Kamloops

Community Climate Action Plan

SITUATIONAL ANALYSIS

August 2019

Kamloops Community Climate Action Plan

This Situational Analysis has been produced to support development of a Community Climate Action Plan for the City of Kamloops.

The development of this plan was identified as a key environmental priority in the 2015-2018 Council Strategic Plan.

A cross departmental advisory body is supporting the process, represented by: Glen Cheetham Project Manager and Sustainability Services Supervisor; Josephine Howitt, Sustainability Program Coordinator; Elnaz Ansari, Traffic and Transportation Engineer; Jason Dixon, Building and Engineering Development Manager; Glen Farrow, Streets and Environmental Services Manager; ; Cara Dawson, Revenue and Taxation Manager; Jason Locke, Community Planning and Sustainability Manager, Adam Chadwick, G.I.S. Manager; Christine Carrelli, G.I.S Technician.

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Advisors

A team of consultants is advising the City in developing its Community Climate Action Plan. This team completed the Situational Analysis.

Megan Shaw, MCIP

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 1

2 INTRODUCTION 3

2.1 REPORT OBJECTIVES AND STRUCTURE....3
SITUATIONAL ANALYSIS OBJECTIVES AND CONTEXT 3
REPORT STRUCTURE 3
"BUSINESS AS USUAL" CONTEXT 4
2.2 RATIONALE FOR ACTION 4
CLIMATE, ENERGY AND COMMUNITY PRIORITIES 4
SCIENCE + POLICY 5
LOCAL IMPACTS AND ADAPTATION 7

3 COMMUNITY ENERGY + EMISSIONS DYNAMICS: CURRENT + FUTURE 8

3.1 CROSS-SECTORAL SYNOPSIS....8
COMMUNITY-WIDE ENERGY + EMISSIONS SNAPSHOT + OUTLOOK 8
GENERAL BUSINESS AS USUAL ASSUMPTIONS 13
LOCAL COMPLEMENTARY POLICIES + PLANS 13
NOTES 15
3.2 LAND USE + DEVELOPMENT SYNOPSIS....16
BUSINESS AS USUAL ASSUMPTIONS 16
KEY LAND USE AND DEVELOPMENT INDICATORS 17
LAND USE SECTOR HIGHLIGHTS 20
AUTHORITY + INFLUENCE 20
LOCAL COMPLEMENTARY POLICIES + PLANS 22
NOTES 22
3.3 BUILDINGS SYNOPSIS 23
BUSINESS AS USUAL ASSUMPTIONS 23
BUILDING ENERGY + EMISSIONS SNAPSHOT + OUTLOOK 23
KEY BUILDING INDICATORS 25
BUILDINGS SECTOR HIGHLIGHTS 25
AUTHORITY + INFLUENCE 26
LOCAL COMPLEMENTARY POLICIES + PLANS 27
NOTES 27
3.4 TRANSPORTATION SYNOPSIS....28
BUSINESS AS USUAL FUTURE 28
TRANSPORTATION EMISSIONS SNAPSHOT + OUTLOOK 28
KEY TRANSPORTATION INDICATORS 29
TRANSPORTATION SECTOR HIGHLIGHTS 30
AUTHORITY + INFLUENCE 33
LOCAL COMPLEMENTARY POLICIES + PLANS 33
NOTES 34
3.5 WASTE & MATERIAL MANAGEMENT SYNOPSIS 36
BUSINESS AS USUAL FUTURE 36
WASTE EMISSIONS SNAPSHOT + OUTLOOK 36
KEY WASTE INDICATORS 37
WASTE SECTOR HIGHLIGHTS 37
AUTHORITY + INFLUENCE 37

LOCAL COMPLEMENTARY POLICIES + PLANS 38
NOTES 38

4 LOCAL ENERGY SUPPLY SYNOPSIS 39

4.1 LOCAL RENEWABLE ENERGY RESOURCE POTENTIAL 39
LANDFILL/SEWAGE GAS / RENEWABLE NATURAL GAS 39
SOLAR 40
BIOMASS 40
HEAT PUMP TECHNOLOGIES 41
MICRO-HYDRO 41
WIND 42
4.2 DISTRICT ENERGY 43
NOTES 43

5 KAMLOOPS AND THE INTERIOR CONTEXT 45

6 ENERGY + EMISSION INDICATORS 47

7 BIBLIOGRAPHY 55

1 EXECUTIVE SUMMARY

The Situational Analysis is the first major deliverable to support development of a Kamloops Community Climate Action Plan (C-CAP). This paper aims to foster critical understanding about community energy and emission dynamics in Kamloops and begin to explore some of the unique challenges and opportunities for action.

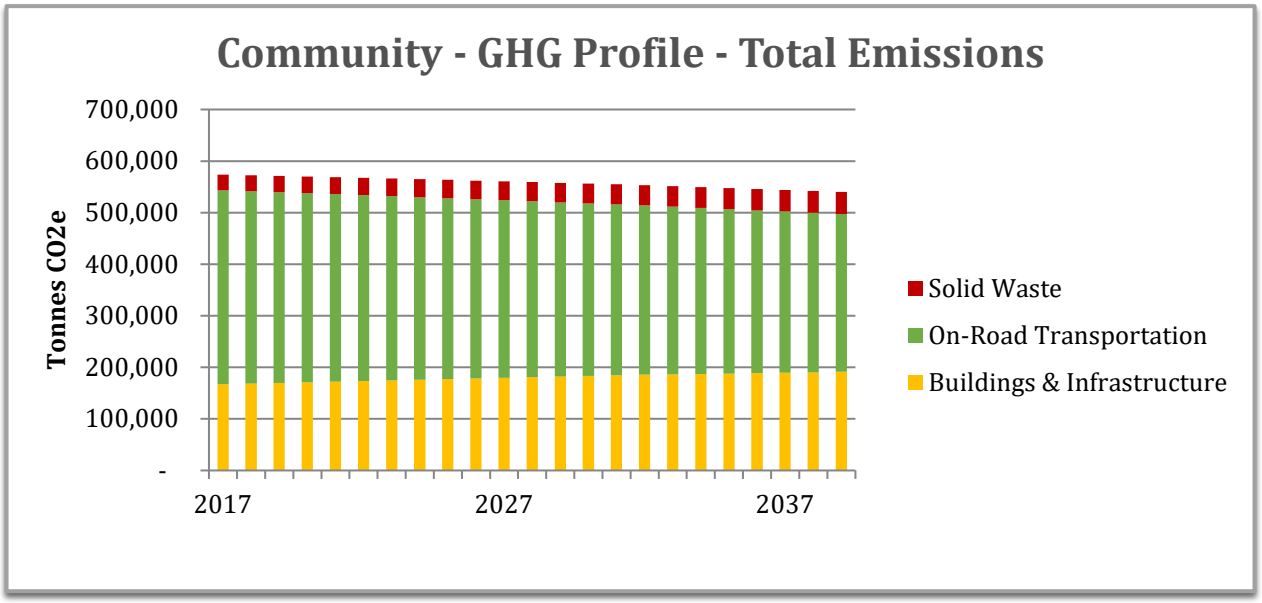
Context

- **The identity and social and economic health of people living at the confluence of the North and South Thompson has been tied to a stable climate for millennia. Regional impacts are already serious:** forest fire and invasive pests, flooding, salmonid health loss, and water insecurity. **Kamloops can make an important contribution to the deep greenhouse gas (GHG) reductions necessary to avoid catastrophic impacts with an effective C-CAP.**

- **Smart GHG reduction priorities can advance key public priorities and strengthen Kamloops' economic and social health.** The C-CAP can support economic development, affordability, and public health. Smart strategies can be informed by and advance key planning agendas: top OCP objectives, Transportation Master Plans, Biosolids Management Plan, and the Downtown Plan.

- **Kamloops has ambitious commitments and is legislatively required to develop policies to reduce GHGs.** Kamloops adopted reduction targets and policies to meet them in its Sustainable Kamloops Plan. Council has made it a priority to strengthen its climate action agenda. The C-CAP will provide deeper analysis and planning support that can strengthen and build on existing policies.

- **BC has ambitious targets and is expected to develop increasingly robust policies to meet them that would require local government collaboration to be successful.** BC has a bold framework to build net-zero-ready new buildings by 2032 that will require strategic local action. CleanBC, recently released, has laid out strong new targets and intentions. Detailed policy is currently being developed. The local government role is being actively considered in many sectors, notably organic waste diversion, renewable natural gas generation, and integrated land use and transportation.



Community Energy & Emission Dynamics

- Half of BC's GHGs are from community activities concentrated in transportation, buildings and waste sectors. Managing these GHGs will involve all levels of government, including local governments.
- **Two-thirds of baseline (current) GHGs (381,500 tCO2e) are in the Transportation sector**. This is similar to most BC communities. The majority of these GHGs are from personal transportation.
- Current (2017 baseline) GHG emissions in Kamloops are 579,000 tonnes of CO2e (tCO2e) or 6.3 tCO2e per capita. This is 9% higher than the BC average of 5.7 tonnes CO2e per capita.
- **Slightly less than 30% of baseline GHGs (167,000 tCO2e) are in the Buildings sector.** This is typical of most BC communities. The majority of buildings' emissions are due to burning natural gas.
- **The smallest share of Kamloops GHGs is in the Waste sector (30,595 tCO2e).**
- **Total GHG emissions decline 6% by 2039 under the Business as Usual (BAU) projection**. The decrease is primarily due to the introduction of new provincial policies, notably a steady increase in the share of personal zero emission vehicles. GHGs in the other two sectors (buildings and solid waste) actually increase under the BAU projection. An effective C-CAP, and strong implementation policy under CleanBC and the Pan Canadian Framework could change these trajectories.
- **Enhanced land use planning can manage transportation and building GHGs.** Development and growth plans shape the nature and use of the housing stock, influencing building energy demand. Land use strongly influences proximity to destinations, the aesthetics of streets and public places, and the viability and attractiveness of different transportation modes and trip distances. Enhanced land use plans have potential to reduce public and personal transportation spending, create affordable housing options, and manage Kamloops' emerging congestion problems.

- **Action in the transportation sector** to increase the share of active travel modes and transit, and reduce commuting distances can be driven through transportation infrastructure investment integrated with land use planning. The Transportation Master Plan provides a basis to developing meaningful reductions in this sector, which can help manage Kamloops' emerging congestion problems, promote public health and community liveability. Enabling successful personal electric vehicle roll-out will depend, in part, on local efforts to facilitate a strong charging infrastructure network.

- **Action in the buildings sector** includes Step Code leadership, a retrofit agenda for existing ageing buildings, and, potentially, innovations on single detached parcels to increase occupancy. Collaborating with builders and developers, and potentially pre-fab, building manufacturers will be central to success. There are opportunities to strengthen the resilience of the building stock and support economic development through action in this sector.

- **Managing waste GHGs** will be influenced by strategies for organic waste diversion and treatment, potential co-management with sewage biosolids, and long-term landfill management strategies. There may be potential to generate renewable natural gas from organic waste, diversifying revenue streams for utility operations and decarbonizing BC's natural gas distribution network.

2 INTRODUCTION

2.1 REPORT OBJECTIVES AND STRUCTURE

SITUATIONAL ANALYSIS OBJECTIVES AND CONTEXT

The Kamloops Energy and Emissions Situational Analysis aims to foster critical understanding about community energy and emission dynamics and management strategies for Kamloops' unique local context. To achieve this, the Situational Analysis provides the following:

- **Snapshot and outlook** of Kamloops community energy and greenhouse gas (GHG) emission activity and explanation of the underlying local dynamics;
- Description of the **authority and influence** of different levels of government over this activity;
- Initial discussion of **challenges and opportunities** for action; and
- **Rationale** for developing a Community Climate Action Plan.

The Situational Analysis is the first major deliverable to support the development of a Kamloops Community Climate Action Plan. A Low Carbon Futures Paper exploring alternative energy and emission options will follow. A Preferred Path Report will result that will then be iteratively strengthened to become the C-CAP. This paper does not explore solutions in a significant manner. This will happen in greater depth during phase 2 of the project: Exploring Options.

REPORT STRUCTURE

- An introduction outlines the objectives and context for the paper and development for a Community Climate Action Plan, including an overview of:
  - Science and Policy

- Local Impacts

- A community energy and emission profile that provides detailed analysis of the dynamics of each sector:
  - Land Use and Development
  - Buildings
  - Transportation
  - Waste

- A synopsis of each sector, starting with a "cross-sectoral" section, includes the following:
  - Key assumptions informing the Business as Usual (BAU) projection;
  - Snapshot of current emissions and outlook of future emissions based on the BAU;
  - Key indicators that determine energy and emission activity;
  - Highlights of current and future energy and emissions;
  - Discussion of authority and influence over energy and emissions;
  - Complementary policy and planning activity;
  - Cursory discussion of challenges and opportunities.

- A high-level evaluation of local energy supply opportunities, including preliminary district energy scoping.

- Current and "Business As Usual" performance on key indicators is benchmarked.

"BUSINESS AS USUAL" CONTEXT

A primary objective of the Business as Usual (BAU) projection is to provide insight into the key variables that change (or are held constant), and then demonstrate the energy and emissions implications. More than anything, **the "Business as Usual" future is a reference case to inform development of alternative future scenarios that will help shape policy and planning recommendations**.

The most important consideration for the BAU Future is: it is not *the* future. It is *a* future – a plausible one given the policies and plans of the City, senior governments and key regulated agencies (e.g. BC Hydro, FortisBC, BC Transit) that impact community energy and emission activity.

A significant influence on Kamloops' future energy and emission path could be a Community Climate Action Plan. Implementation will depend on resonant strategies that inspire active engagement by many players in the community and beyond, and, most significantly, are driven by a supportive Council.

2.2 RATIONALE FOR ACTION

CLIMATE, ENERGY AND COMMUNITY PRIORITIES

Climate action is typically only modestly successful when it focuses exclusively on climate change and GHG management. Most local governments with successful climate change programs have strategies that complement other core priorities that deeply resonate with Council, staff and the community. Making connections to priorities that are meaningful supports the development of high impact plans to address global climate change. One of the advantages of this approach is that energy and emission management can bolster action on existing priorities.

Relevant priorities that complement emission management:

- ***Municipal Infrastructure Cost Management****:* Focused growth (for instance: infill development) reduces the cost of laying, maintaining and replacing roads, sewers, and water mains, and providing emergency management and waste management services. Smart growth can manage property taxes, utility rates and long-term municipal infrastructure deficits.

- ***Air Quality****:* Reducing fossil fuel combustion in transportation, notably diesel fueled heavy duty freight, will improve local air quality. Enabling active transportation and transit, improving vehicular efficiency and shifting to electric drivetrains, and renewable fuels will reduce criteria air contaminants.

- ***Public Health:*** The majority of people get most of their exercise through utilitarian activity (Frank, 2014). Neighbourhoods and infrastructure that support walking and cycling have lower rates of inactivity, obesity and diabetes (Glazier, 2014). These health care costs are on the rise in Canada.

- ***Demographic Change Management:*** Kamloops has a growing share of empty nesters, seniors, and one-person households. These cohorts typically have higher demands for multi-family housing, good active transportation and transit travel options, and easy access to key services such as pharmacies and grocery stores (Statistics Canada).

- ***Economic Development:*** This analysis finds Kamloops residents and businesses spend almost $200 million annually in energy. Most energy spending leaves town. Energy retrofits create local economic opportunities, and reduced energy spending in buildings and transportation will result in a larger share of this money being re-invested in the community. There are growing opportunities in clean technology for communities like Kamloops, e.g. renewable energy generation and prefabricated, high-efficiency building manufacturing.

- ***Resilient Housing:*** Stronger building codes, capacity building and innovative builders will support construction of higher quality, more comfortable, durable buildings and homes with lower operating costs. More multi-family housing, inherently more energy efficient, will better support an aging population and smaller households. New single-family homes that are secondary suite-ready would support lower cost, lower carbon and more flexible housing options.

- ***Affordability:*** There are diverse housing options that are more affordable and energy efficient, including secondary suites, laneway housing, stratified single family homes and diverse multi-family homes. Wood-frame multi-family housing is the least expensive housing to build per square metre. It is typically also the most energy efficient. Good infrastructure and urban design can reduce transportation spending, which is the second largest household expenditure after housing.

SCIENCE + POLICY

- **The relatively stable climate that has allowed communities to flourish around the confluence of the North and South Thompson Rivers and globally over the last several thousand years depends on greenhouse gases that trap heat into the earth's atmosphere.** Without greenhouse gases in our atmosphere, the world would be 33° Celsius cooler for an average global temperature of -19° Celsius (World Meteorological Organization, 2019**). Since the beginning of the industrial revolution, human activities have added almost 40% more greenhouses gas to the atmosphere, increasing average**

global temperatures. The primary source of additional GHG emissions is the combustion of fossil fuels – gasoline, diesel, coal and natural gas – followed by the removal of forests for farming and urbanization. These activities release carbon dioxide into the atmosphere. Methane is another significant greenhouse gas, primarily from industrial activities but also from organic waste decomposing in landfills.

- A primary impetus for developing a Community Climate Action Plan is a **2007 legislative requirement under BC's Local Government Act requiring Official Community Plans to include "…targets for the reduction of GHGs… and policies and actions... [for] achieving those targets."** This was one of many policy changes driven by the BC Government upon making its commitment to reduce provincial GHG emissions 33% below current levels by 2020 and 80% by 2050.

- The BC Government announced a transformative commitment to climate action in a 2007 throne speech. "The science is clear. It leaves no room for procrastination… The more timid our response, the harsher the consequences…" These targets and timetables reflected a dominant interpretation of IPCC science on the levels of GHG reductions necessary to stabilize the atmosphere and prevent dangerous, runaway climate change.[1]

- An increasing number of prominent institutions are taking a growing interest in the central and strategic role of cities in deep emissions reductions, including the Organization for Economic Cooperation and Development (see OECD, 2012), and the Global Commission on the Economy and Climate co-chaired by Felipe Calderón, former President of Mexico, and Nicholas Stern, former World Bank Chief Economist (Calderón, 2014). **Urban emission reduction strategies are amongst the most attractive because the magnitude of benefits offsets the costs.**

- A review of the latest IPCC Assessment Report finds: "**Urban centres account for more than half of the world's population, most of its economic activity and the majority of energy-related emissions. The role of cities in reducing emissions and protecting their inhabitants is therefore central to effective climate policies."** (European Climate Foundation, ICLEI - Local Governments for Sustainability, Cambridge Judge Business School, 2014)

- The Climate Action Charter signed in 2007 by the BC Government and virtually all BC local governments, including Kamloops, resolved to support provincial-local government collaboration to mitigate climate change impacts. Amongst other goals, **local governments voluntarily committed to create "complete, compact, more energy efficient rural and urban communities."**

- To respond to the Local Government Act requirements and BC Climate Action Charter, the City of Kamloops preliminarily assessed and outlined its climate commitments in the Sustainable Kamloops Plan (2010). **The Sustainable Kamloops Plan provides targets, actions** and an ongoing monitoring process to direct the City to advance environmental, economic, and social sustainability, including:

    - Reduce community-wide greenhouse gas emissions by 40% below 2007 levels by 2020;
    - Reduce residential-based GHG emissions to 0.9 tonnes/capita by 2020;
    - Reduce transportation-related GHG emissions to 2.4 tonnes/capita by 2020;

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[1] Based on stabilization scenarios developed by the Intergovernmental Panel on Climate Change Working Group III on Mitigation in its 4th Assessment Report 4, section 13, see Box 13.7 (IPCC, 2007)

- Increase alternative transportation to 30% of all trips.

- After extensive stakeholder consultation, the province launched the BC Energy Step Code in 2016. The Step Code is a set of new building standards that provides an incremental and consistent approach to stepping up energy efficient construction and ultimately net zero ready construction by 2032. The Code requires buildings to meet energy efficiency requirements through energy modeling and air tightness testing. The City of Kamloops will have to develop an implementation strategy to determine how to phase in the Step Code.

- The BC Government renewed its climate action commitment in 2018, deepening its short term GHG reduction targets to 40 percent below 2007 levels but delaying the timeline to 2030. It included a 60 percent reduction by 2040, and 80 percent by 2050. **The BC Government overhauled its climate plan in December 2018, releasing the first phase of CleanBC** (BC Government, 2018). There is significant detail yet to be fleshed out, including new strategies on community planning and transportation. Key commitments include:

  - **Diverting 95% of organic waste** from landfills by 2030;
  - **Reaffirming a 75% landfill gas capture requirement** in large landfills (e.g. Mission Flats);
  - **Phasing in 100% electric passenger vehicle sales by 2040**, requiring local/regional EV charging infrastructure networks;
  - **Meeting a 15% renewable requirement in BC's natural gas distribution network**;
  - **Deepening building energy retrofit support.**

- The most recent **IPCC report – *Global Warming at 1.5°C* – intensifies the GHG reductions required to protect atmospheric stability and avoid the most serious consequences of climate change** (IPCC, 2018). **To limit warming to 1.5° Celsius above pre-industrial times, GHGs must be reduced 50% from 2010 levels by 2030 and 100% by 2100.** This is still not sufficient to avoid some significant serious local impacts, including greater frequency of extreme heat episodes, which would increase mortality, growing forest fire risk and water insecurity, and more intense wind and rain events.

- **In its 2015-2018 Strategic Plan, Kamloops City Council identified climate action as a key environmental priority,** specifically prioritizing the development of a comprehensive community climate action plan.

LOCAL IMPACTS AND ADAPTATION

- **Kamloops' identity is intimately tied to a natural world that depends on a stable climate.**

  - **The confluence of the North and South Thompson has been an important centre for fishing, hunting, trapping and commerce for millennia.** The Thompson River supports 24 fish species including ecologically and culturally important salmon runs sensitive to temperature changes.

  - **The Thompson region supports a large forest products industry, vibrant agricultural sector, and an important and growing tourism destination.**

- **The Thompson region is already experiencing observable, measurable and significant climate changes,** including: (Walker, I and Sydneysmith, R, 2008)

- Declining salmon populations due to rising water temperatures in fresh (and marine) water habitats;
- Increased frequency and severity of forest fires and floods;
- A devastating mountain pine bark beetle infestation was historically held in check by early winter cold snaps that would control larvae populations. (The pine beetle will have killed an estimated 55 percent of B.C.'s mature merchantable pine by 2020-- more softwood than B.C. has exported to the U.S. over the last 30 years.) (NRCan, 2017; BC Government, 2017)

- **Projected climate changes – notably hotter temperatures, prolonged droughts, intense rain and storm episodes – will intensify each of these risks** and others including reduced fresh water security, and unpredictable hydroelectric reservoir levels.

- Reducing vulnerability to climate change involves GHG reductions and adaptation measures. The City is taking initial steps to reduce risk to forest fire and flooding. This Plan focusses on reducing the community's greenhouse gases, (GHGs).

3 COMMUNITY ENERGY + EMISSIONS DYNAMICS: CURRENT + FUTURE

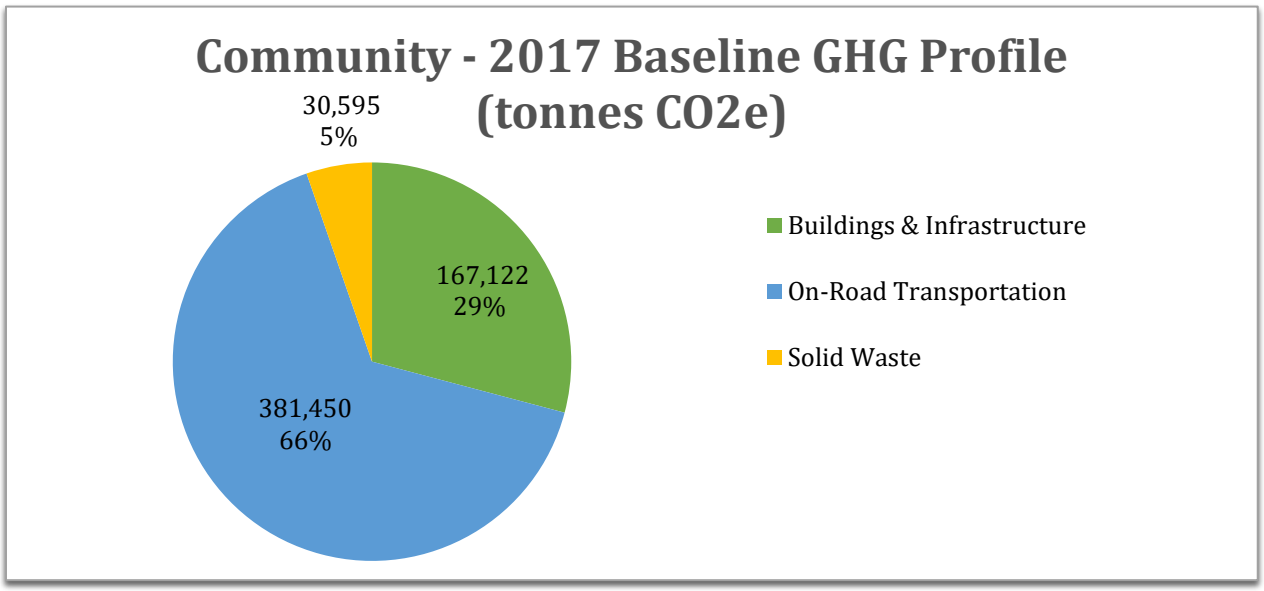
3.1 CROSS-SECTORAL SYNOPSIS

COMMUNITY-WIDE ENERGY + EMISSIONS SNAPSHOT + OUTLOOK

BASELINE

- Current (2017 baseline) GHG emissions in Kamloops are 579,000 tonnes CO2e or 6.3 tonnes CO2e per capita. **This is 9% higher than the BC average** of 5.7 tonnes CO2e per capita.

Figure 1 Baseline Community GHG Profile



- The vast majority of Kamloops' GHGs are from energy-related activity, primarily the combustion of natural gas in buildings and gasoline for transportation.

- **Two-thirds of current GHGs are in the transportation sector**. This is similar to most BC communities. Average personal vehicular driving distances are slightly higher than the provincial average. Personal vehicles are less fuel efficient on average. Kamloops has significantly less 'originating' commercial vehicle traffic which is in-scope in this study (pass-through traffic in the Trans Canada Highway is not counted in this study).

- **Slightly less than 30% of current GHGs are in the Buildings sector.** This is typical of most BC communities. The majority of buildings emissions are due to burning natural gas.

- **The smallest share of Kamloops GHGs is from the Waste sector.** Waste is a non-energy emission source, resulting from organic waste decomposition in landfills in the absence of oxygen (i.e. anaerobic), producing methane.

- **Personal spending** on building and transportation energy in 2017 is approximately **$184 million** across the community. This is **$1,994** per person or **$4,302** per household.[2] That level of spending comprises 6% of annual median total household income[3].

- Household emissions are lowest in higher density, mixed-use areas with a diversity of housing types and transportation options, and closer proximity to key destinations, notably work and school (Downtown, North Kamloops and Lower Sahali). (See Figure 4 map)

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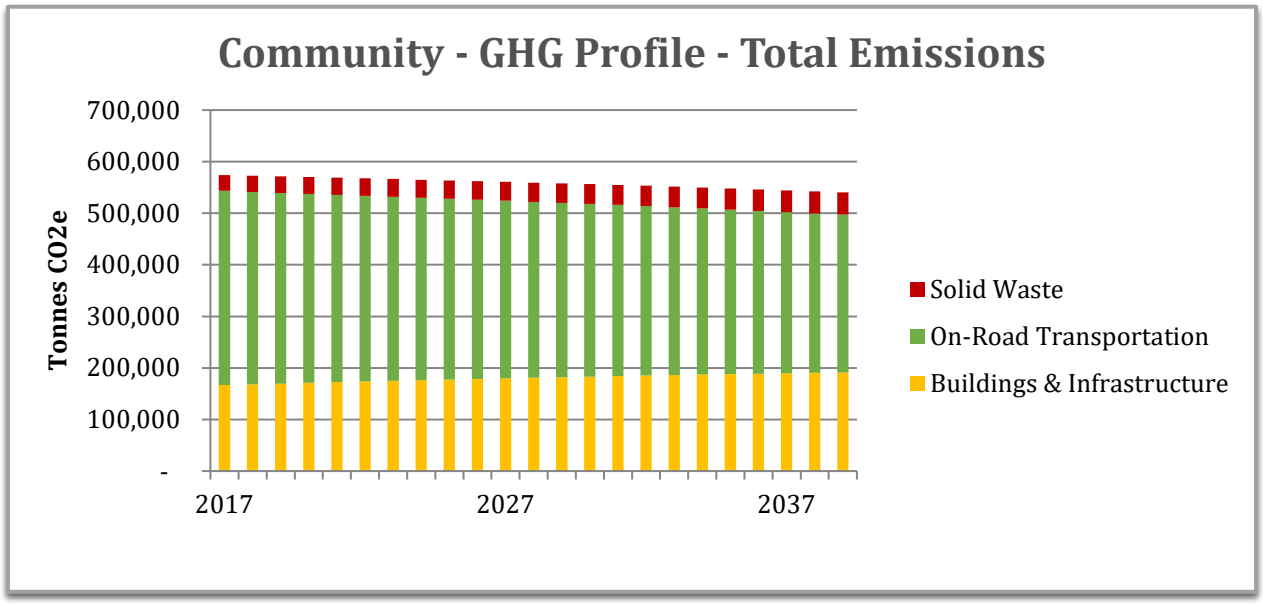
[2] Based on average buildings' energy cost rates from BC Hydro (2018) and Fortis Gas BC (2018) and Statistics Canada average 2017 fuel price for Kamloops ($1.17/L)
[3] Or 6.8% of after-tax family income (Median total income of households in 2015: $73,336, Median after-tax income of households in 2015: $64,169) – Statistics Canada (2016)

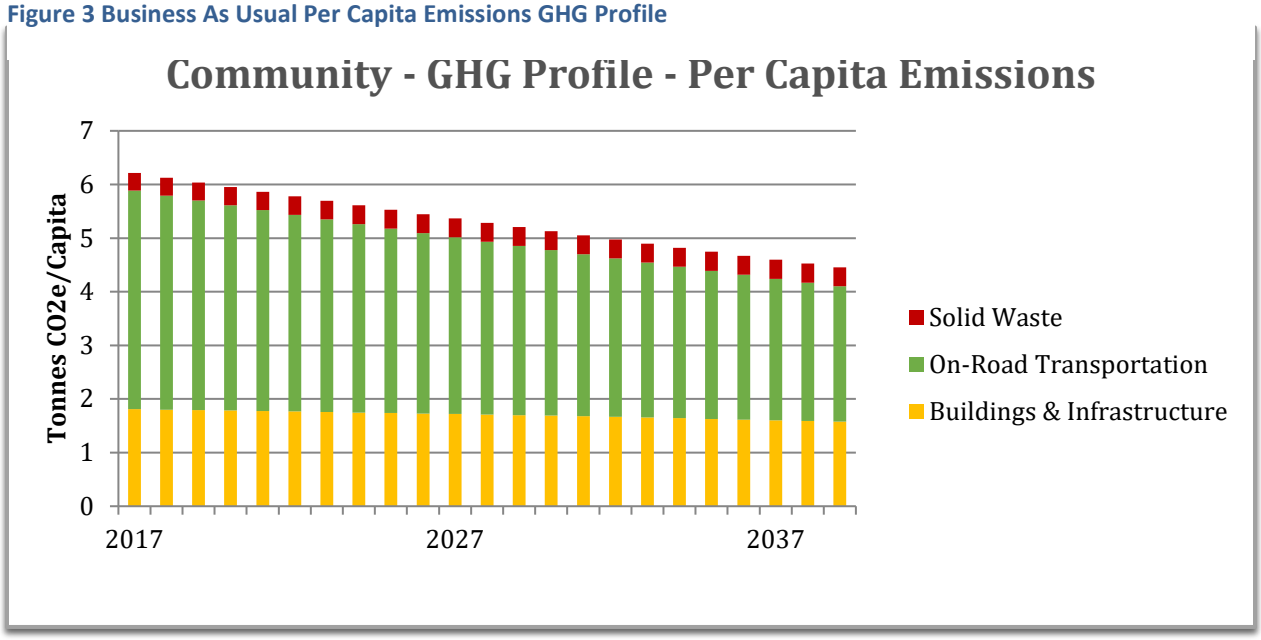
BUSINESS AS USUAL

Figure 2 Business As Usual Community GHG Emissions Profile



- **Total GHG** emissions **decline 6% by 2039** under the BAU projection. The decrease is primarily due to the introduction of new provincial policies, which will steadily increase the share of personal zero emission vehicles, i.e. electric vehicles (18% of fleet ZEV by 2039, 40% by 2050). Emissions in the other two major sectors (buildings and solid waste) actually increase under the BAU projection.

Figure 3 Business As Usual Per Capita Emissions GHG Profile



- **Per capita emissions decline 28%** by 2039. This highlights again the dramatic gains made in overall vehicle fleet fuel efficiency in the BAU projection time period.

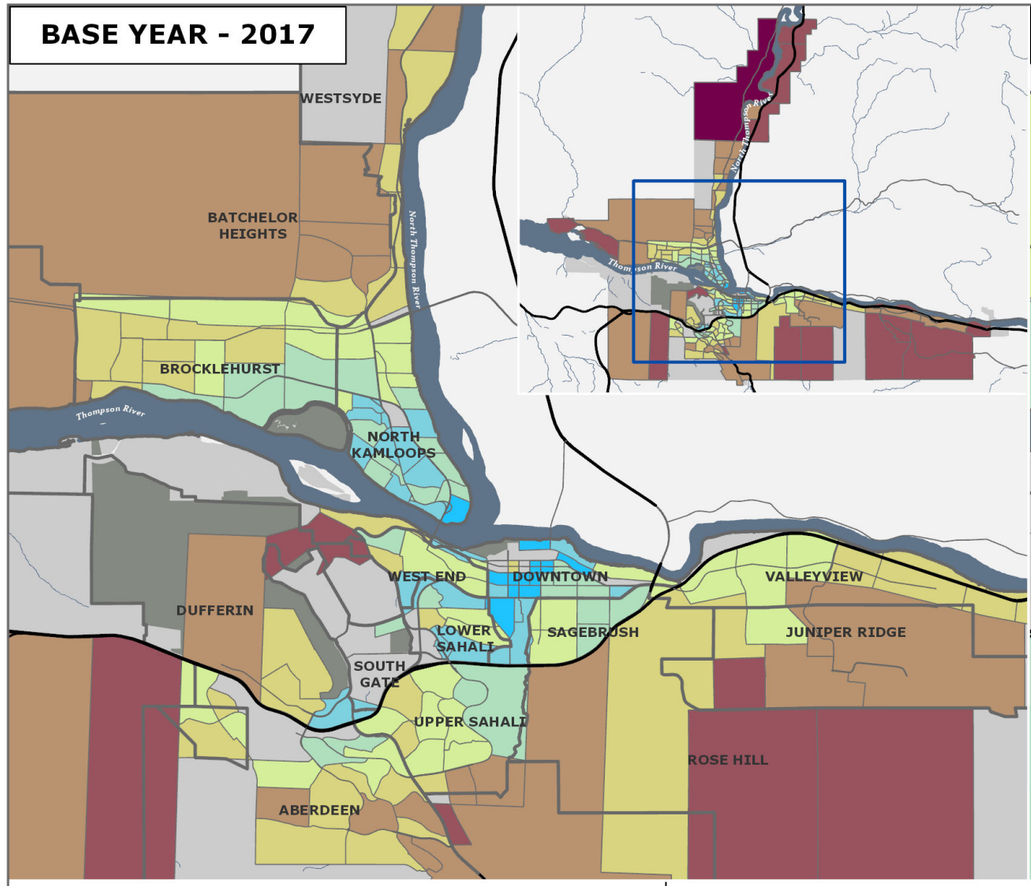
- **Building emissions increase**, but more slowly than population as improved efficiency (reflecting current Step Code implementation timelines)[4] and a shift towards multi-family housing offsets growth.

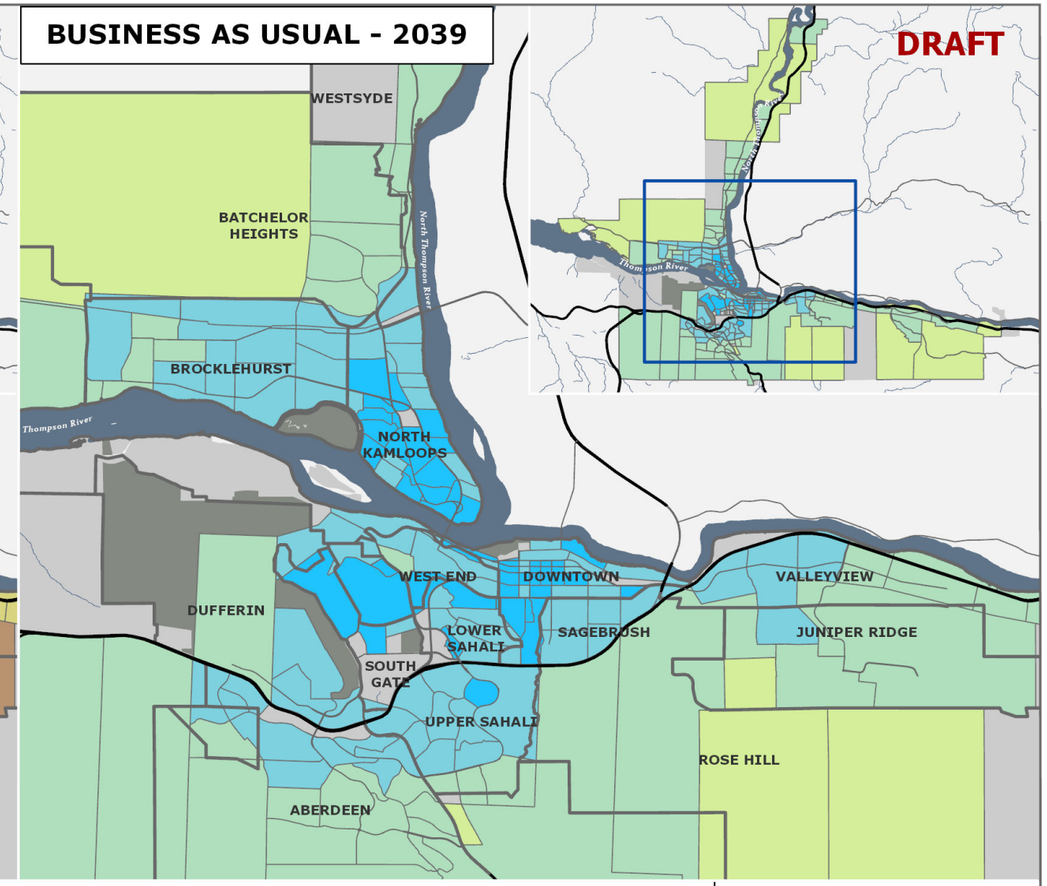
- **Transportation emissions decrease.** Personal vehicles, the dominant transportation mode, are decarbonized through efficiency and electric vehicle take up.

- **Emissions from solid waste increase with population**, but as waste is a smaller part of overall emissions, its impact on overall emissions is not as great.

[4] *Step 3 by 2022, Step 4; 2027 and 5 by 2032*

Figure 4 Total Average Annual Household Emissions by Area





AVERAGE HOUSEHOLD EMISSIONS (tonnes CO2e)

- < 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- 10.0 - 12.0
- 12.0 - 14.0
- 14.0 - 16.0
- 16.0 - 18.0
- 18.0 - 20.0

- HIGHWAY
- ROAD
- WATERCOURSE
- WATERBODY
- PARK
- NEIGHBOURHOOD
- NO RESIDENTIAL HOUSEHOLDS

NOTES AND DISCLAIMERS

INFORMATION HAS BEEN GENERALIZED FOR DISPLAY PURPOSES AND IS BASED ON PRELIMINARY MODELING AND RESULTS.

REFERENCES

TAZ AND POPULATION DATA FROM CITY OF KAMLOOPS.
BASE INFORMATION SOURCED FROM CITY OF KAMLOOPS 2018.

CALCULATIONS

	AVERAGE tonnes CO2e/HH			AVERAGE tonnes CO2e/HH	
NEIGHBOURHOOD	2017	2039	NEIGHBOURHOOD	2017	2039
ABERDEEN	14.47	8.48	NOBLE CREEK	19.77	11.82
BARNHARTVALE	17.19	10.08	NORTH KAMLOOPS	8.66	6.04
BATCHELOR HEIGHTS	15.66	8.58	PINEVIEW	12.55	7.98
BROCKLEHURST	11.53	7.38	RAYLEIGH	16.38	9.78
CAMPBELL CREEK	16.90	10.21	ROSE HILL	16.50	9.98
DALLAS	15.61	9.50	SAGEBRUSH	9.96	6.54
DOWNTOWN	7.73	5.93	SOUTHGATE	12.39	6.24
DUFFERIN	13.45	8.27	TRANQUILLE	16.16	7.59
HEFFLEY CREEK	16.98	10.19	TRU	17.17	5.90
IRON MASK	16.29	9.23	UPPER SAHALI	11.28	7.48
JUNIPER RIDGE	14.40	9.10	VALLEYVIEW	12.74	8.12
KNUTSFORD	15.18	9.49	WEST END	10.61	6.99
LOWER SAHALI	9.09	6.12	WESTSYDE	16.43	8.82
MISSION FLATS	14.46	7.73			

0 1 2 3 4
Kilometers

PROJECT
KAMLOOPS
CLIMATE ACTION PLAN

DATE
2019-02-20

Boston Consulting

Kamloops
Canada's Tournament Capital

GENERAL BUSINESS AS USUAL ASSUMPTIONS

Energy and emissions under the Business As Usual Future assume policy and planning will incorporate measures envisioned in the recent Official Community Plan and Transportation Master Plans and that pace of development will continue according to the historical trend with no dramatic measures to manage carbon and energy. Detail on these assumptions is outlined under each sector.

- Building and vehicle efficiency will steadily improve under provincial government commitments.
- Kamloops land use and transportation policy and planning supports modest improvements to net building emissions. Per capita automobile ownership declines (i.e. improves) slightly yet is offset by the addition of dwellings in more suburban areas resulting in an increase in total community driving distances.
- Kamloops' and the Thompson-Nicola Regional District's (TNRD) waste and materials management policy and planning supports significant waste planning and investment.
- Population and job growth projections are consistent with the Kamloops OCP and Transportation Master Plan.

LOCAL COMPLEMENTARY POLICIES + PLANS

Official Community Plan

- The City of Kamloops completed an update to KAMPLAN, its Official Community Plan (OCP), in early 2018. The previous update to the City's OCP was in 2004. The OCP does not set targets to reduce GHG emissions, but rather **refers to targets developed in the Sustainable Kamloops Plan** (2010). These are further discussed below.

- **KAMPLAN's community vision aligns with many co-benefits supported by climate action**. KAMPLAN's community vision includes: community sustainability, healthy people, resilient economy, inclusive housing, and vibrant neighbourhoods. Highlighted community values that informed the plan include direction to: develop complete neighbourhoods, support urban intensification, support the availability of diverse housing options, improve transportation and connectivity, promote economic resiliency, optimize existing municipal infrastructure, among others.

- **KAMPLAN has many policies to support GHG reductions through land use and urban form**, including:
    - Requiring new developments to meet criteria for complete communities;
    - Encouraging parking variances and exemptions;
    - Supporting the development of neighbourhood-serving land uses;
    - Supporting home-based businesses;
    - Supporting the redevelopment of mixed-use town centres, and encouraging mixed use commercial and multi-family development in neighbourhood centres;
    - Encouraging active transportation connections in new developments;
    - Supporting diverse housing options;
    - Supporting infill developments;
    - Supporting secondary and carriage suites;
    - Encouraging density in nodes and corridors;
    - Limiting additional subdivision in suburban areas;
    - Discouraging subdivision and densification in rural areas; and

- Encouraging government offices to locate in the city centre.

- **Transportation policy to encourage reduced GHGs** in KAMPLAN include:
  - Adopting a complete street approach;
  - Considering opportunities to encourage electric vehicle charging stations in new buildings and retrofitting mixed-use, multi-family and office buildings;
  - Accepting some increased traffic congestion and providing transportation alternatives;
  - Considering parking variances where sustainable transportation options or incentives are provided or are in close proximity, such as car sharing, frequent transit routes, etc.;
  - Requiring new developments to include pedestrian and cycling connections;
  - Improving accessibility;
  - Support more frequent transit in densifying areas; and
  - Encouraging multi-modal transportation connections.

- **Energy Efficient Buildings policy** in KAMPLAN includes:
  - Considering incentives to encourage energy efficiency in the design and retrofitting of commercial and residential buildings; and
  - Considering creating new Development Permit Area Guidelines and zoning regulations to reduce GHGs and encourage energy efficient buildings.

Sustainable Kamloops Plan

- The Sustainable Kamloops Plan (2010) provides measurable targets, actions and an ongoing monitoring process to direct the City toward more environmental, economic, and social sustainability. Specifically:
  - Reduce community-wide greenhouse gas emissions by 40% below 2007 levels by 2020;
  - Reduce residential-based GHG emissions to 0.9 tonnes/capita by 2020;
  - Reduce transportation-related GHG emissions to 2.4 tonnes/capita by 2020;
  - Increasing alternative transportation to 30% of all trips.

- The Plan's policies and GHG targets were reviewed and considered in the development of the OCP. The Sustainable Kamloops Plan also includes goals and actions to address Climate Change Adaptation that are currently being implemented.

NOTES

Challenges

- KAMPLAN does not set specific GHG targets, but refers to targets set in 2010 for Sustainable Kamloops Plan.

Opportunities

- Sustainable Kamloops Plan implementation is tied to targets and actively monitored and reported to Council.
- The Community Climate Action Plan can address many community priorities, KAMPLAN implementation, and add rigour with strong measurable targets and indicators.
- The City may be well positioned to take advantage of the growing demand and competitive advantages of pre-fabricated, premium efficiency building construction for domestic and eventually international markets. The City has very good transportation infrastructure connections for trade, a strong wood products sector, access to fibre, a university with some strengths in related fields, and a strong trades sector. This will be a growing economic development opportunity in some BC communities.
- The Community Climate Action Plan can serve as a basis for setting strong GHG targets which will then be incorporated into KAMPLAN as an OCP amendment.

3.2 LAND USE + DEVELOPMENT SYNOPSIS

While Land Use is not a typical sector, it underpins the primary energy and emission sectors. Land use and development define key parameters that influence building energy demand, and land use strongly influences proximity to destinations, the aesthetics of streets and public places, and the viability and attractiveness of different transportation modes.

BUSINESS AS USUAL ASSUMPTIONS

- The Business as Usual (BAU) future is based on the following land use and development assumptions, fundamentally influencing emissions in every sector:
  - Population and employment growth projections of 0.5% per cent per annum align with the Kamloops OCP.
  - The form of growth is most strongly influenced by the OCP and secondarily by current development trends, specifically:
    - Share of infill/replacement development is primarily allocated to core areas and inner suburb neighbourhoods;
    - Generally, Kamloops residents will increasingly live in a diverse array of dwelling types and land uses;
    - Southwest Sector continues to develop on trend in residentially zoned and designated land, with a diverse mix of unit types; and
    - The multi-family share modestly increases to accommodate increasing populations of seniors and young families, as well as potentially address increasing concerns regarding housing affordability.
  - Employment and commercial building growth locations are consistent with demographic analysis under the OCP.

	2016	2039
Projection		
Population	90,280	120,137
Jobs	47,825	53,311
Dwelling Split		
Single detached	74%	62%
Town / Row House	8%	14%
Low rise (<5 story)	16%	21%
High rise (>5 story)	2%	3%

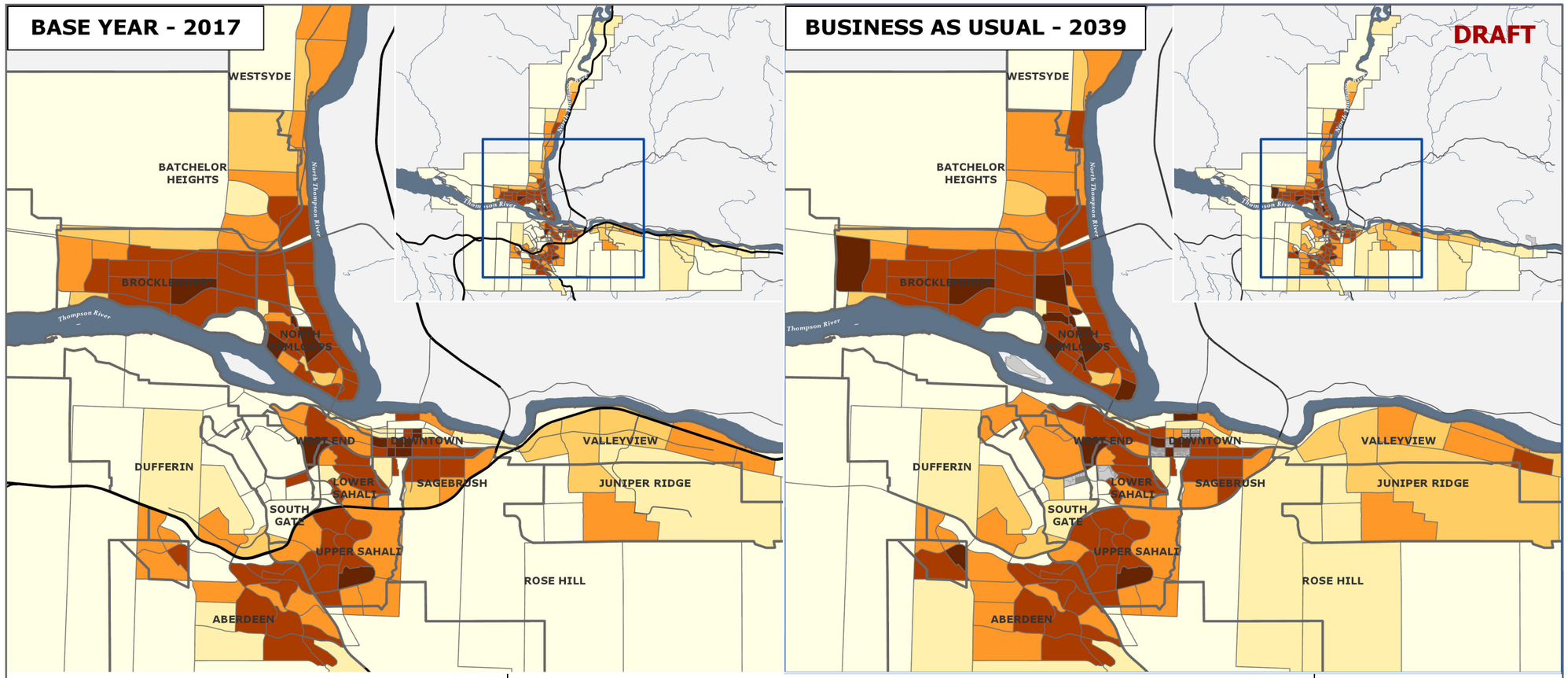
Table 1 Business As Usual Housing and Job Assumptions

Business As Usual Growth By OCP Area	New Housing Distribution	Housing Form	New Job Distribution
Core	22%	V. High Multi- Family (Med-High Density)	25%
Northeast Sector	0%	Single Detached Only	0%
Northwest Sector	19%	V. High Multi-Family	11%
Southeast Sector	19%	High Single Detached, High Multi-Family	14%
Southwest Sector	41%	V High Single Detached, V High Multi-Family due to development at TRU and along McGill Street.	49%

KEY LAND USE AND DEVELOPMENT INDICATORS

- Primary land use indicators influencing building and transportation emissions:
  - Centred population and employment hubs and nodes (low GHG communities are characterized by major employment opportunities focussed in big hubs with high residential concentration, and other residents and service jobs are focussed in nodes and along corridors);
  - Population and employment density (moderate density can more than offset growth in transportation emissions, and may enable district energy);
  - Neighbourhood land use mix (greater diversity – residential/commercial/institutional/parks – increases proximate destinations, reducing driving distances and increasing walking and cycling opportunities); and
  - Building types and floor areas (shared walls, i.e. multi-family, and smaller floor area reduce building energy demand).
- Improving performance on these indicators can reduce GHGs and/or energy use.
- See “Community Energy and Emission Indicators” section for detailed current and BAU performance.

Figure 5 Average Population Density by Area



POPULATION DENSITY
(PERSONS PER HECTARE)

- 0 - 1
- 2 - 5
- 6 - 10
- 11 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100

- HIGHWAY
- ROAD
- WATERCOURSE
- WATERBODY
- PARK
- NEIGHBOURHOOD

NOTES AND DISCLAIMERS

POPULATION FORECASTS FROM CITY OF KAMLOOPS OCP ALLOCATED AT A TRAFFIC ANALYSIS ZONE LEVEL. FORECASTS ARE CONGRUENT WITH THE TRANPSPORTATION MASTER PLAN.

REFERENCES

TAZ AND POPULATION DATA FROM CITY OF KAMLOOPS.
BASE INFORMATION SOURCED FROM CITY OF KAMLOOPS 2018.

CALCULATIONS

POPULATION CHANGE 2017 to 2039			
NEIGHBOURHOOD		NEIGHBOURHOOD	
ABERDEEN	74%	NOBLE CREEK	8%
BARNHARTVALE	7%	NORTH KAMLOOPS	21%
BATCHELOR HEIGHTS	33%	PINEVIEW	19%
BROCKLEHURST	23%	RAYLEIGH	4%
CAMPBELL CREEK	22%	ROSE HILL	> 100%
DALLAS	33%	SAGEBRUSH	11%
DOWNTOWN	37%	SOUTHGATE	> 100%
DUFFERIN	68%	TRANQUILLE	6%
HEFFLEY CREEK	4%	TRU	> 100%
IRON MASK	26%	UPPER SAHALI	10%
JUNIPER RIDGE	51%	VALLEYVIEW	54%
KNUTSFORD	51%	WEST END	16%
LOWER SAHALI	40%	WESTSYDE	18%
MISSION FLATS	> 100%		

0 1 2 3 4
Kilometers

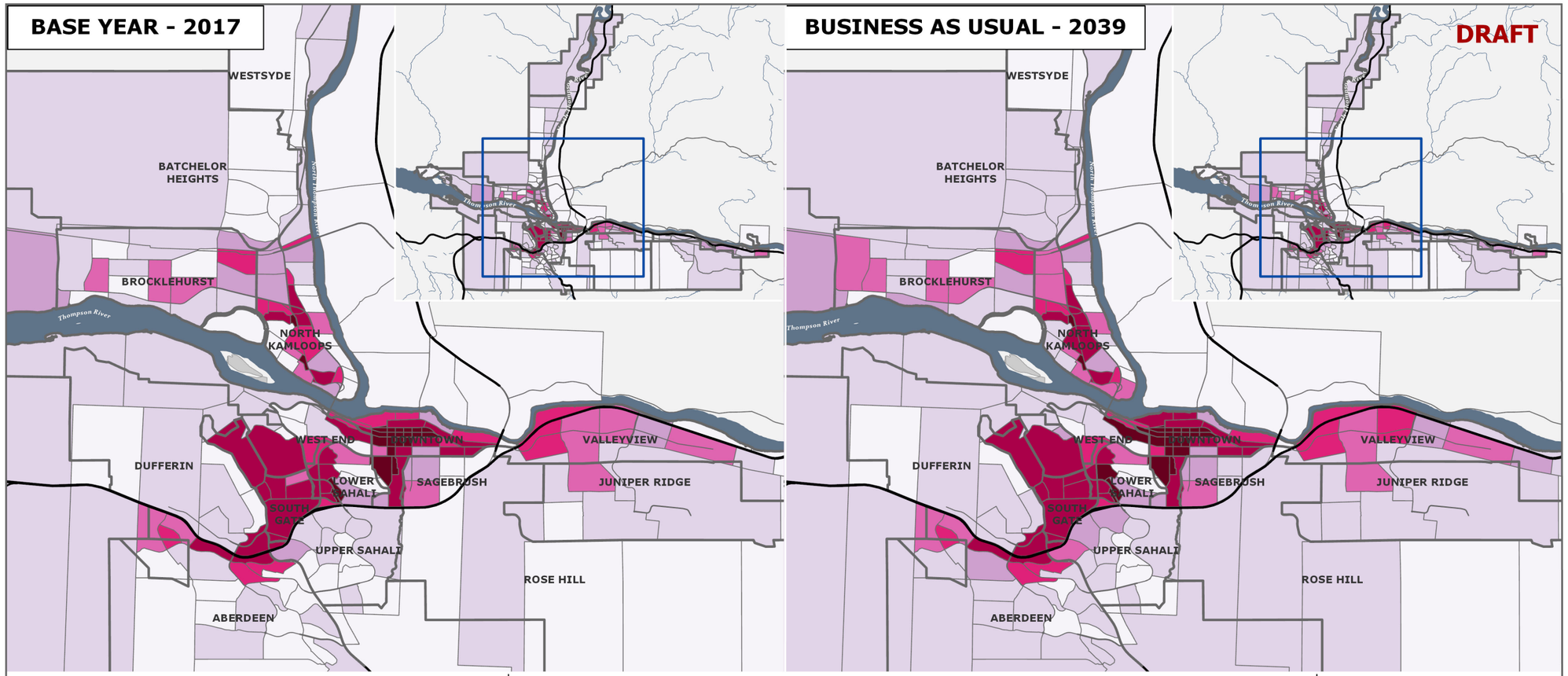
PROJECT
KAMLOOPS
CLIMATE ACTION PLAN

DATE
2019-01-09

Boston Consulting

Kamloops
Canada's Tournament Capital

Figure 6 Average Job Density by Area



COMMERCIAL DENSITY (JOBS PER HECTARE)

- 0
- 1 - 2
- 3 - 5
- 6 - 10
- 11 - 20
- 21 - 50
- > 50
- NO RESIDENTIAL HOUSEHOLDS

- HIGHWAY
- ROAD
- WATERCOURSE
- WATERBODY
- PARK
- NEIGHBOURHOOD

NOTES AND DISCLAIMERS

FLOOR SPACE FORECAST AS PROVIDED BY CITY OF KAMLOOPS AND DERIVED FROM GENERALLY ACCEPTED JOBS TO FLOOR SPACE MULTIPLIERS.

REFERENCES

TAZ AND POPULATION DATA FROM CITY OF KAMLOOPS.
EMPLOYMENT DATA FROM CENSUS.
BASE INFORMATION SOURCED FROM CITY OF KAMLOOPS 2018.

CALCULATIONS

JOB DENSITY CHANGE 2017 to 2039

NEIGHBOURHOOD		NEIGHBOURHOOD	
ABERDEEN	46%	NOBLE CREEK	21%
BARNHARTVALE	30%	NORTH KAMLOOPS	26%
BATCHELOR HEIGHTS	> 100%	PINEVIEW	> 100%
BROCKLEHURST	34%	RAYLEIGH	11%
CAMPBELL CREEK	7%	ROSE HILL	0%
DALLAS	238%	SAGEBRUSH	9%
DOWNTOWN	6%	SOUTHGATE	8%
DUFFERIN	21%	TRANQUILLE	0%
HEFFLEY CREEK	17%	TRU	17%
IRON MASK	142%	UPPER SAHALI	46%
JUNIPER RIDGE	161%	VALLEYVIEW	15%
KNUTSFORD	No Change	WEST END	77%
LOWER SAHALI	24%	WESTSYDE	44%
MISSION FLATS	133%		

0 1 2 3 4
Kilometers

PROJECT
KAMLOOPS
CLIMATE ACTION PLAN

DATE
2019-01-09

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Canada's Tournament Capital

LAND USE SECTOR HIGHLIGHTS

- An important factor restraining Kamloops' emissions growth with its current land use approach is low population and job growth rate (~0.5% per annum). Efficiency and low carbon fuel switching in buildings and transportation is allowing a gradual decarbonization of the community, even with some additional homes, businesses and cars.

- **Population and job growth can either contribute to emission reductions or emissions growth depending on its form.** Urban form determines some inherent building efficiency fundamentals, travel distances, walking and cycling propensity, and public transit viability.

    - High focused, mixed-use growth can support deep, community-wide emission reductions.

    - Widely distributed residential growth with or without commercial growth, but in separate areas, can drive emission growth.

    - Kamloops' modestly higher than average per capita GHGs relative to other communities is influenced by its distributed urban form, requiring longer driving distances.

- **The further neighbourhoods are from downtown Kamloops, generally the lower the walkability**. Downtown has the highest walkability. Five land use variables strongly influence neighbourhood walkability: residential density, job density, land use mix, intersection density and pedestrian network quality and completeness.

    - The neighbourhoods of Westsyde, Brocklehurst and Valleyview have moderate walkability scores, due to the commercial corridors along arterials.

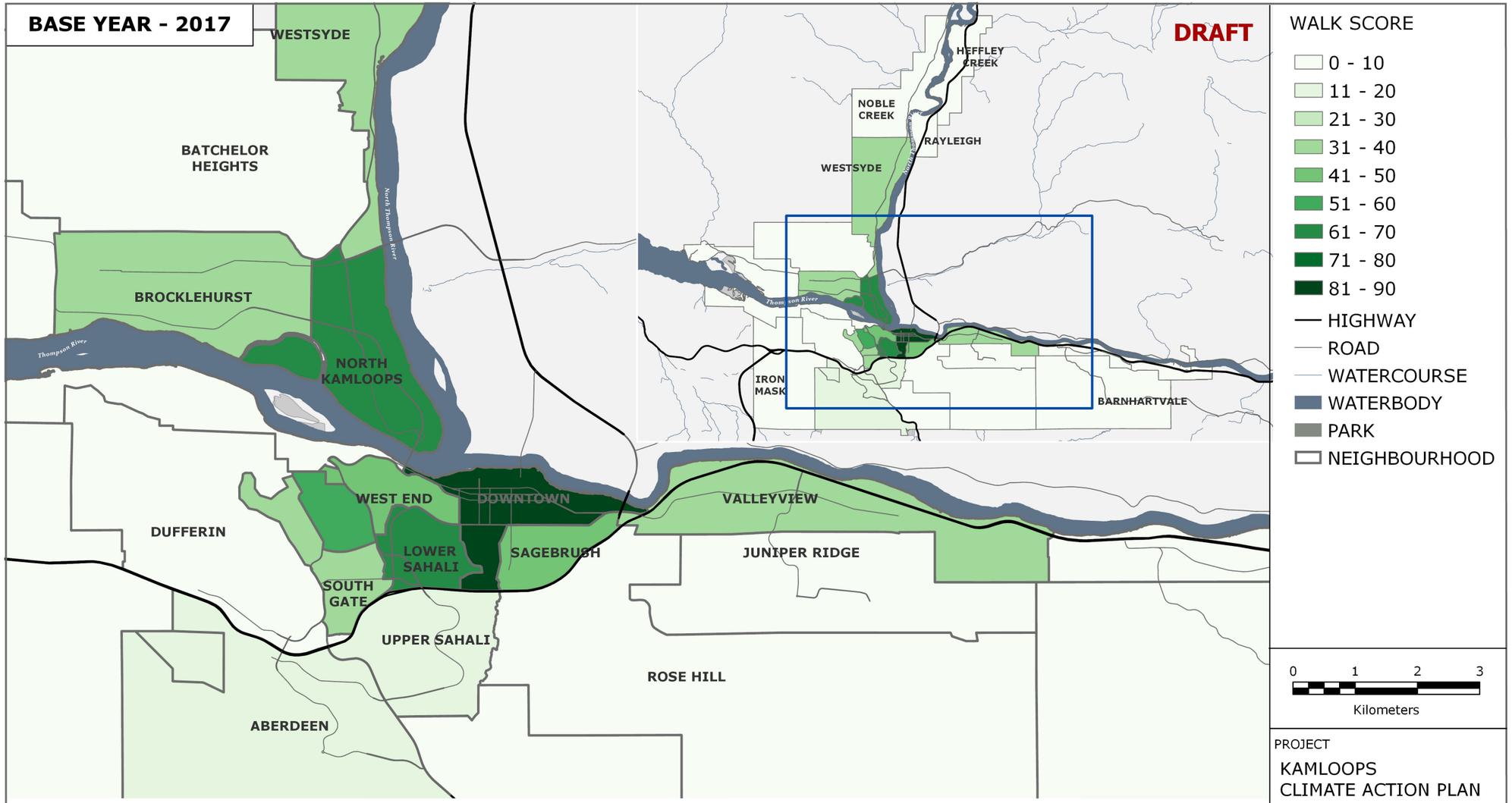
    - The more recent and rapidly developing neighbourhoods of Aberdeen, Juniper Ridge and Batchelor Heights have very low walkability scores due to the absence of local destinations.

AUTHORITY + INFLUENCE

- Local government's area of greatest authority is around land use and development planning. This authority has significant influence over building and transportation emissions.

- The City of Kamloops has considerable influence over all of the "key land use and development indicators" that influence building and transportation emissions (listed above).

Figure 7 Kamloops Walkability



PROJECT

KAMLOOPS
CLIMATE ACTION PLAN

DATE

2018-01-10

Boston Consulting

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Canada's Tournament Capital

NOTES AND DISCLAIMERS

WALK SCORES OBTAINED FROM WALKSCORE.COM SCORES ARE CALCULATED BASED ON AMENITIES AWARDED POINTS BASED ON PROXIMITY (HIGHEST WITHIN A 5 MINUTE WALKING DISTANCE AND DECREASING WITH DISTANCE).
THESE RESULTS REPRESENT AVERAGE SCORES FOR AN ENTIRE NEIGHBOURHOOD. THERE MAY BE AREAS IN SOME NEIGHBOURHOODS WHERE SCORES COULD BE HIGHER OR LOWER THAN THESE AVERAGE WALK SCORES.

CALCULATIONS

AVERAGE WALK SCORE							
NEIGHBOURHOOD	WALK SCORE	NEIGHBOURHOOD	WALK SCORE	NEIGHBOURHOOD	WALK SCORE	NEIGHBOURHOOD	WALK SCORE
ABERDEEN	15	HEFFLEY CREEK	0	PINEVIEW	16	VALLEYVIEW	37
BARNHARTVALE	0	IRON MASK	10	RAYLEIGH	7	WEST END	42
BATCHELOR HEIGHTS	3	JUNIPER RIDGE	7	ROSE HILL	0	WESTSYDE	34
BROCKLEHURST	33	KNUTSFORD	0	SAGEBRUSH	45		
CAMPBELL CREEK	6	LOWER SAHALI	67	SOUTHGATE	40		
DALLAS	6	MISSION FLATS	0	TRANQUILLE	0		
DOWNTOWN	84	NOBLE CREEK	0	TRU	52		
DUFFERIN	9	NORTH KAMLOOPS	69	UPPER SAHALI	16		

REFERENCES

WALK SCORE (2019). Walkscore Methodology. Retrieved from https://www.walkscore.com/methodology.shtml

LOCAL COMPLEMENTARY POLICIES + PLANS

- An Official Community Plan is a municipality's central planning agenda. While it is land use-oriented, it addresses many other sectors, as discussed above, under "Cross Sectoral Synopsis."
- The current neighbourhood plans influence transportation energy and emissions in many of the same ways as the OCP, but in more detail. The City of Kamloops intends to focus planning on these more targeted areas, including the North Shore. Neighbourhood plans exist for most of the city that are 10 to 25 years old.
- Aberdeen (2008) and Juniper Ridge (2007) have the most recent neighbourhood plans and will continue to be areas of most significant residential growth with higher emission intensity due to the limited land use mix and single-family orientation.
- The City is currently developing a Downtown Plan. As the traditional city centre, land use downtown influences neighbourhood and community wide transportation modes and travel distances through its land use mix, focus of growth, urban design, and transportation networks.
- The North Shore is expected to be the next neighbourhood planning area. There is significant opportunity to increase active transportation and improvements to multi-family. This area also includes a high number of existing multi-family units.

NOTES

Challenges

- Limited housing diversity and micro commercial activity at urban edge.
- Growth far from commercial areas.
- Physical barriers of rails, rivers, freeways, steep slopes.

Opportunities

- Sustaining the transition to multi-family housing, proximate to services and transit supports GHG management and demographic change, specifically plummeting household size (i.e. in terms of persons per dwelling) and an aging population.
- Modest mixed-use intensification – micro markets – in strategic locations.
- Gentle intensification in existing general urban areas close to commercial zones with secondary suites, attached accessory dwelling units, laneway housing, providing more affordable housing for smaller households.
- Renewing older neighbourhood plans.
- Focussed growth Downtown and North Kamloops.
- Grassland and farmland protection.
- Urban tree replanting to respond to mountain pine beetle kill (Currently, addressed in the 2016 Urban Forest Management Plan, overall tree canopy target of 20%.)

3.3 BUILDINGS SYNOPSIS

BUSINESS AS USUAL ASSUMPTIONS

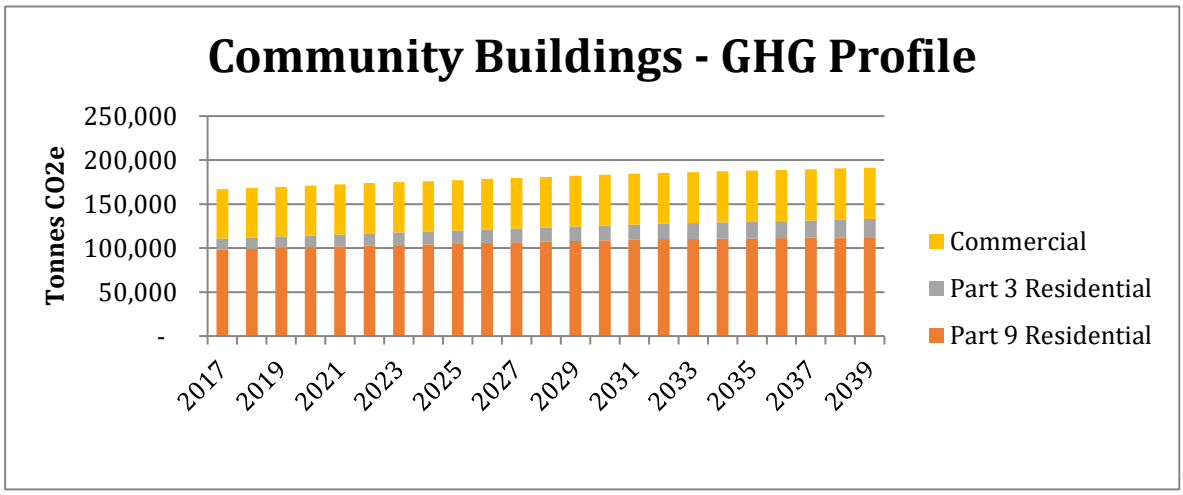
- The BAU scenario for buildings is based on the following key assumptions:
  - Current size and modest growth rate for single detached homes will continue, with modestly higher growth rates for multi-family. Replacement/teardown rates for single-family homes will continue at their current low pace[5].
  - Efficiency of new buildings will continue to improve through 2032, based on projected code updates outlined in the latest BC climate plan.
  - BC Hydro's emissions factor will remain at 2017 levels.

BUILDING ENERGY + EMISSIONS SNAPSHOT + OUTLOOK

- **Buildings make up 30% of emissions in Kamloops**, with residential buildings accounting for approximately two-thirds of these emissions. Note this total does not include energy or resulting emissions from industrial buildings which are not covered in the scope of this document.

- **Building energy consumption per capita is consistent** with similar communities in the region. Although Kamloops has somewhat higher natural gas usage and lower electricity usage than both Kelowna and the TNRD average, overall residential consumption is about the same. This higher gas consumption does result in higher emissions per capita, about 12% higher than Kelowna and 20% higher than the TNRD average. The higher use of natural gas is likely due to gas infrastructure and availability rather than any significant differences in energy consumption.

Figure 8 Business As Usual GHG Emissions from Community Buildings



[6][7]

[5] *Based on a review of current development data. Additionally, given current comparatively low rates of land value appreciation and the fact that most housing stock in the City is less than 40 years old, it is unlikely that the demolition rate will increase substantively in the near-to-medium term.*
[6] *Note, Part 3 Buildings refer to large and complex buildings*
[7] *Note, Part 9 Buildings refer to houses and small buildings*

Figure 9 Business As Usual Energy Profile for Community Buildings

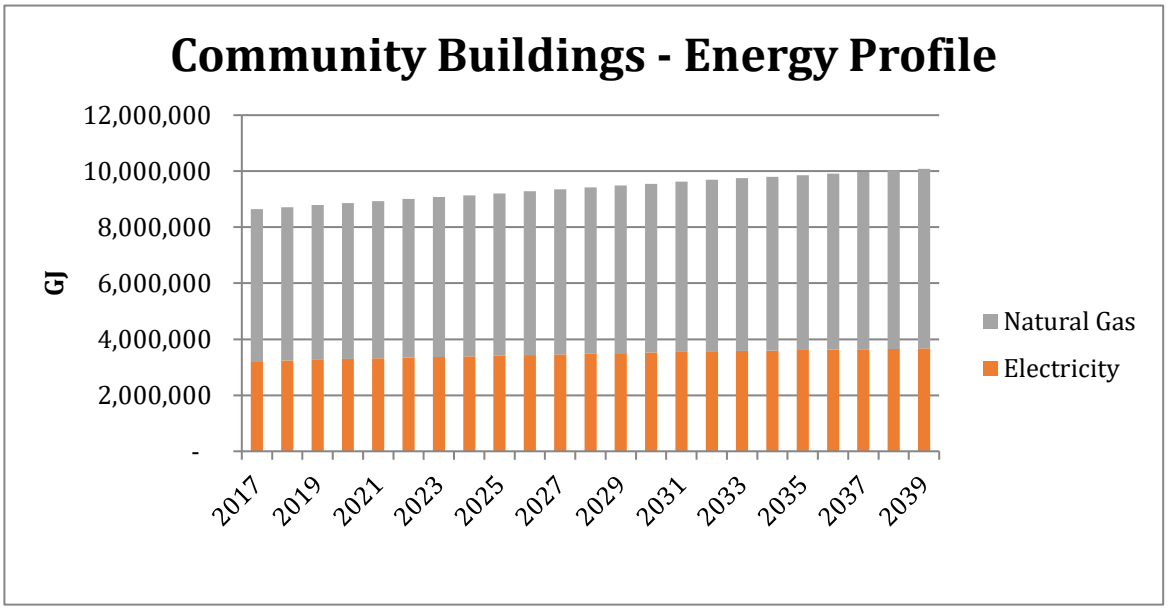
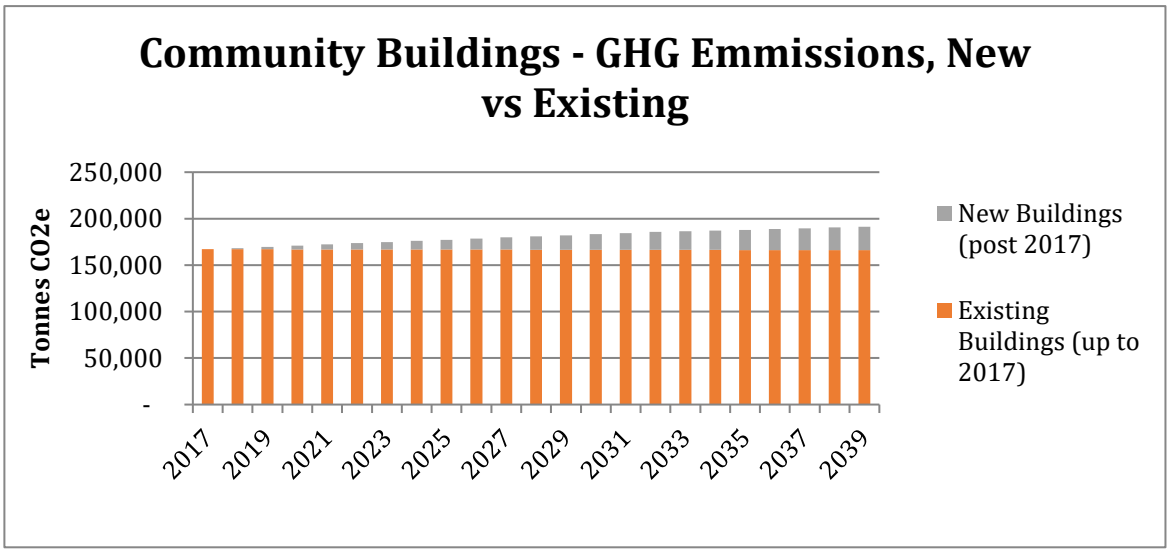


Figure 10 Business As Usual GHG Emissions for New and Existing Buildings



- In the BAU projection**, emissions from buildings are expected to increase 16% by 2039**. This is less than the increase in population, due to increased efficiency standards for new buildings. Total energy consumption will increase by a similar amount. Residential buildings will increase their share of total emissions, due to increasing home size, although average consumption per square meter is expected to decline.

- Existing buildings will continue to produce the majority of GHG emissions well into the future. 85% of emissions in 2039 will come from buildings built prior to 2017.

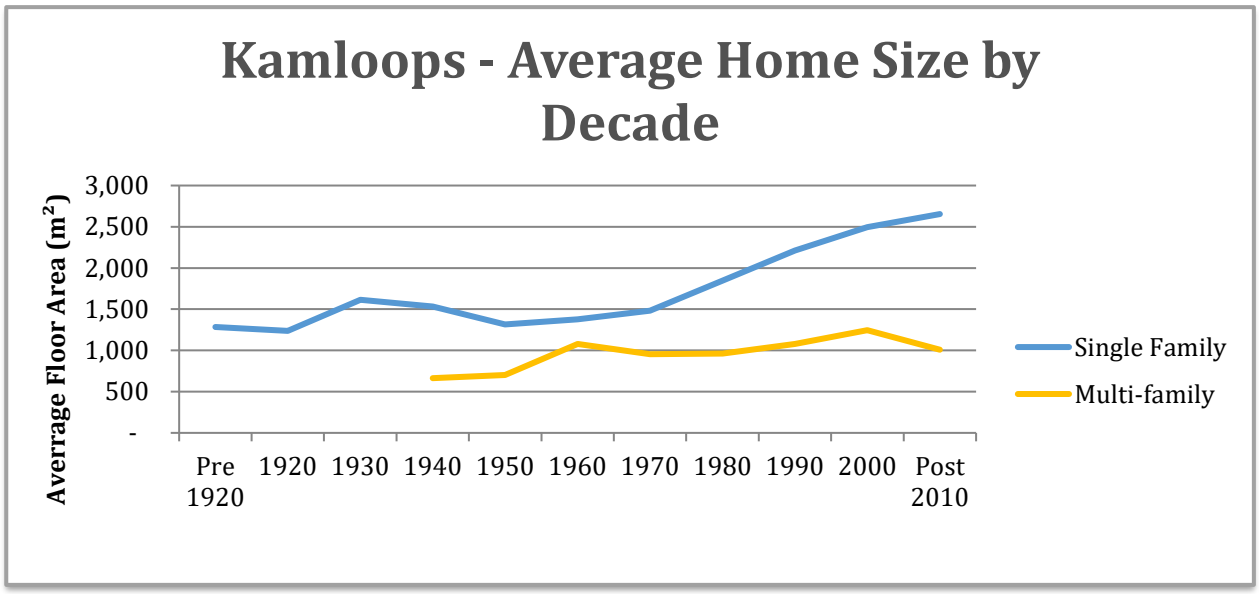
KEY BUILDING INDICATORS

- Primary indicators determining building energy and emission activity are:
  - Building age (generally new buildings are more efficient);
  - Building type (single detached, high rise, retail, office, etc.);
  - Intensity of use (e.g. the type of use and occupancy);
  - Building size (including amenities such as pools and heated sub-surface parking);
  - Thermal performance (influenced by window area, building code/code compliance, and green construction);
  - Lighting and plug loads (notably efficiency and number of large appliances);
  - Heating technology type and efficiency;
  - Energy supply carbon intensity (typically grid electricity, natural gas, and renewables); and
  - Energy retrofit rate of existing buildings.
- Improving performance on these indicators can reduce GHGs and/or energy use.
- Many variables beyond Kamloops influence are not listed, e.g. energy prices and local climate
- See "Community Energy and Emission Indicators" section for detailed current and BAU performance.

BUILDINGS SECTOR HIGHLIGHTS

- **The average new single detached home in Kamloops is 2650 square feet.** That is more than 70% larger than homes built prior to 1976 and approximately consistent with BC trends. Home size is a factor increasing residential energy demand and emissions and single-family homes continue to be a large share of new construction.
- While single detached home size is increasing, family size is shrinking, exponentially increasing energy use and emission intensity per capita. Kamloops has a particularly high share of households with a single person (28%), and couples without children at home (33%).
- **Future energy demand for new homes will be somewhat offset by an increase in the share of multi-family homes.** Multi-family homes are inherently more thermally efficient than single-family homes due to shared walls, and they typically have smaller floor areas.
- **The rate of house demolition is very low, at 0.05% of homes in the City being demolished each year.** This means that older homes are not being replaced by more efficient new homes. Only 22% of homes were built prior to 1976, therefore this low demolition rate is not likely to change.
- **Electricity consumption is predicted to rise more than natural gas consumption.** This is due to building code efficiency gains focused on heating, as well as an increase in the number of condos, which often have electric heat and/or heat pumps.
- Existing buildings (built prior to 2017) will dominate building stock and energy use and emissions well into the future. Even by 2039, new homes will only make up 15% of residential units.

Figure 11 Average Home Size by Decade



AUTHORITY + INFLUENCE

- Authority and influence over building energy and emissions activity involves all levels of government.
- The Province's BC Building Code establishes the basis for building energy performance. The Province has updated the code periodically to support significant energy efficiency gains, including an update in December 2018.
- The Province and Federal Government regulate major energy-using appliances and equipment.
- The carbon intensity of electricity and natural gas is determined by provincial policy and regulation, under which BC Hydro and FortisBC deliver energy services.
- BC Hydro and FortisBC deliver conservation programs for existing buildings and new construction.
    - The Province and Federal Government are only intermittently delivering conservation programs, such as EnergyBC.
- While building energy and emission management is a new area of interest for local governments, they have significant influence over building energy use through land use and development policy:
    - Zoning that determines building type and size, and number of units per parcel, including single family neighbourhoods; and
    - Permitting and inspections strongly influence building performance.

LOCAL COMPLEMENTARY POLICIES + PLANS

- The Official Community Plan can significantly influence building energy demand primarily through zoning, permitting, and area plan policies, and its climate change mitigation content.

NOTES

Challenges

- Kamloops' existing housing stock may not be optimized to accommodate the large and growing share of one and two-person households and seniors.
- Fast moving changes in building science and codes with inadequate capacity building of trades and sub-trades may result in many buildings not being constructed to current efficiency standards. However, additional study is required in this area to confirm this hypothesis.
- While local governments can take some action, the provincial and national policy context must be strengthened to support a high impact building retrofit agenda.
- CleanBC has identified heat pumps as an important solution in new and existing construction for decarbonization. This will only be realized with better incentives and training support.
- Occasional heat pump performance issues in Kamloops may be due to incorrect heat pump selection/installation/setup. Better education/training could be required.
- There is currently only 300 kW of installed solar PV within City limits registered to the net metering program. Likely this is due to lack of financial incentives and long pay-off times which have resulted in low uptake levels despite high sunshine hours in Kamloops.

Opportunities

- Implementation of the Step Code provides an opportunity for the City to support efficiency improvements within an established framework and build *potentially* more durable housing with lower operational costs.
- Strategically implementing the Step Code and facilitating capacity building can help builders and developers prepare for increasingly frequent and demanding code changes
- Interest in aging in place with seniors, young adults and young families are increasing demand for smaller, more affordable homes in mixed-use neighbourhoods.
- Availability of higher efficiency technologies makes it easier and less costly to construct more efficient buildings.
- While note as ideal as the Lower Mainland in BC, a moderate climate with good amounts of sunshine supports technologies such as air-source heat pumps and solar design.
- Thompson Rivers University (TRU) may be a very strategic partner for labour force capacity building to meet higher levels of the Step Code, heat pump design and installation, and other building science and technology knowledge needs.
- Most local governments are in a position to either improve the permitting process for heat pump installations or to work with permitting organizations to streamline activities. This should only be a priority if there are strong capacity building programs for heat pump installation.
- The BC Government is strengthening conservation incentives for new and existing

buildings, as is BC Hydro and FortisBC. These should be actively promoted and potentially supplemented.

- The City is considering allowing more secondary suites and garden suites as permitted use in more urban areas of the city, provided they meet the zoning requirements. This should allow for a greater mix of available housing.

3.4 TRANSPORTATION SYNOPSIS

BUSINESS AS USUAL FUTURE

- The BAU Future is based primarily on the following transportation assumptions:
  - **Streets:** Existing street network is maintained. Connectivity with the provincial highway network is maintained. Streets in new neighbourhoods support local and regional mobility and favour efficient designs as per the Transportation Master Plan.
  - **Transit:** Service is maintained in existing neighbourhoods with improvement in services during frequent use times. Frequent transit system implementation in accordance with the Kamloops Transit Future Plan and Transportation Master Plan.
  - **Active Transportation:** Additional sidewalks and bike routes to improve connectivity and safety and encourage use of sustainable transportation modes as per the Transportation Master Plan.
  - **Vehicle Efficiency:** Vehicle efficiency is determined by committed regulatory improvements up to 2025, and purchasing trends, including electric vehicle take-up rates.

TRANSPORTATION EMISSIONS SNAPSHOT + OUTLOOK

- **Transportation emissions comprise 66% of community wide emissions in 2017**. Personal transportation emissions are modestly above the Thompson-Nicola and Central Okanagan Regional District averages.
- **Transportation emissions are overwhelmingly from personal vehicles** due to low commercial and industrial activity, and, in turn, few commercial registered vehicles.
- Transportation emissions decline 19% by 2039 due to steadily improving provincial efficiency standards and electric vehicle take up, displacing a measurable share of fossil fuels with low carbon electricity.

Figure 12 Business As Usual GHG Emissions Profile for Community Transportation

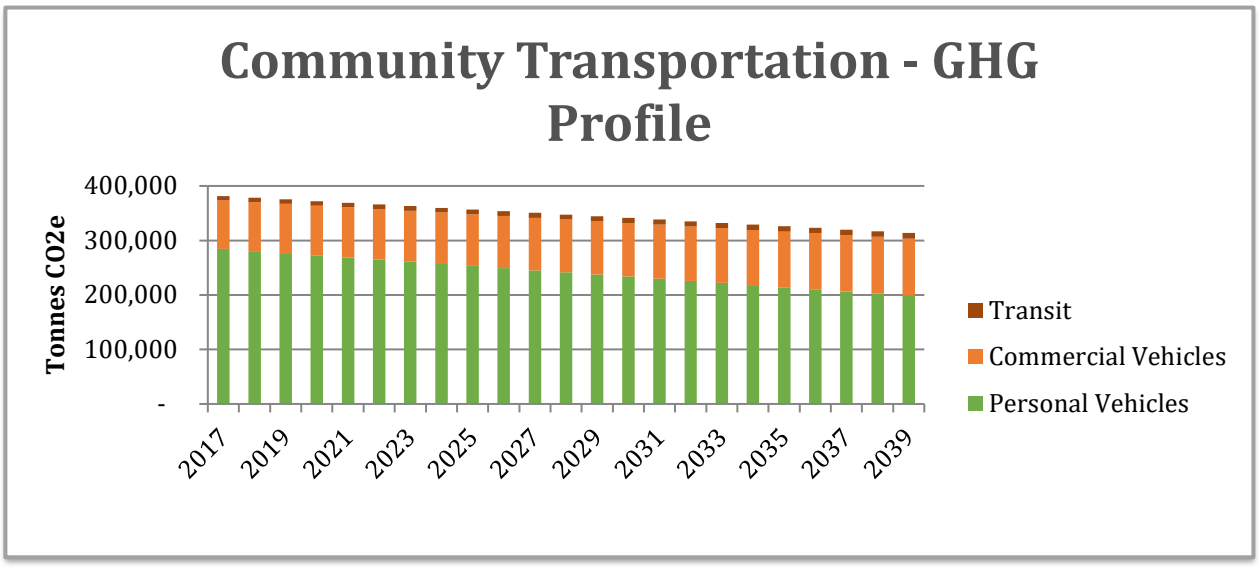
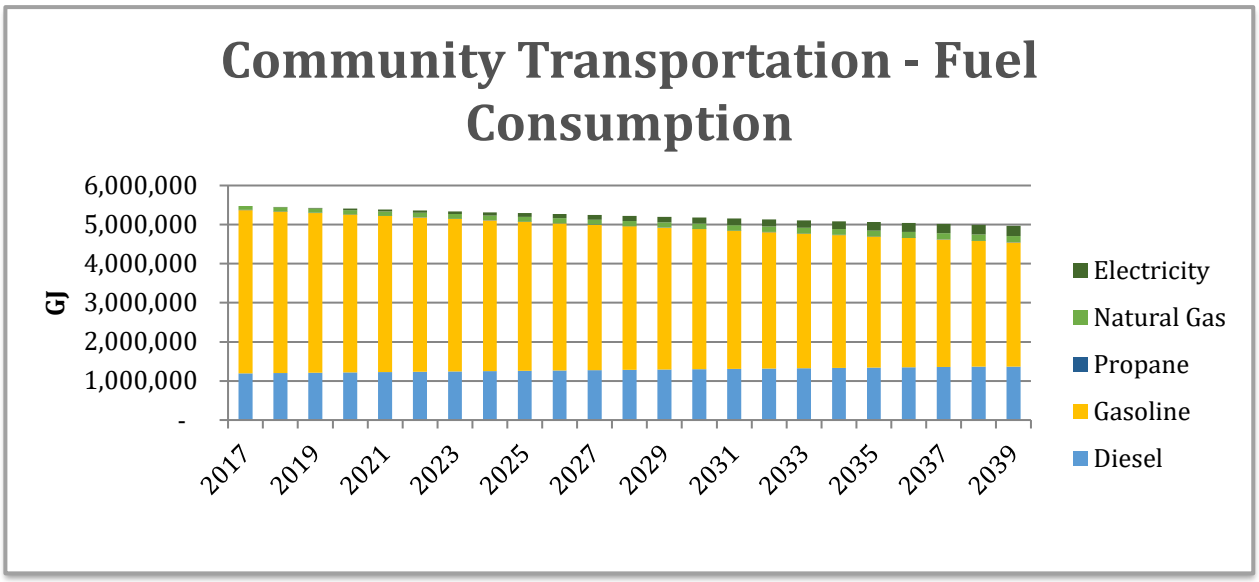


Figure 13 Business As Usual Fuel Consumption for Community Transportation



KEY TRANSPORTATION INDICATORS

- Key indicators influencing transportation energy and emission activity can be categorized in two broad areas:

    1. **Transportation Systems**
        - Road network (type, density, length, connectivity)
        - Walking and cycling network (type, length, density, connectivity, safety, aesthetic)
        - Vehicles (numbers, fuel efficiency and type, distance travelled)

- Transit system (routes, speed, comfort, fuel efficiency and type)
- Transportation demand management (e.g. parking availability, transit stop comfort)

2. **Land Use & Community Design**
    - Land use mix (residential/commercial/institutional)
    - Key destination access (e.g. major grocery stores, retail nodes, downtown core)
    - Residential density
    - Employment density, key centers
    - Topography and development context

- Improving performance on these indicators can reduce GHGs and/or energy use.
- See "Community Energy and Emission Indicators" section for detailed current and BAU performance.

TRANSPORTATION SECTOR HIGHLIGHTS

- The single biggest factors driving emission reductions are automobile efficiency improvements of 40% on average driven by senior government policy, and a displacement of 18% internal combustion engine vehicles by electric vehicles consistent with moderate forecasts (see graph below).
- As well as displacing fossil fuels with low carbon electricity in BC, the average electric vehicle is currently four times more efficient at converting energy to the drive train than an internal combustion engine.
- While transportation emissions decline under the BAU, congestion may increase slightly due to an increase in total community-wide personal driving distances.
    - Average distances travelled by personal vehicle and transit decrease over the BAU future, but the modest increase in the population increases overall driving demand (see graph below).

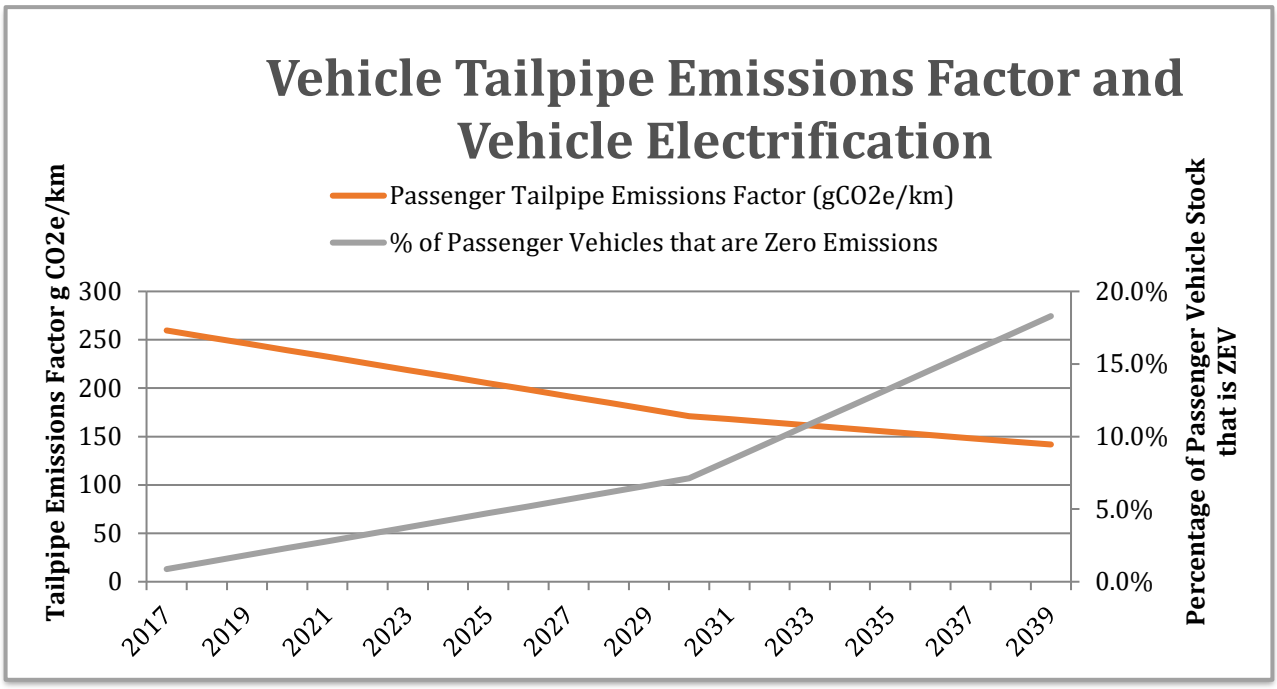
Table 2 Travel Distance by Mode

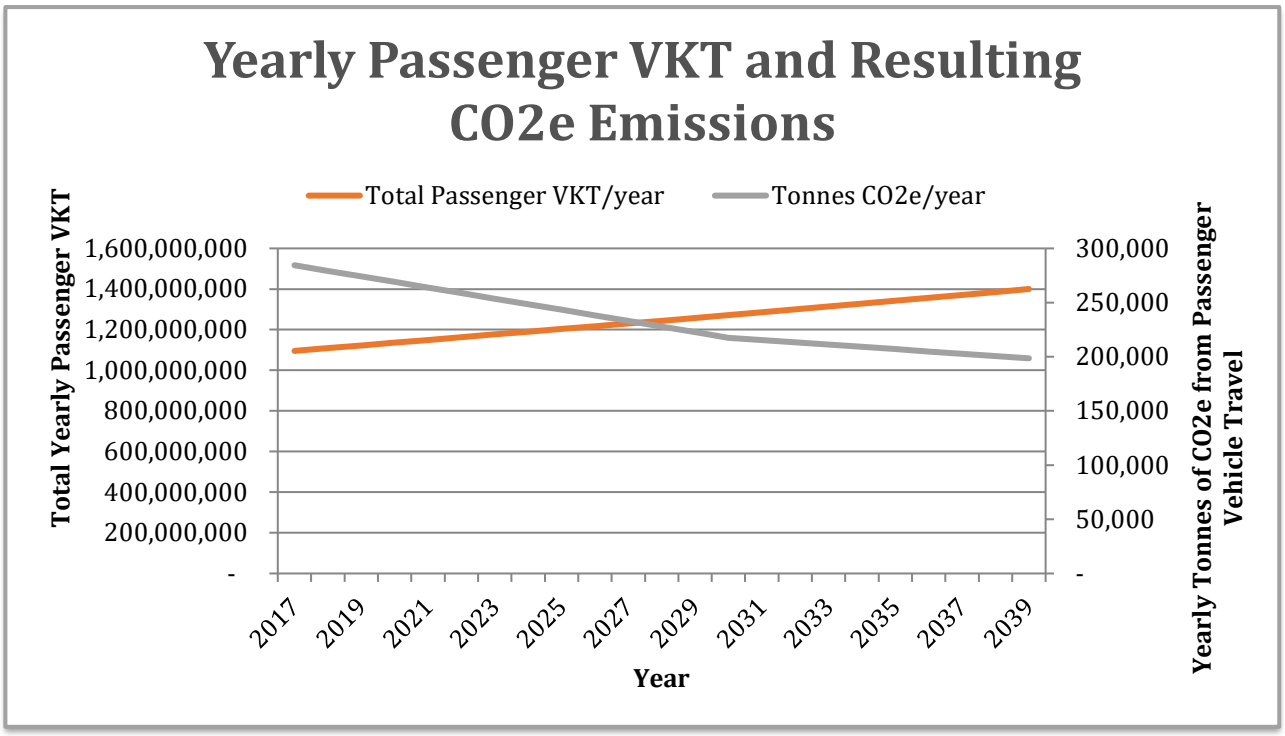
Average Annual Travel Distance By Mode	2017	2039
Total Community Personal Vehicle KM Travelled	1,095,000,000	1,400,000,000
Per Capita Vehicle KM Travelled	12,150	11,662
Vehicle KM Travelled Per Vehicle	14,838	15,163
Total Community Transit Passenger KM Travelled	96,300,000	123,100,000
Per Capita Transit Passenger KM Travelled	1,066	1,023[8]

[8] *Despite a 50% increase in vehicle service hours per household, transit distance traveled remains static in 2039. This is due to a confluence of factors including: increased density in transit served areas, which causes a modal shift to active transportation; increased land use mixing at nodes, which reduces the need for longer transit trips; and greater access to local amenities, which reduces trip length and trip propensity.*

- Personal driving distances slightly higher than the region, personal vehicle mode share is average, and personal transportation emissions are higher suggesting lower efficiency vehicles.
- Lower personal driving distances are correlated with proximity to key employment destinations.
- Work location strongly influences transportation behaviour, including travel distances, mode preferences, and locational shopping preferences.
    - The most common destinations for these workers are Downtown (38%), the Southwest Sector (34%), notably including Southgate (14%), and North Kamloops (8%).
- As the Kamloops population ages, travel behaviour will continue to change with a smaller share of commuting trips beyond the community, and a higher share of local recreational, social, commercial and health trips.

Figure 14 Tailpipe Emissions and Vehicle Electrification and the Relationship Between Passenger Kilometres Travelled and Emissions





AUTHORITY + INFLUENCE

- Authority and influence over transportation energy and emissions activity involves all levels of government.
- The foundation of good transportation planning is good land use and development planning. Local land use is local government's area of paramount authority and covers the continuum from location and type of growth to electric vehicle charging potential in new development.
- Local governments determine most of transportation systems within their boundaries, with the exception of highways and transit (where there is some shared influence).
- The inter-regional nature of a large share of travel makes the same land use and transportation influence of municipal neighbours, within and beyond the TNRD, very important.
- The local significance of neighbouring Tk'emlúps te Secwepemc lands as a key local and regional employment destination, and increasingly interconnected area, makes Tk'emlúps te Secwepemc lands similarly important.
- BC Transit manages and co-plans public transit.
- The Province through the Ministry of Transportation has jurisdiction over some important road and bridge infrastructure and key destinations, notably: Highways 1 and 5. The Province plays a significant role in financing major transportation infrastructure (e.g. roads, bridges, public transit) and establishes the policy context for electric vehicle market transformation.
- The Federal Government, similarly, plays a significant role in financing major transportation infrastructure. The Federal Government plays a role in vehicle efficiency and can facilitate electric vehicle market transformation through regulation and investment.

LOCAL COMPLEMENTARY POLICIES + PLANS

- Kamloops Transportation Master Plan, which contains four strategic goals that are aligned with the OCP that, additionally, directly influence GHG intensity:
    - **Sustainable Transportation –** Create an environmentally, socially, culturally and economically sustainable transportation system.
    - **Walking** – Be a pedestrian-friendly community with networks that integrate with transit, neighbourhood amenities, parks, open space, and schools.
    - **Bicycling** – Provide safe and convenient bicycle routes suitable for commuting, recreating and other daily trips.
    - **Transit** – Foster an efficient, affordable, safe and accessible transit system that is an attractive alternative to the private vehicle and integrates with other transportation modes.
- A stated TMP objective is to reduce transportation-related greenhouse gas emissions.

- Walkability is the one transportation mode over which a municipality has greatest influence through street and pedestrian network design, land use mix, and focus of growth. The current downtown plan is taking advantage of this influence.

- Approved directions from the Official Community Plan can significantly influence transportation energy and emissions through considerations for: transportation networks, parking policies, land use mix, location and intensity of growth, building types, permitting, area plans, and public realm and urban design.

- BC Transit Kamloops Transit Future Plan calls for increased levels of transit service in reasonably well populated areas (which is mirrored in the Transportation Master Plan).

- Downtown Transportation Choices Strategy (or Downtown TDM)

NOTES

Challenges

- Topography, notably steep terrain, is a challenging variable that has to be taken into consideration in active transportation planning.

- There is currently, limited local EV charging infrastructure, which will reduce the impact of EV implementation policy.

- Widely distributed settlement nodes over the last century and amalgamation of many smaller local government over a large urban region. This continues to influence development patterns today.

Opportunities

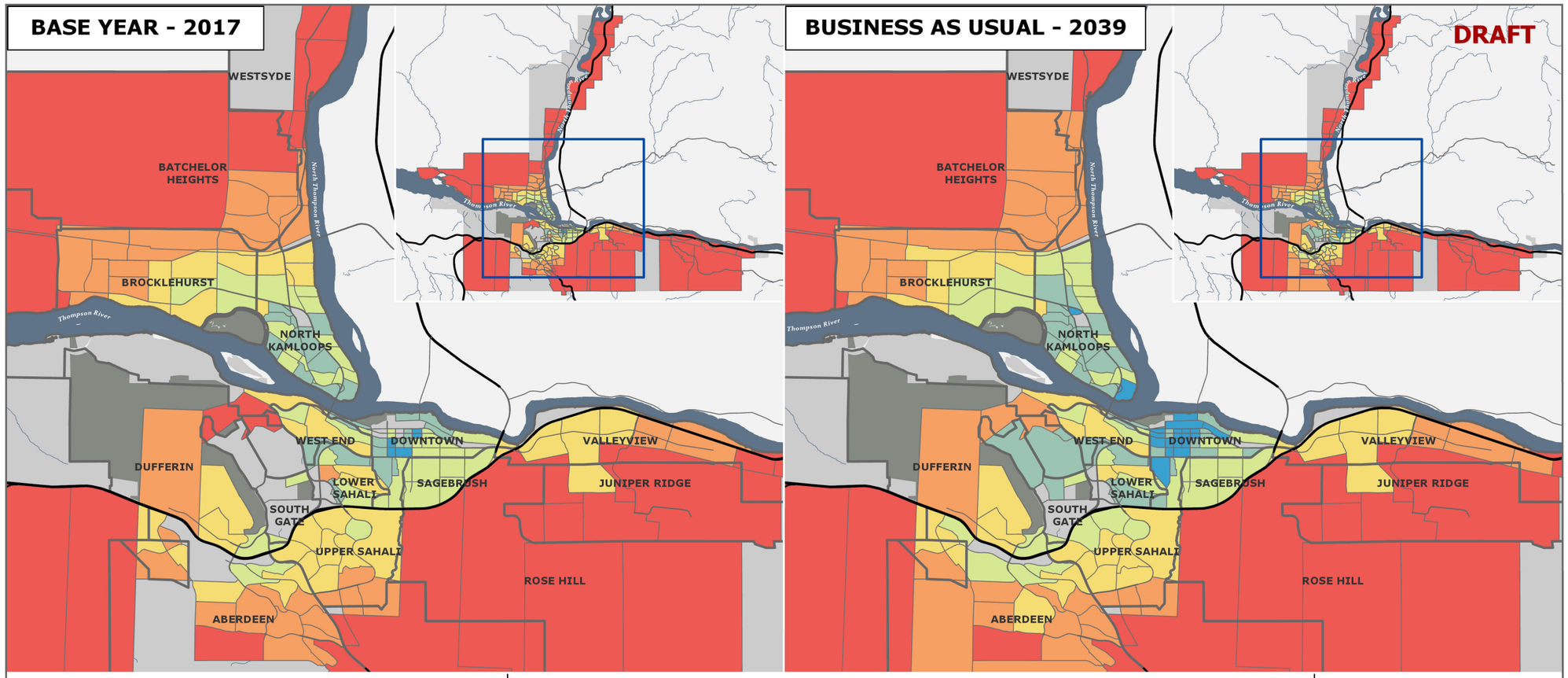
- Kamloops residents highly value their health. Active transportation complements these values.

- There is high utilization of areas with good pedestrian infrastructure and design.

- There is likely a constituency of Kamloops innovators and early adopters interested in electric vehicles. A well-developed EV charging infrastructure network would influence personal EV penetration rates.

- Key performance indicators from the Transportation Master Plan can be effectively leveraged to guide and/or meet the goals this plan.

Figure 15: Annual Distance Driven by Household by Neighbourhood



DISTANCE DRIVEN PER YEAR (KM PER HOUSEHOLD)

- 0 - 15,000
- 15,001 - 20,000
- 20,001 - 25,000
- 25,001 - 30,000
- 30,001 - 35,000
- > 35,000
- NO RESIDENTIAL HOUSEHOLDS

- HIGHWAY
- ROAD
- WATERCOURSE
- WATERBODY
- PARK
- NEIGHBOURHOOD

NOTES AND DISCLAIMERS

VKT PER HOUSEHOLD CALCULATED USING CMHC IBI GREENHOUSE GAS FOR NEIGHBOURHOOD EMISSIONS CALCULATION TOOL. VEHICLES PER HOUSEHOLD AND VKT HAVE BEEN CALIBRATED TO CEEI DATA (2012), KAMLOOPS' TRANSPORTATION PLANS AND STUDIES.

REFERENCES

TAZ AND POPULATION DATA FROM CITY OF KAMLOOPS.
BASE INFORMATION SOURCED FROM CITY OF KAMLOOPS 2018.

CALCULATIONS

	AVERAGE VKT/HH			AVERAGE VKT/HH	
NEIGHBOURHOOD	2017	2039	NEIGHBOURHOOD	2017	2039
ABERDEEN	33,118	30,882	NOBLE CREEK	54,481	N/A
BARNHARTVALE	44,823	41,825	NORTH KAMLOOPS	18,602	17,410
BATCHELOR HEIGHTS	36,822	28,942	PINEVIEW	28,258	27,372
BROCKLEHURST	27,390	25,539	RAYLEIGH	40,232	38,537
CAMPBELL CREEK	44,359	42,513	ROSE HILL	41,317	39,861
DALLAS	40,746	37,999	SAGEBRUSH	21,175	20,218
DOWNTOWN	17,044	13,736	SOUTHGATE	30,054	19,262
DUFFERIN	30,378	28,786	TRANQUILLE	40,064	27,886
HEFFLEY CREEK	47,715	N/A	TRU	38,958	18,022
IRON MASK	45,042	43,135	UPPER SAHALI	25,686	24,519
JUNIPER RIDGE	34,056	33,631	VALLEYVIEW	31,352	29,129
KNUTSFORD	36,682	35,511	WEST END	22,581	21,489
LOWER SAHALI	19,926	18,210	WESTSYDE	42,773	33,578
MISSION FLATS	32,573	28,415			

0 1 2 3 4
Kilometers

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3.5 WASTE & MATERIAL MANAGEMENT SYNOPSIS

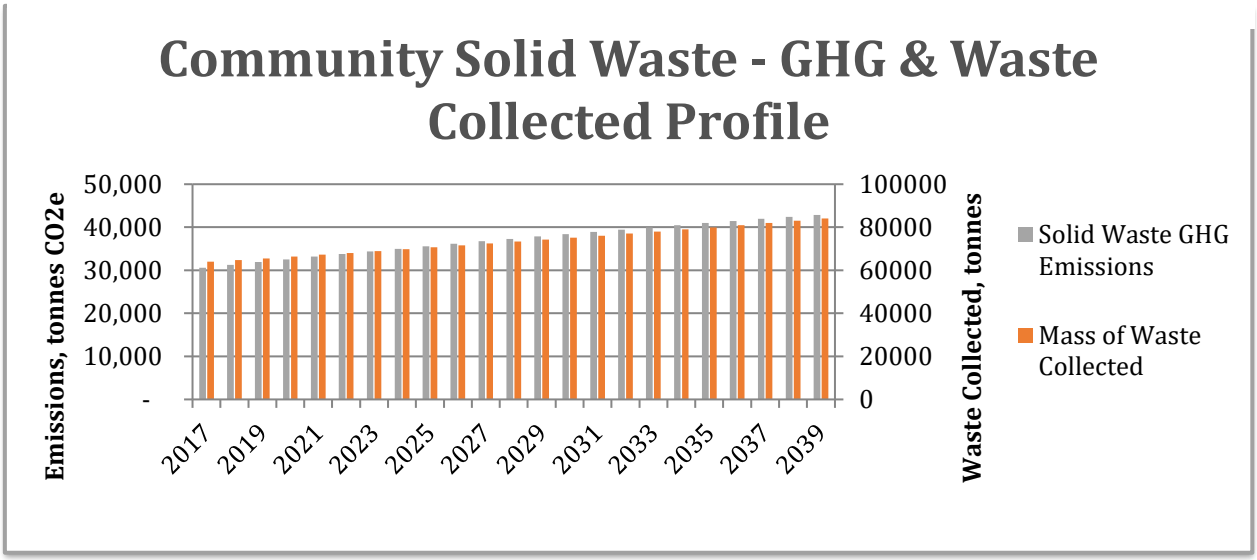
BUSINESS AS USUAL FUTURE

- The BAU Future is based on the following assumptions:
  - Emissions are based on a waste-in-place methodology that reflects long term GHG emissions from landfills as organic waste slowly decomposes in landfills.
  - Per capita waste and materials ("garbage," recyclables and organics) generation is assumed to continue at same rate as currently.
  - Waste composition based on 2011 waste composition study, with adjustments to 2017.
  - Landfill gas collection and flaring maintained at current rate.

WASTE EMISSIONS SNAPSHOT + OUTLOOK

- Waste is the smallest source of emissions at 5% in 2010. The source is the decomposition of organic waste anaerobically in landfills (in the absence of oxygen). It is the only non-energy source of GHGs.
- **Waste emissions increase by 40% by 2039** due to increased waste disposal and sustained emissions from existing waste in the landfill.

Figure 16 Business As Usual Waste Emissions Profile



- From an "inventory" perspective, other emissions associated with waste and materials management are attributed to other sectors and/or other jurisdictions, e.g.:
  - Waste hauling emissions are attributed to the transportation sector;

- Processing recyclables is attributed to the industrial sector or commercial building sector and would only be counted if activity is in Kamloops; and
- Embodied carbon and energy in products consumed by local residents and businesses are attributed to the jurisdiction where they are manufactured.

KEY WASTE INDICATORS

- In contrast to other sectors, waste emissions are not energy-related. **Most waste emissions come from anaerobic decomposition of organic material in landfills,** generating methane, a particularly potent greenhouse gas.
- Major organic sources are food and paper in residential, and commercial/institutional sectors, and wood from demolition, land clearing and construction (while the latter is large, this is excluded from "community" emission inventories).
- The primary indicators determining locally-attributed emissions are:
  - First and foremost, landfilled organic waste, influenced by waste and material management strategies;
  - Paper recycling rates,
  - Food and yard waste diversion rates to composting (or other GHG management systems)
  - Waste wood re-use in construction or energy.
  - Landfill methane management effectiveness.
- Improving performance on these indicators can reduce emissions.
- See "Community Energy and Emission Indicators" section for current and BAU performance on detailed indicators.

WASTE SECTOR HIGHLIGHTS

- The quantity of waste sent to the landfill has been fairly steady since 2006 with recycling and yard waste composting programs offsetting increases due to population growth. **Per capita landfill rates have decreased by 9% over that time.**[9]
- However, the Kamloops landfill rate is 60% higher than in other TNRD communities and 40% higher than the provincial average[10]. As well as residential, this is due to higher commercial and demolition waste volumes.
- Recycling programs have been initiated for residential curbside recycling, centralized yard waste composting, and wood waste diversion. **Waste diversion levels in the TNRD have increased steadily from 21% in 2014, to 29% in 2015 and 36% in 2016.**

AUTHORITY + INFLUENCE

- Authority and influence over waste and material management involves all levels of government, and extends beyond the federal government.
- TNRD regionally drives waste management policy and planning in collaboration with member municipalities, of which Kamloops is the largest.

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[9] *TNRD Solid Waste Management Plan Update – Characterization of Existing System Report, 2017*
[10] *TNRD Solid Waste Management Plan Review – Waste Reduction and Diversion Opportunities, 2017*

- Kamloops has policies and programs that influence collection and facilitate sustainable waste and materials management. Collection services are delivered by Kamloops and the private sector.
- There are, nevertheless, **significant provincial and federal policy implications** such as landfill management, packaging, product design, product stewardship, recycling, and take back programs.

LOCAL COMPLEMENTARY POLICIES + PLANS

- Sustainable Kamloops Plan, 2010
- TNRD Draft Solid Waste Management Plan, 2017
- City of Kamloops Biosolids Management Plan, current

NOTES

Challenges

- BC's re-affirmation of a 75% methane capture rate at landfills may result in stronger enforcement and a need to increase the landfill's current gas capture rate.[11] The low capture rate and cost of a pipeline interconnection to the natural gas distribution network are currently barriers to project development.
- Increasing diversion, notably organics, in multi-family and commercial sub-sectors is challenging in many communities for a variety of reasons, notably in existing buildings: building space limitations, coordinating multiple different players at each pick up, local government influence over private sector haulers.
- A new sewage treatment facility included a methane capture system but no anaerobic digestor, limiting RNG potential from sewage treatment.
- City and Regional District plans for food waste diversion may create

Opportunities

- The CleanBC commitment of 15% renewable gas in the natural gas distribution network and a 95% organic diversion target will likely increase regulatory and fiscal policy to generate RNG from municipal organics, biosolids from wastewater treatment and landfill gas.
- The absence of a comprehensive curbside organic waste diversion and centralized food composting program means Kamloops could leapfrog this management strategy, avoid these costs and potentially generate renewable natural gas, generating revenue to offset waste management. This opportunity is currently linked to the evaluation of a process to co-manage biosolids and food waste through a composting process.
- The landfill/sewage treatment centre area may be an appropriate location for a food/yard waste composting or anaerobic digester to support RNG generation. The latter would require a pipeline interconnection, which would have to be financed externally.
- Building bylaws could be strengthened to accommodate better organic diversion in

[11] *Although the climate does impact the decomposition rate, 30,000 tonnes of GHGs are released annually.*

commercial (notably restaurants and grocery stores) and multi-family.

- Landfill Bio Cover is currently being researched at Mission Flats Landfill as a complement to the existing Landfill Gas management system.

4 LOCAL ENERGY SUPPLY SYNOPSIS

Kamloops is served by BC's two major utilities – BC Hydro and FortisBC. BC Hydro's electrical grid serves all developed areas of the City. FortisBC provides natural gas service throughout the City, although some homes and older neighbourhoods may not be connected to the natural gas grid. Use of propane and heating oil is thought to be minimal.

Energy supply is heavily influenced by provincial policy. All utilities (except municipal utilities) are regulated through the BC Utilities Commission. BC Hydro is a crown corporation and subject to provincial policy. Current provincial/utility policy restricts the sale of generated electricity to BC Hydro, who purchases it through its Net Metering or Standing Offer programs. The design of power purchase programs can significantly influence the type of generation used.

Energy supply opportunities are also heavily influenced by price. The price of electricity and natural gas will influence the cost effectiveness of renewable energy technologies, as will the price paid by utilities to purchase excess energy. Relative costs can be influenced by incentives and grants offered by utilities and senior governments.

In addition to the traditional energy utilities, there are a number of renewable energy opportunities within the City. Renewable energy generated may be used on site in a home or building, used as a heat source for a district heating system, or sold to BC Hydro/FortisBC.

The following is a brief overview of renewable energy resource potential for key technologies and their applicability within Kamloops.

4.1 LOCAL RENEWABLE ENERGY RESOURCE POTENTIAL

LANDFILL/SEWAGE GAS / RENEWABLE NATURAL GAS

Landfill gas is generated at the Mission Flats landfill, of which roughly 10% is captured and flared. There may be potential to capture more of this landfill gas, as well as use it for other purposes. FortisBC has expressed interest in purchasing the gas, purifying it and injecting it into their piped natural gas system where it would be sold as Renewable Natural Gas (RNG). The interest in RNG is likely to grow as the Province has a 15% renewable gas targeted across the provincial distribution network by 2030.

Additionally, the landfill or sewage treatment plant may be an appropriate location for an anaerobic digester to support RNG generation, possibly combined with landfill gas or sewage gas to justify a pipe connection.

If the landfill/sewage gas was sold to FortisBC, it would not necessarily remain within the city to reduce local emissions. The City could arrange to use the gas in its own corporate facilities (essentially buying it back from

Fortis) or promote its use by others in the community, resulting in local use. The most strategic use of RNG is as a fuel for heavy duty, long distance freight which is very difficult to electrify.

Landfill/sewage gas may also be used for other purposes, such as heating buildings and commercial activities. These would need to be located close to the landfill or waste treatment facility to be cost effective. Greenhouses are often identified as a good candidate for such use.

SOLAR

Solar is the fastest growing energy source in the world. Traditionally, most solar in Canada has been thermal, and used to produce hot water. Solar thermal viability is best in situations where low temperature water heating is required, such as swimming pools. Photovoltaics (PV), which are used to produce electricity, have not been common in BC due to the high cost relative to hydroelectric power. But with PV panel prices dropping by 90% over the past two decades, viability may be comparable or better than solar thermal in many cases. If prices continue to drop and electricity costs rise, we may see PV competitive with grid power within the horizon of this plan. The growing demand for electricity, due to its strategic role in decarbonizing transportation, buildings and industry, may result in a better policy environment in BC for small scale and micro (building-scale) renewables.

Kamloops has a favourable climate for solar, with some of the most sunshine in the province. Most areas of the City have good access to solar, with minimal shading from surrounding topography. The level of solar access would have to be assessed on a case by case basis, but there are likely many homes and businesses that would be good candidates for some kind of solar system.

Passive design is another means of utilizing solar energy to provide shelter and comfort by considering local climate conditions and minimizing dependence on energy-consuming mechanical and conventional electrical systems. Passive solar utilizes solar heat gain in the winter to warm the interior of a building, controls solar heat gain in the summer, and facilitates daylighting, natural ventilation, and cooling. Passive solar involves careful consideration of building orientation, glazing, shading, and massing, as well as landscaping.

BIOMASS

Biomass energy can use various types of organic matter to generate heat and/or electricity. Wood is the most commonly used form of biomass, and is used extensively as firewood in homes. Biomass can also include wood waste (such as sawdust or bark), food and green waste, construction waste, agricultural residues, or other sources, and can be used to generate heat or power. Biomass can be considered a mature technology, with many large mills in BC burning wood waste to generate power. However, research continues into alternative sources of biomass and different means of generating energy from biomass.

Although there is little supply of forest biomass within the City, there is a significant amount in the area surrounding Kamloops. Demolition and construction waste generated within the City is another considerable source of biomass. However, while there may be plenty of biomass supply, there are also many players competing for it. These include the pulp and paper industry, pellet mills, OSB plants, district heating systems, and power generators. Biomass energy projects must carefully assess the costs of obtaining a reliable source of biomass.

Biomass combustion will increase local particulate emissions, although large biomass systems can burn very cleanly. Biomass projects may require changes to local bylaws to be permitted.

The CleanBC 15% renewable gas target by 2030 will likely result in RNG generation from biomass syngas processes (vs anerobic digestors used for organic municipal and agricultural waste). These technologies are less mature, more expensive and typically require large scales. If BC is to meet this 15% target, woody biomass will likely be part of the mix.

HEAT PUMP TECHNOLOGIES

Heat pumps are used to extract heat from a variety of low temperature sources. Heat pumps use electricity very efficiently and enable the use of low-grade renewable heat sources. BC's electricity has very low GHGs so heat pumps have immense potential to displace natural gas heating system in new and existing buildings, the dominant source of building GHGs by far.

Major barriers to broadly deploying heat pump technologies are knowledge in the general consumer and commercial/institutional consumer sectors, and knowledge, skills and experience in trades and construction sector where the traditional, go-to heating systems are natural gas fueled.

Air-source Heat Pumps extract heat from outdoor air and are fairly common in BC. The climate in Kamloops is favourable to air-source heat pumps. While their efficiency is not as high as some other heat pump technologies, they are lower in cost, readily available and currently have the widest potential application. They can be used in most homes and some commercial/institutional buildings and can be readily deployed in energy retrofits as well as new construction.

Geo-exchange is the use of heat stored in the ground, using coils of pipe to extract the heat using a transfer fluid. Although not as common as air-source heat pumps, geo-exchange is nevertheless well established in BC, particularly in the interior. Vertical drilling is the most common type of ground field, while horizontal ground fields are less costly but require more space – schools with their playing fields are often good candidates. Geo-exchange is quite site specific and it is hard to generalize about conditions. But geo-exchange systems have been used successfully throughout the BC interior and most areas in Kamloops would likely be good candidates for geo-exchange (currently the community of Sun Rivers on Tk'emlúps land is on geo-exchange). Business case analysis and system design for Kamloops should consider increased ambient temperature and heat waves otherwise these systems may not function effectively for cooling.

Sewer heat recovery. Similar to geo-exchange or ocean energy, heat may be recovered from sewer mains using heat pumps. Sewer mains have an advantage over geo-exchange and ocean energy in that the temperature of the sewage is warmer, increasing viability. On the other hand, flow rates and discharge temperature limits as well as the location of sewer mains can restrict its application. Due to its high cost, sewer heat recovery is only applicable for concentrated thermal loads, e.g. large high rises, ideally several blocks of medium to high rise buildings in a district energy network.

MICRO-HYDRO

Most of BC's power is hydro generated, primarily from large dams. But small-scale hydro is the second largest source of electrical power. Depending on the site, micro-hydro can be competitive with grid electricity, which has led to a boom in micro-hydro generation in the past few years. However, there are no identified creeks with micro-hydro potential within the City or the immediate surrounding area. There may be smaller creeks that could be used for micro-hydro, but they would likely not be economically viable.

WIND

Wind power is another form of renewable energy experiencing rapid growth world-wide, but with little in BC. Wind power requires steady winds and tends to work best in large, open areas (e.g. prairies, ocean off-shore, mountain ridges). There are four commercial wind farms in BC, three in the northeast and one on the tip of Vancouver Island.

The viability of wind power is most parts of Kamloops is low, as its position in the valley shelters it most of the time. Wind speeds average 2.8 m/s at the airport, considered very low for power generation (10 – 20 m/s is ideal). There may be some potential on surrounding ridges and as demand for power rises and the policy context changes, these opportunities may become economical.

4.2 DISTRICT ENERGY

There has been a surge in interest and activity in district energy (DE) systems in BC in the past decade. DE systems have been in place in BC for many years, but almost all have served single user campuses (e.g. hospitals, universities). The one exception was the central steam system in downtown Vancouver. In 2005 Revelstoke opened the first municipally owned DE system in BC, serving the downtown with hot water. Since then new DE systems have been built in Gibsons, North Vancouver, Prince George, Richmond, Surrey, Vancouver, Victoria, and Whistler, with others proposed or underway.

District energy is viewed as a means to provide low carbon heat to buildings that otherwise would be unable or unwilling to use it. Some systems have been built using natural gas as the initial fuel source, with the intent that renewable sources will be switched in the future. Other benefits include lower up-front costs to building owners and the potential of a long-term revenue stream to the municipality. However, DE systems are large, capital intensive projects that require significant expertise and capacity to build and operate.

At this time there are no DE systems proposed for Kamloops, although Thompson Rivers University has been exploring it. To be viable, DE systems need significant density of heating loads within an area. Generally speaking, heating loads of 2500 to 3000 GJ/Ha would be considered a minimum for DE viability, although most systems have much higher loads than this. This translates to floor area ratios (FAR) of at least 1.0 and preferably 2.0 to 3.0. The only area that currently has sufficient density to potentially be viable for district energy is the downtown core. The challenge with the downtown core is that the business case for creating DE systems, largely through retrofits is, more challenging and typically requires several blocks of high rises to make projects viable.

BC's increasingly strong efficiency requirements are also reducing DE viability for new medium density developments that historically had strong business cases.

NOTES

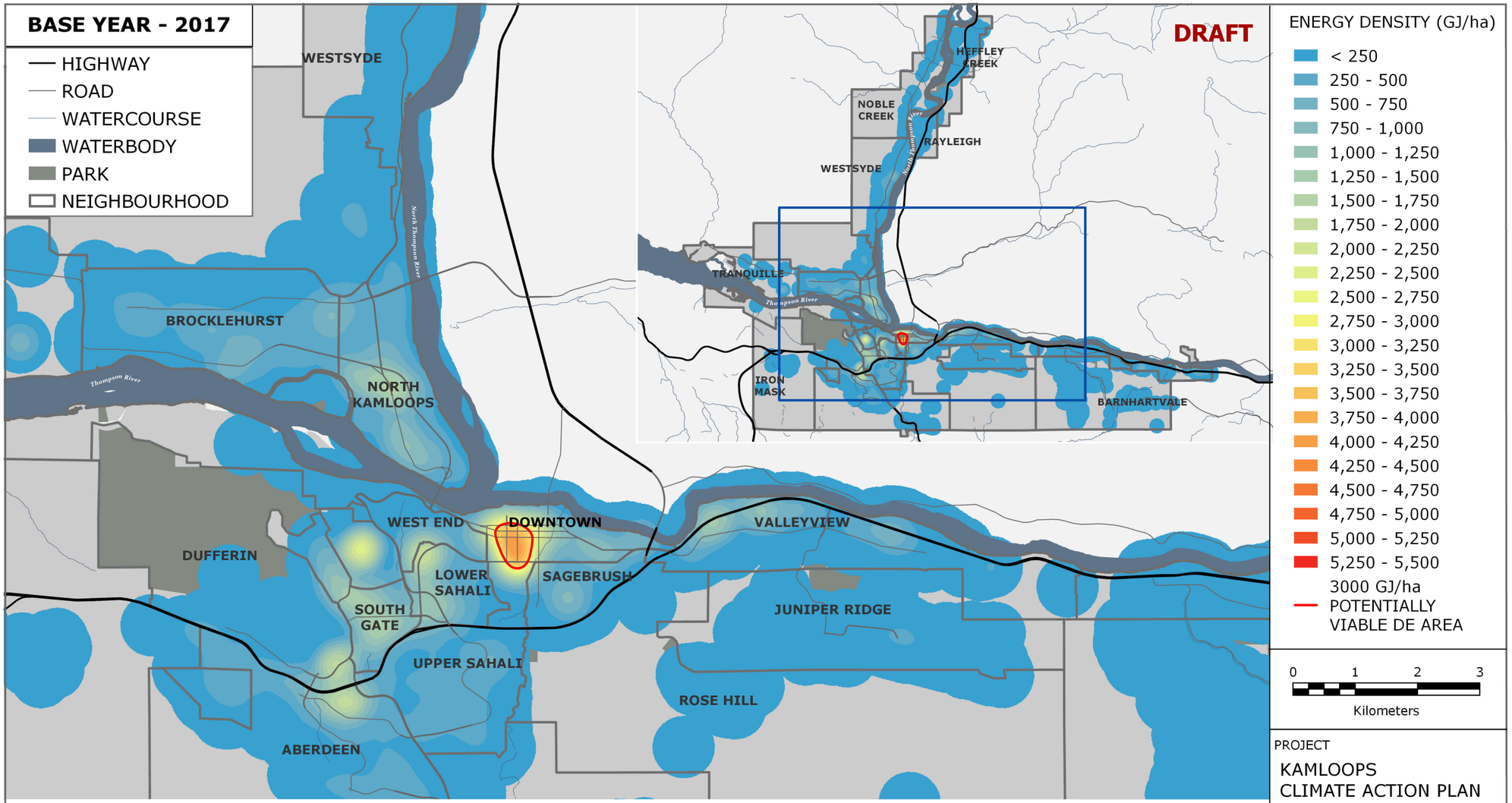
Challenges

- The absence of a fiscal incentive is a barrier for small renewable power projects, notably solar, that could make an important contribution to decarbonizing transportation and industry. These opportunities may emerge over time.
- One of the greatest opportunities for decarbonizing existing and new buildings is heat pumps but there are consumer knowledge barriers, and knowledge and experience barriers for trades and construction companies that defer to traditional natural gas heating systems.

Opportunities

- Some of the biggest renewable energy opportunities are discussed above in the waste sector.
- Incrementally building the capacity of trades and consumer knowledge regarding heat pumps, and potentially promoting and providing incentives monetary or otherwise could increase penetration of heat pumps in new and existing buildings.

Figure 17 Thermal Energy Demand by Area - 2017



NOTES AND DISCLAIMERS

THERMAL ENERGY DEMAND DERIVED FROM ASSUMED HEATING REQUIREMENTS AND AVERAGE ENERGY USE INTENSITIES BY BUILDING TYPE.

CALCULATIONS

AREA OF POTENTIALLY VIABLE DE AREA = 32.5ha

REFERENCES

BUILDING DATA FROM BC ASSESSMENT AND CITY OF KAMLOOPS.
BASE INFORMATION SOURCED FROM CITY OF KAMLOOPS 2018.

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5 KAMLOOPS AND THE INTERIOR CONTEXT

Every jurisdiction has unique characteristics that impact local carbon and energy indicators, making it difficult to directly compare performance, e.g. regional climate, carbon intensity of the grid, proximity to the regional central employment area, era natural gas was introduced. It is, nevertheless, useful to provide some context and reference for Kamloops' carbon and energy profile. In that spirit, Kamloops' averages are contrasted to the Kelowna average, another large city in the Interior.

Table 3 Comparison table between Kamloops and Kelowna

Indicator	Explanatory Notes	Kamloops		Kelowna	Source
Total Tonnes Personal CO_2e Per Capita†	Includes personal transportation, residential buildings, and solid waste.	5.1		4.6	CEEI, 2010
Residential Building Tonnes CO_2e Per Capita†	Kelowna has slightly higher electricity use for heating, partially explaining this difference.	1.2		1.1	CEEI, 2010
Home Building Energy Spending Per Capita	Estimated based on nominal residential electricity and natural gas rates.	$628		$656	CEEI, BCH, FBC
Personal Transportation Tonnes CO_2e Per Capita	This includes personal cars, light trucks, motorhomes and motorcycles, and the jurisdiction's share of public transit.	3.2		3.1	CEEI, 2010
Transportation Modal Split (%) for all trips, Monday to Friday		Car	87%	84%	Census Journey to Work, 2016
		Transit	5%	4%	
		Bike	1%	4%	

			Walk Other	6% 2%	6% 3%	
Avg Vehicle Kilometres Per Capita (VKT)	Total kilometres travelled by passenger vehicle (cars, light trucks, motorcycles) per year.		11.373		11,144	CEEI, 2010
Neighbourhood Walkability on a score of 0 to 10	Average neighbourhood walkability across jurisdiction using multiple indicators.		3.8		4.2	Walk Score
Solid Waste Diversion Rate			35%		43%	TNRD/CORD SWMP's
Location of work	Work location strongly influences transportation behaviour, including modes and distances. (Kelowna has a number of proximate, neighbouring municipalities which likely results in commutes that are not that long despite being outside the municipality.)	-Home-based employment -Different municipality -Own municipality -Own municipality + home-based	6% 11% 81% 87%		12% 24% 66% 78%	Stats Canada, 2016

† These values may differ slightly from the Community Energy and Emissions Profile in the previous sub-sections due to adjustments made to enhance understanding. These values, however, are unadjusted.

6 ENERGY + EMISSION INDICATORS

The following indicators are helpful for several reasons:

- They can enhance understanding of energy and carbon dynamics within and beyond the community, facilitating development of management strategies;
- Performance on many of these indicators will be adjusted to set sectoral and sub-sectoral targets in the final Community Climate Action Plan to guide implementation;
- Benchmarks can guide implementation, and support monitoring and continuous improvement.

Accuracy of base year (2017) performance is generally high, and often from sophisticated, focused research or direct measurement. Future milestone performance is defensible but less accurate due to the number and complexity of variables, and future uncertainties.

Table 4: Detailed Energy and Emission Indicators

Community Wide Activity					
Indicator	Description	2017		2039	Notes
Total Community Wide GHGs	Total tonnes CO_2e of transportation, buildings and waste	579,167		547,922	Model output
Per Capita Tonnes of Community GHGs (CO_2e)	Per resident tonnes of CO_2e of total transportation, buildings and waste	6.27		4.52	Model output
Per Capita Tonnes of Personal GHGs	Per capita tonnes of CO_2e of personal transportation, residential buildings, solid waste	4.70		3.17	Model output

Population and Employment	Population grows .05% per annum Jobs grows .05% per annum	Pop: 90,280 (2016) Jobs: 47,825 (2016)		Pop: 120,317 Jobs: 53,311	Model input[12]
Land Use					
Indicator	Indicator Description	2017		2039	Notes
Households 400 m to Key Transportation Amenities (5 min walk)	Basic Bike Route:	63%		91%	Model input[13]
	Frequent Transit: every 15 mins/7 to 7	N/A		55%	
	Basic Transit:	94%		89%	
Dwelling Units and Employee Density Per Hectare (UPH/EPH)	Core	10.3 / 21.2		13.1 / 23.3	Model input[14]
	Southwest	1.2 / 1.8		1.8 / 2.2	
	Southeast	0.6 / 0.5		0.8 / 0.7	
	Northwest	1.3 / 0.4		1.6 / 0.5	

[12] 2016 values are from the 2016 Census profile for City of Kamloops. 2039 population values are from the OCP. 2039 employment values derived from future commercial floor area.
[13] Derived from BC Assessment and Transportation Master Plan
[14] Sector divisions from OCP, dwellings from BC Assessment, future dwellings based on OCP and projected population growth, current employment from Census and future employment derived from future commercial floor area.

	Northeast	0.5 / 0.1		0.5 / 0.1	
Dwelling Split	Type	Current		Total / New	Model input[7]
	Single Detached	74%		62% / 34%	
	Townhouse, Rowhouse	8%		14% / 28%	
	Low rise apartment (<5 story)	16%		21% / 35%	
	High rise apartment (≥5 story)	2%		3% / 5%	
Avg Size New Single Detached	Square metres (feet)	237 m^2 2555 ft^2		237 m^2 2555 ft^2	Model input[15]
Transportation					
Indicator	Indicator Description	2017		2039	
Total Transportation GHGs	Total tonnes of CO_2e of personal, commercial, transit	381,450		313,687	Model output
Personal Transportation GHGs	Tonnes of CO_2e of personal cars, light trucks, motorhomes and motorcycles, and share of transit.	284,463 3.15/ tCO2e/cap		198,560 1.66 tCO2e/cap	Model output

[15] *BC Assessment*

Total Personal Vehicle KM Travelled	Total Annual Personal Driving Distances (VKT)	1,095,000,000 km		1,400,000,000 km	Model output
Vehicle KM Travelled Per Capita	Per capita personal vehicle KM travelled	12,150 km/cap/year		11,662 km/cap/year	Model output
Total Passenger KM Travelled	Total transit passenger distance travelled	96,300,000 km		123,100,000 km	Model output
Transit KM Travelled Per Capita	Per capita transit passenger KM travelled	1,066 km/cap/year		1,023 km/cap/year	Model output
Mode Share (All Trips, Monday to Sunday)	Drive (including Drive with Passenger share)	87%		% TBD	Model input[16]
	School Bus	1%		% TBD	
	Transit	5%		% TBD	
	Walk	6%		% TBD	
	Bike	1%		% TBD	
Transit Route Network Length	Total One-Way Transit Route kilometres	305 km		369km	Model input[17]

[16] *Census 2016, Journey to Work; 2007 Kamloops Household Travel Survey (School Buses)*
[17] *Transportation Master Plan*

Average Yearly Transit Vehicle Service Hours Per Dwelling	Based on estimated vehicle headway, service day and average vehicle speeds	24.4 yearly vehicle service hours / hh		38.4 yearly vehicle service hours / hh	Model input[10]
Cycling Path Length	Total cycling paths in km, including bike lanes, boulevard separated paths, boulevard shared use path, off street paths	70km		154km	Model input[10]
Arterial Road KM	This excludes highways	1,225 km		1,966 km	Model input[10]
Personal Vehicle Ownership Per Capita	Personal cars, trucks, and motorcycles per capita, excluding commercially registered vehicles	1.81		1.68	Model output
Passenger Vehicle Efficiency	Average fuel consumption of passenger vehicles in litres per 100 kilometres (L/100km)	10.95		6.05	Model output
Personal Electric Vehicle Share	Zero or low emission vehicles share of overall passenger vehicle fleet	<1%		18%	Model Input (estimate from CleanBC)
Buildings					
Indicator	Indicator Description	2017		2039	
Total Building Energy Consumption / GHGs	Energy use (Gigajoules) and tonnes of CO_2e for residential and commercial/institutional buildings.	5,428,358 GJ 167,122 t		6,308,716 GJ 191,361 t	Model output

Per Capita Personal Building Energy Use / GHGs	Per Capita Residential Buildings Gigajoules and tonnes of CO_2e	36.0 GJ/per Capita 1.20 t/per Capita		27.2 GJ/per Capita 1.10 t/per Capita	Model output
Building / Site Scale Renewable Energy	kW of solar PV connected	300 kW		TBD	Would have to collect date, if desired.
Residential Energy Retrofit Rate	Annual retrofit rate for dwellings built by 2007 with ≥10% improvement: for single detached	Negligible		TBD	Would require further research if desired. May be useful to collect in future
Solid Waste					
Indicator	Indicator Description	2017		2039	
Total Waste GHGs	Tonnes of CO2e Direct landfill emissions from all waste per capita	30,595		42,874	Model output
Total Community Waste/ Material Management %	Composting and Recycling	35%		35%	Model input (TNRD)
	Residual (tonnes landfilled)	63,951		84,050	

Total per capita waste and materials landfilled	Per capita tonnes of waste landfilled	0.69		0.69	Model Input (TNRD, estimate)

Table 5 Dwelling and Employment Densities for Kamloops Neighbourhoods and Sectors

Sector	Neighbourhood	Units Per Ha		Employment Per Ha	
		2017	2039	2017	2039
Core	Downtown	10.12	14.70	63.44	67.16
	North Kamloops	10.96	13.46	7.97	10.05
	Sagebrush	7.48	8.27	3.15	3.43
	West End	11.55	13.77	1.69	2.99
Northeast	Rayleigh	1.53	1.53	0.11	0.12
	Heffley Creek	0.17	0.17	0.07	0.08
Northwest	Batchelor Heights	0.56	0.73	0.01	0.06
	Brocklehurst	8.53	10.44	2.34	3.15
	Noble Creek	0.06	0.07	0.01	0.01
	Tranquille	0.01	0.01	0.76	0.76
	Westsyde	1.84	2.19	0.34	0.48
Southeast	Barnhartvale	0.27	0.27	0.00	0.01
	Campbell Creek	0.36	0.43	3.12	3.35
	Dallas	2.39	3.36	0.22	0.74
	Juniper Ridge	1.47	2.48	0.21	0.54
	Rose Hill	0.07	0.16	No Jobs	0.04
	Valleyview	2.31	3.56	4.55	5.24
Southwest	Aberdeen	1.79	3.05	1.08	1.57
	Dufferin	0.67	1.01	1.57	1.91
	Iron Mask	0.01	0.01	0.23	0.56
	Knutsford	0.03	0.03	No Jobs	0.00
	Lower Sahali	8.72	12.64	16.43	20.38
	Mission Flats	0.00	0.00	0.16	0.38
	Pineview	9.20	10.94	0.05	1.18
	Southgate	0.59	2.10	30.75	33.28
	TRU	No Units	9.78	16.91	19.86
	Upper Sahali	8.72	9.46	0.75	1.09

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