awareness, and provide 'foundations' for a range of conservation behaviour.

Action 12-1: Consider supporting promotion of local food systems

The presence of agriculture in Abbotsford is obvious. However, the variety of agricultural operations, and the associated opportunities for education, jobs, training, and creating the 'agricultural entrepreneurs' of tomorrow are not always highlighted. As the City becomes more and more urbanized, a greater share of the residents will not be familiar with the agricultural opportunities. This action encourages the City to actively support local agriculture and promote it to the community. Examples include:



- the economic development strategies – where agriculture is an established component;
- educational programs such as farm tours;
- partnering with industry and training groups to promote local agri-business;
- supporting local farmers markets (e.g. in kind support, or use of City lands);
- community or neighbourhood activities (community fairs, community gardens etc.); and
- support for agricultural-related initiatives via the Agriculture Enhancement Grants Program Fund.

These may be formalized or ad-hoc. While the energy or emissions savings may not be dramatic, the profile of these activities is important. As well, links can be made to water conservation, recycling, and organics diversion programs.

Theme: Economy

Goals	Goal 6: Establish Abbotsford as a centre for green business, where our resources are used efficiently and environmental impact is reduced Goal 7: Create local employment opportunities to reduce the need to drive outside the community for work and services
OCP Targets	Not specified. Most reductions are achieved in other theme areas
Recommended Strategies	13: Promote a "green economy" as a key City objective
Supportive Senior Government Regulation or policies	BC Jobs Plan BC Climate Action Plan
Supportive City Plans	City in the Country Plan (2004) Economic Development Strategy and Action Plan (under development) Official Community Plan (2005)
Estimated Impacts of these Strategies	Not quantified
Co-benefits	• Local job development • Energy spending stays within the community • Development of energy related industries

Economic Development: Context

The City plays an active role in economic development. It includes economic development as a key mandate of its Economic Development and Planning Services (EDPS) Department and promotes economic growth and business development within Abbotsford while ensuring it maintains an ideal place to do business. The EDPS Department focuses on attracting and/or aiding businesses and industries looking to establish, expand or relocate in the City of Abbotsford.

The City maintains a standing Council Committee for this area (Economic Development Advisory Committee) and established a Mayor's Task Force on Economic Prosperity in 2012.

Economic Development: Strategies and Actions

Strategy 13: Promote a "green economy" as a key City objective

The City is an active participant in economic development within the community. Through the Economic Development and Planning Services department, the City works with key stakeholders in the community (e.g. UFV, TRADEX, Tourism Abbotsford, Abbotsford International Airport (YXX), Abbotsford Downtown Business Associations (ADBA) , Abbotsford Chamber of Commerce, Abbotsford Community Foundation, etc.) to prepare, coordinate and implement opportunities for long-term economic development plans and policy development in the City while also pursuing revenue opportunities that will reduce the City's dependence on general taxation.

Action 13-1: Consider incorporating recommendations of the Green Economic Investment Study into the City's economic development plans and strategies

Concurrent with the work on the Green Energy Plan, the Green Economic Investment Study has explored options for the City's economic development strategy to attract and highlight green investment strategies. This study defined six major sectors of involvement: (i) agriculture, (ii) development, (iii) commercial operations, (iv) manufacturing, (v) transportation infrastructure, and (v) research & education sectors.

Once complete, the study will provide a set of recommendations for the community to pursue. This action supports the inclusion of these recommendations into the City's economic strategies.

6 | IMPLEMENTATION

This Plan outlines strategies that can be taken to support and promote greenhouse gas and energy use reductions in Abbotsford. Some strategies will be relatively easy to put into place, because they require little change and will cost little to implement (e.g. Promoting programs) while others will require more significant change (e.g. neighbourhood plans). Fundamentally important to the successful implementation of the GEP is the understanding that it is a community plan and its success will ultimately depend on inspired community action. This includes identifying opportunities for the businesses, community stakeholders, and the City to work collaboratively to reduce energy use and greenhouse gas emissions for the community. Success will require that stakeholders of Abbotsford understand, value and practice principles of sustainability, and strong sustained leadership from all parts of the community is paramount. Measuring success will require monitoring to measure effectiveness of chosen strategies and actions on moving the community towards the energy vision of energy efficiency, reduced carbon emissions and clean air. To accomplish this, a series of indicators are recommended.

Provincial Community Energy and Emissions Inventory (CEEI)

The Province has developed community energy and emissions inventories for every municipality in BC. The baseline year was 2007, and the results from 2010 are currently being finalized. The Province plans to provide updated inventories every two years from 2012 onwards. The City should review and report out to the community, progress on the following indicators from the CEEI:

- Total GHG emissions (tonnes of CO2e)
- GHG emissions by sector (buildings, transportation, waste) (tonnes of CO2e)
- Per capita total energy consumed (GJ per capita)
- Per capita electricity consumed (kWh per capita)

Additional Indicators

The CEEI provides an excellent opportunity for municipalities to better understand where energy is being consumed and in what form. However, to gain a better understanding of the impact of implementing this Green Energy Plan, it will be important to measure progress in a number of other ways. These may include:

- Percentage of approved development applications in the core vs. outside the core
- Kilometres of sidewalk, designated cycle lanes, and separated cycle lanes or paths
- Transit ridership
- Mode share for all trips (where available based on trip diary surveys), or Mode share for commute to work (Statistics Canada)
- Percent of new buildings meeting energy efficiency objectives identified on the Sustainable Development Scorecard
- Percent of homes participating in energy efficiency retrofit programs
- Number of homes connecting to alternative energy supply (building permit data)
- Agricultural energy supply (e.g. annual tonnes of manure processed by AD, or amount of biogas produced annually)

APPENDICES

Appendix A: Reduction Assumptions from Senior Government Initiatives

Appendix B: BAU and Reduction Scenario Results

Appendix C: Transit Modeling Assumptions - Reduction Scenario

Appendix D: Thermal Energy Load Maps

APPENDIX A: REDUCTION ASSUMPTIONS FROM SENIOR GOVERNMENT INITIATIVES

Table A-1: Assumptions Used for Defining Energy Reductions from Senior Government Initiatives

	Area	Sector	Energy Change	Start Year	End Year	Notes
Near term	Buildings	New Residential Buildings	-25%	2011	2020	EGH 73 (pre-2007) to 77 to proposed 80 + additional load efficiencies
	Buildings	New Commercial Buildings	-12%	2011	2020	Approximate to the Buildings Plan Strategy Targets
	Buildings	Existing Residential Buildings	-7.5%	2011	2020	Estimate of 0.5% to 1.0 % per year annual improvement through natural replacement and load efficiencies
	Buildings	Existing Commercial Buildings	-5%	2011	2020	Modest improvement assumed
	Buildings	Industrial Buildings	0%	2011	2020	Assumed no regulated changes
	Vehicles	Passenger Vehicles	-25%	2016	2030	Federal Vehicle Standards fleet rollover takes to 2030
	Vehicles	Commercial Vehicles	-10%	2016	2030	Federal Vehicle Standards fleet rollover takes to 2030
Medium Term	Buildings	New Residential Buildings	-10%	2021	2035	Assumption of modest improvements.
	Buildings	New Commercial Buildings	-17%	2021	2035	Tracking Ashrae 90.1 target 2020 to 2035
	Buildings	Existing Residential Buildings	-10%	2021	2035	Continued 0.5% to 1% per year
	Buildings	Existing Commercial Buildings	-5%	2021	2035	Assumption of modest improvements.
	Buildings	Industrial Buildings	0%	2021	2035	Assumed no regulated changes
	Vehicles	Passenger Vehicles	-10%	2031	2035	Assumption
	Vehicles	Commercial Vehicles	-5%	2031	2035	Assumption
FAR Term	Buildings	New Residential Buildings	-10%	2036	2050	Assumption
	Buildings	New Commercial Buildings	-10%	2036	2050	Assumption
	Buildings	Existing Residential Buildings	-5%	2036	2050	Assumption
	Buildings	Existing Commercial Buildings	-5%	2036	2050	Assumption
	Buildings	Industrial Buildings	0%	2036	2050	Assumption
	Vehicles	Passenger Vehicles	-10%	2036	2050	Assumption
	Vehicles	Commercial Vehicles	-5%	2036	2050	Assumption

APPENDIX B: UPTAKE ASSUMPTIONS FOR SCENARIO DEVELOPMENT

Reduction estimates are based on a simple savings and uptake estimation. The savings [A] are estimated for each participant, or each sector as a whole. The participation [B] is the portion of the residents, or the portion of that sector that participates. The resulting fractional savings [C] is simply [A] * [B] = [C]. Additionally, the effectiveness of the measure is scaled in over an implementation period.

The estimates for the two scenarios are defined by different participation – representing the different strengths of the measures.

Table B-1: Uptake Assumptions for each Scenario

Action Item	Emissions Sector	Start year	Full effect Year	Participation [B] (% of sector) BAU Scenario	Participation [B] (% of sector) Reduction Scenario
Focused growth	Personal Vehicles	2013	2040	50%	100% [1]
Improved transit	Personal Vehicles	2013	2038	25%	100% [1]
Improved ped & cycling infrastructure	Personal Vehicles	2013	2028	0%	100% [1]
TDM	Personal Vehicles	2015	2025	0%	100% [1]
EV infrastructure	Personal Vehicles	2013	2023	0%	100% [1]
Smaller homes	NEW Residential Buildings	2013	2014	0%	100% [1]
Home retrofit incentive program	Existing Residential Buildings	2015	2025	0%	30%
Zoning bylaw Passive design	NEW Residential Buildings	2015	2020	0%	25%
Zoning bylaw Passive design	NEW Commercial Buildings	2015	2020	0%	25%
DPA requirement for alternative energy	NEW Residential Buildings	2018	2019	0%	25%
DPA requirement for alternative energy	NEW Commercial Buildings	2018	2019	0%	25%
Promote alternative energy in homes	Existing Residential Buildings	2015	2020	0%	5%
District energy	NEW Residential Buildings	2015	2030	0%	6.65%
District energy	NEW Commercial Buildings	2015	2030	0%	5%
Anaerobic Digestion	Agriculture	2012	2030	10%	50%
SF Residential Organics Diversion	Waste	2014	2025	80%	80%
Commercial Organics Diversion	Waste	2016	2030	80%	80%

Note [1]: For personal vehicle transport, the participation is indicated as 100%. This implies that the reduction calculation is based on the entire sector (e.g. a fleet average), and not that 100% of residents will adopt this activity.

APPENDIX C: TRANSIT MODELING ASSUMPTIONS - REDUCTION SCENARIO

The following tables outline the assumptions that were modeled in the Reduction Scenario to understand the potential reductions in overall Vehicle Kilometres Travelled as a result of increased transit service levels. The first table outlines a series of new routes that align with the draft Transit Future Plan 25-year network vision. The second table reflects increased service levels in existing routes that also align with the Transit Future Plan draft vision.

Table C-1: Modeled transit service levels for the reduction scenario: New routes

Route	Description	Type	Modeled Service Levels *(Average # of Buses/hr)*
Route A	Replaces routes 2, 3, and 12; Runs from Mt Lehman Rd to McKenzie Rd	Rapid (Bus or Urban Rail)	10.2
Route B	Rapid Bus along Highway 1	Rapid	10.2
Route C	Runs from Sumas Off Ramp along Gladys Ave, Essendene Ave, George Ferguson Way to Clearbrook Rd, then south to terminate at Old Yale Rd	Frequent	10.2
Local Service	Local service improves to 18 hours per day, with 15 minute peak period service for 4 hours per day and 30 minute service in off-peak hours	Local	3.2

Table C-2: Modeled transit service levels for the reduction scenario: Expansion of existing routes

Route		Current Service Levels *(Average # of Buses/hr)*	Modeled Service Levels *(Average # of Buses/hr)*	Change in Service *(%)*
#1	Blueridge-McKee GoLine	3.0	7.0	131%
#2	Bluejay-Huntingdon GoLine	1.7	10.2	515%
#3	Clearbrook-UFV GoLine	1.8	10.2	482%
#4	Saddle	1.1	3.2	199%
#5	Hospital	2.1	7.0	238%
#6	Gladwin-Trethewey	0.9	7.0	722%
#7	Sumas Mountain	1.1	3.2	196%
#12	UFV-Bourquin Connector	0.8	10.2	1126%
#15	Auguston Connector	0.6	7.0	1076%
#16	McMillan Commuter	0.6	3.2	444%
#17	Townline Industrial	0.3	3.2	1109%
#21	Aldergrove Connector	0.6	7.0	1100%
#22	East Townline	0.1	3.2	5340%
#23	West Townline	0.1	3.2	5340%
#24	Centre Loop	0.1	7.0	11660%
#26	Sandy Hill	0.1	3.2	5340%
#31	Valley Connector	2.7	7.0	160%

APPENDIX D: THERMAL ENERGY LOAD MAPS

Figure D-1: Current Load Map

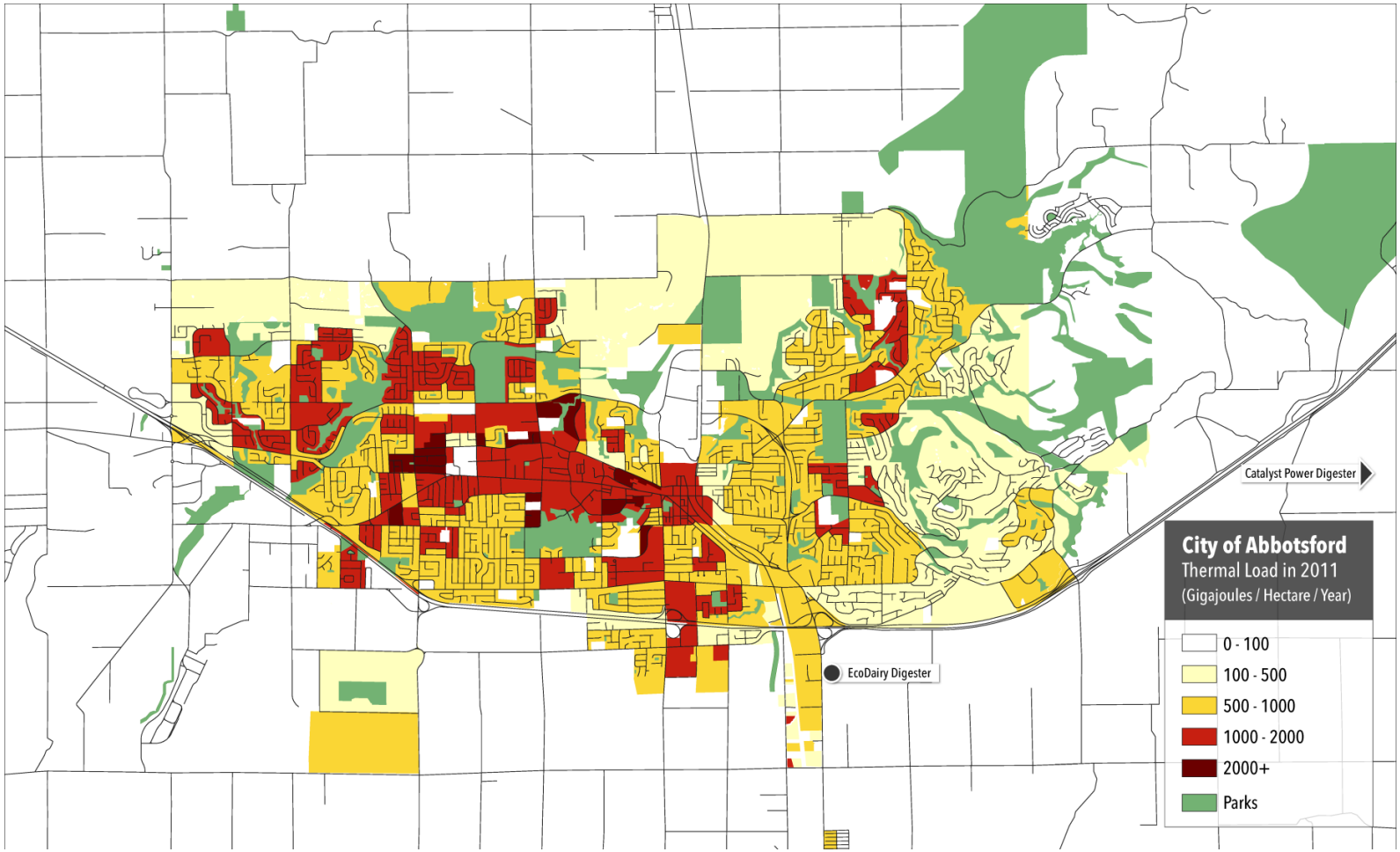


Figure D-2: NEW thermal Load 2011 to 2040: BAU Scenario

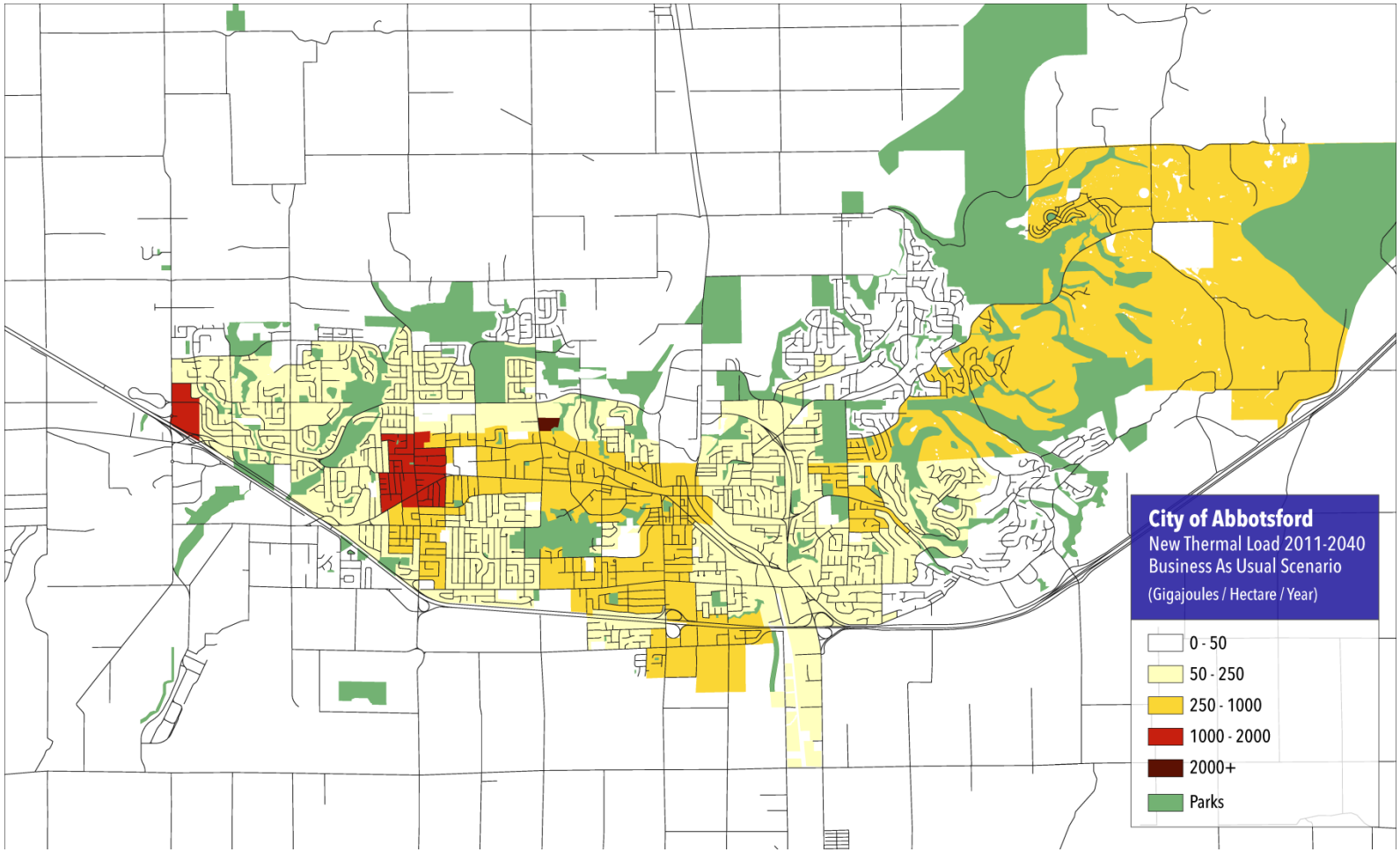


Figure D-3: Thermal Load 2040: BAU Scenario

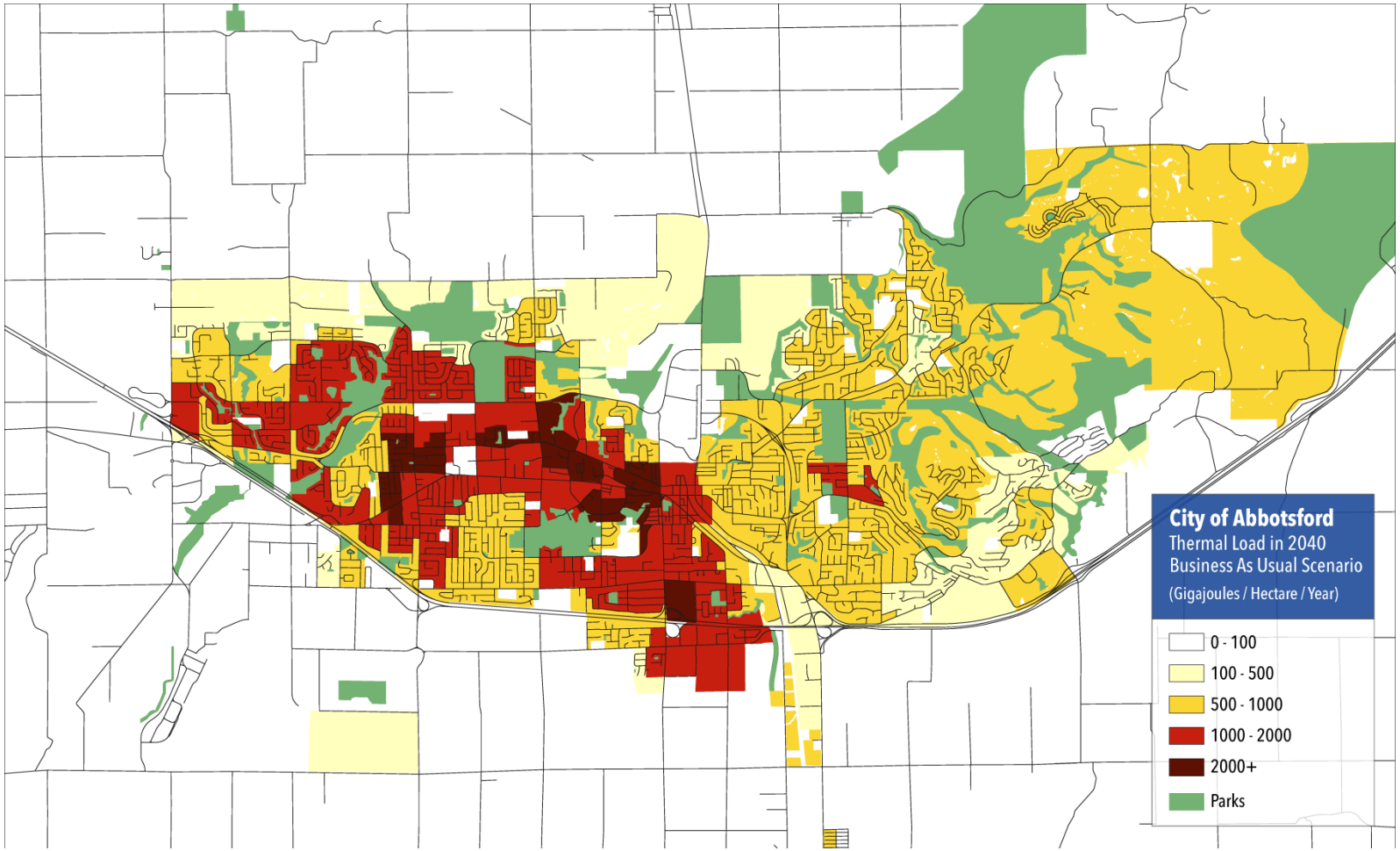
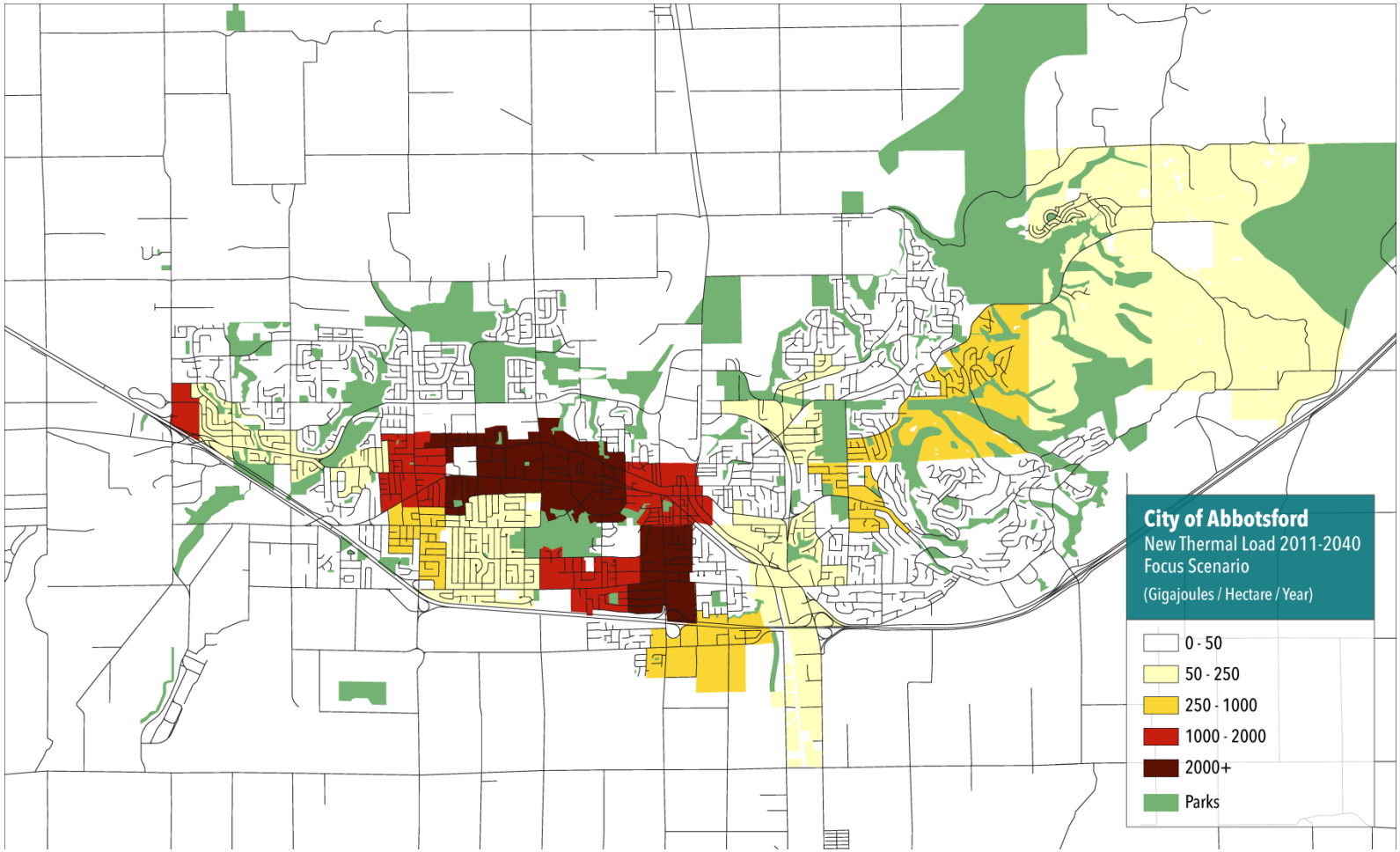


Figure D-4: NEW thermal Load 2011 to 2040: Reduction Scenario



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