

An aerial photograph of the Mountainside Arena, a large building with a flat roof covered in solar panels. The arena is surrounded by green trees and a parking lot. The text "Climate Change Planning Workshop" is overlaid in white on the solar panels.

Climate Change Planning Workshop

Mountainside Arena

April 4, 2019

Business risk

Climate change and the threat to companies

Firms urgently need to rethink how they approach climate risk

U.S. economy will be burned
by climate change, report says

Protecting
environment
'key challenge
of our times'

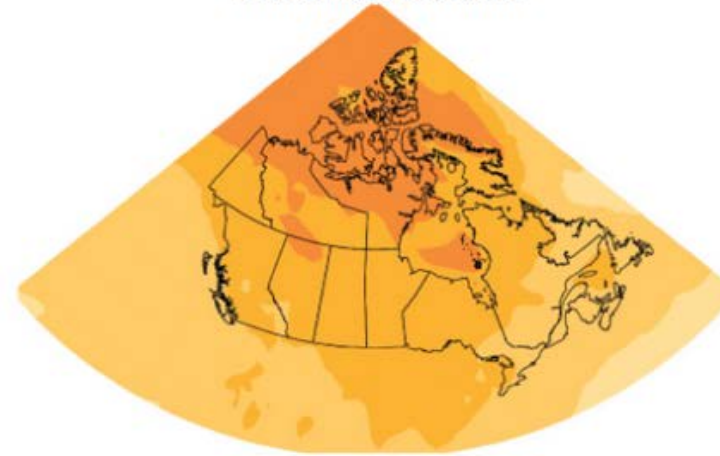
European declaration points to
threats to global peace, stability

Canada not doing enough to fight climate change, federal environment
commissioner warns

Report on
climate
change shows
Canada
warming at
twice the rate
of rest of
world

PROJECTED ANNUAL TEMPERATURE CHANGE FOR CANADA
For late century, 2081-2100

Low-emission scenario



High-emission scenario

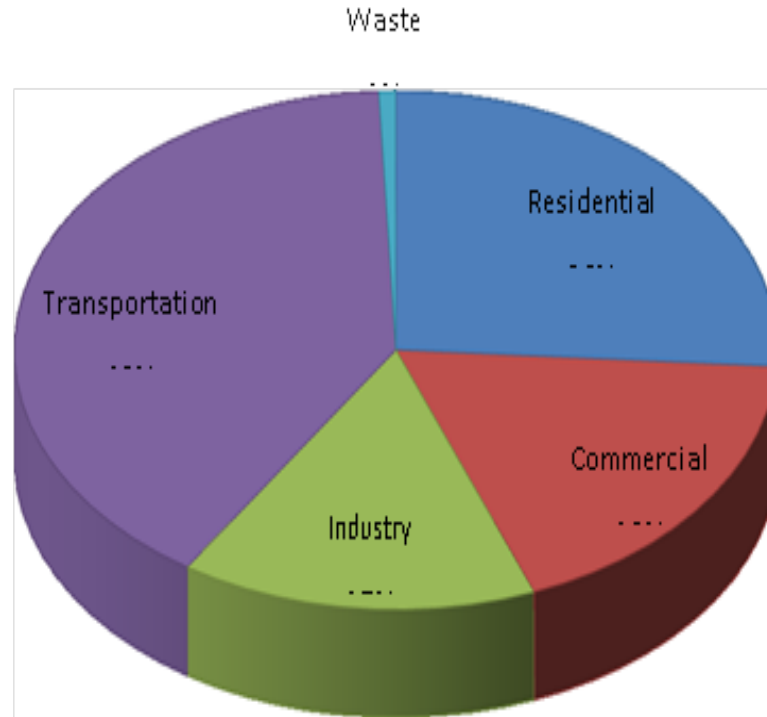




Adaptation

Mitigation – It's about reducing fossil fuels use

Burlington's GHG Emission Sources



Agenda

1:10 pm	Climate Change and Extreme Weather: Not Adapting is Not an Option	Natalia Moudrak
1:55 pm	Understanding the Impacts of Climate Change on Burlington	Fleur Storace-Hogan
2:05 pm	City Actions – Climate Change Mitigation and Adaptation	Cary Clark Steve Robinson Tom Pedlar Jessica Wesolowski Lynn Robichaud
2:55 pm	Coffee Break	Chair Stolte
3:00 pm	Burlington: Getting to Net Carbon Neutral	Dr. Jim Cotton
3:35 pm	Facilitated Discussion	Stephanie Venimore
3:50 pm	Wrap Up and Next Steps	Allan Magi
3:55 pm	Council comments	Chair Stolte

CLIMATE CHANGE AND EXTREME WEATHER: NOT ADAPTING IS NOT AN OPTION



Natalia Moudrak
Director, Intact Centre
nmoudrak@uwaterloo.ca

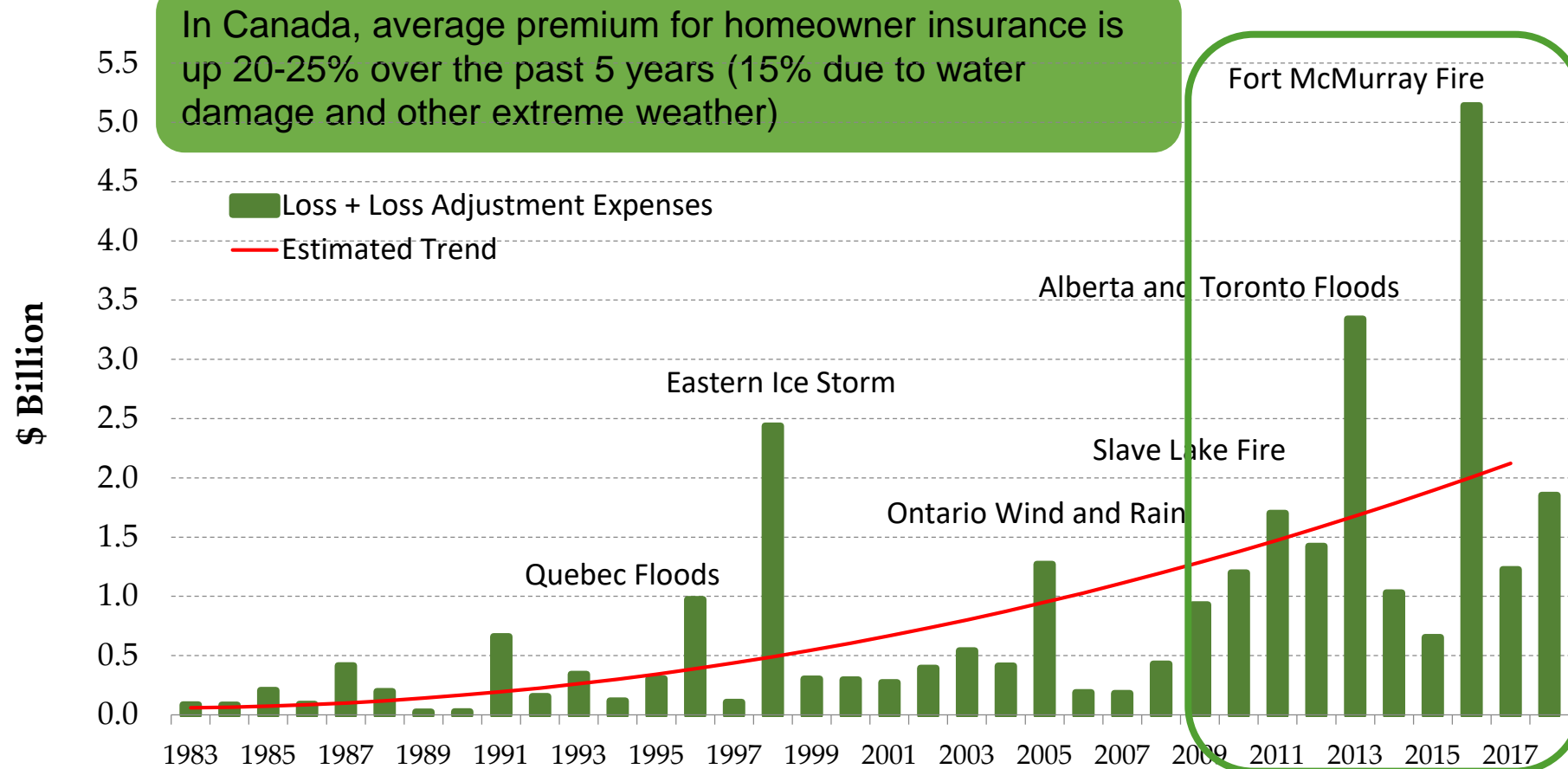
April 4, 2019

1. Climate change: a problem that won't go away
 - Rising costs of extreme weather and flooding
 - Record floods increase risk of mortgage arrears
 - Mental stress and time off work claims
2. Adaptation examples: guidelines, standards and professional training on flood-resilience:
 - Homes
 - New Communities
 - Existing Communities
 - Commercial Real Estate
3. New Areas of Focus: Addressing Fire & Extreme Heat
4. Discussion

COSTS OF EXTREME WEATHER: P&C CATASTROPHIC INSURABLE LOSSES (\$CAD) - CANADA

INTACT CENTRE
ON CLIMATE ADAPTATION

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Loss + Loss Adjustment Expenses

\$2017 - total natural-catastrophe losses normalized by inflation and per-capita wealth accumulation

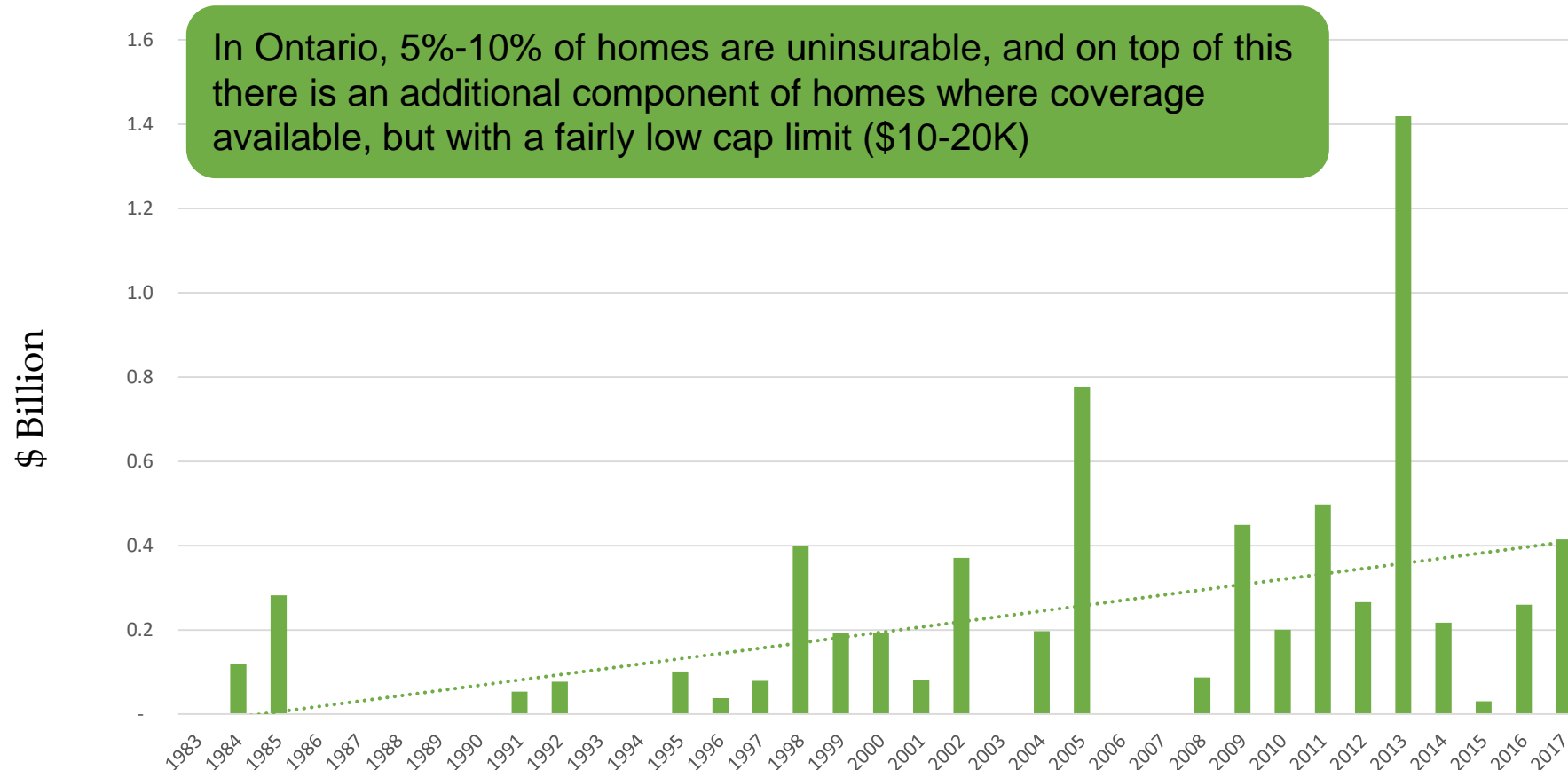
Courtesy: Insurance Bureau of Canada

Note: Cost to government and homeowners 3-4X that of private insurers.

COSTS OF EXTREME WEATHER: P&C CATASTROPHIC INSURABLE LOSSES (\$CAD) - ONTARIO

INTACT CENTRE
ON CLIMATE ADAPTATION

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Loss + Loss Adjustment Expenses

\$2017 - total natural-catastrophe losses normalized by inflation and per-capita wealth accumulation

Courtesy: Insurance Bureau of Canada

Note: Cost to government and homeowners 3-4X that of private insurers.

Historic flooding hits British Columbia after record snowpack starts melting, Canada

Posted by TW on May 14, 2018 in categories [Featured articles](#), [Floods](#)



Southwestern Ontario's worst flooding in decades triggers an emergency, an evacuation and aggravation

Churchill residents reeling from rail closure after unprecedented flooding

By [James Wilt](#) in [News](#), [Energy](#) | June 13th 2017

CANADA

Alberta flooding sets records, prompts calls for action on climate change

Just inches of air left for two men rescued from flooded elevator



London sops up after record rains, historic flooding



THE LONDON FREE PRESS

Published on: February 22, 2018 | Last Updated: February 22, 2018 2:47 PM EST

Worst floods in New Brunswick history: how 2018 compares

Flooding a part of recorded history in the province for more than 300 years



Julia Wright · CBC News · Posted: Apr 30, 2018 5:41 PM AT | Last Updated: April 30

Manitoba floods leads province to declare state of emergency, seek help from military

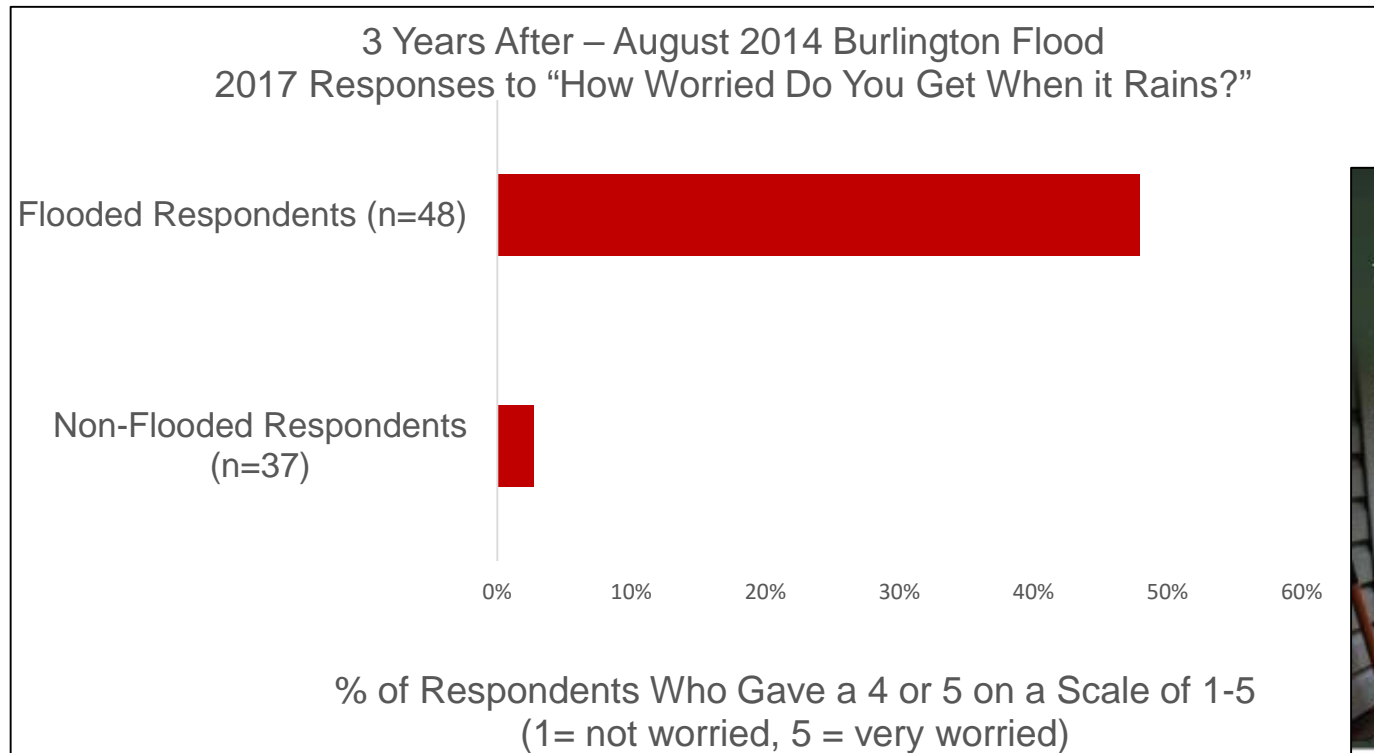
Manitoba is declaring a provincial state of emergency and is asking the Canadian military to help fight a surge in flooding in Saskatchewan.



**REPEATED
FLOODING
ELEVATES
RISK OF
MORTGAGE
ARREARS**

MENTAL HEALTH IMPACTS OF FLOODING

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56% of flooded households had at least one working member taking time off work. **7 days off work** was the average time off work per flooded household (10x the Ontario average).

HOME FLOOD PROTECTION PROGRAM (BURLINGTON PILOT)

INTACT CENTRE
ON CLIMATE ADAPTATION

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- 120 home flood protection program assessments completed (2017/18);
- 79% of Burlington homeowners took at least one action 3 months after completing an assessment to reduce flood risk;
- 71% of Burlington homeowners took an additional action to reduce flood risk 6 months following the assessment;
- The most popular “do it yourself” actions included: extending downspouts, installing window well covers, removing barriers to floor drains and testing sump pumps to make sure they are operational; and
- Some Burlington residents also installed backup sump pumps, sump up batteries, backwater valves, as well as replaced basement windows and eaves troughs.

HOME FLOOD PROTECTION PROGRAM (CURRENT STATUS)

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Fleming College

PROGRAMS & COURSES

ENROL IN HOME FLOOD RISK ASSESSMENT TRAINING

Course Code: CNST223

TOC

Study the theory and gain technical practice in identifying the broader factors that influence urban household floods in Canada. We will examine the impact of climate change, municipal engineering and practices, government land development policies and building and electrical codes on the risk of floods. We will provide insight into how the availability of flood risk insurance for homeowners has evolved. You will gain an in-depth understanding of how to complete a visual assessment of overland, infiltration and sewer backup risks at homes built during different eras of development, identify opportunities to reduce these risks and where further investigation is needed. You will be able to practice and demonstrate proficiency in the use of a nationally applicable flood risk assessment tool by completing one full flood risk assessment at a home of your choosing during the course.

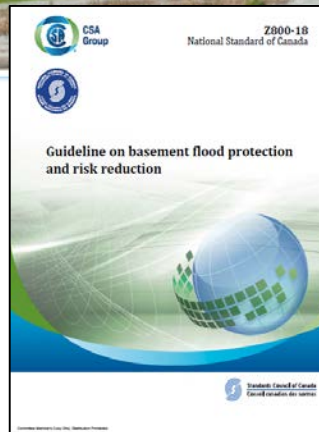
- Additional pilots in Toronto and Saskatoon
- Informed first-ever home flood risk assessment training course for home inspectors (developed with Fleming and Seneca Colleges, available nationally)
- Shorter version of the course is being developed for insurance brokers and real estate agents

NEW GUIDELINES AND STANDARDS FOR FLOOD-RESILIENCE (EXAMPLES):

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ON CLIMATE ADAPTATION

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Homes - Flood Protection Guideline



https://store.csagroup.org/ccrz_ProductDetails?sku=Z800-18

New Community Design Standard



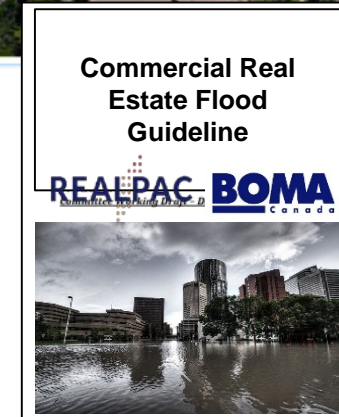
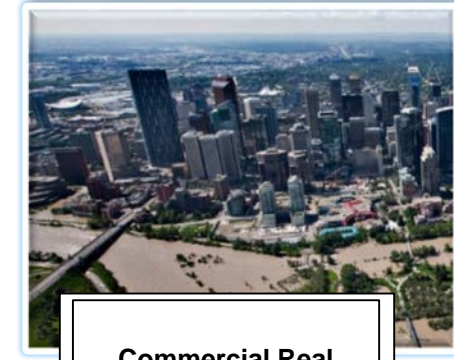
<https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2017/10/Preventing-Disaster-Before-it-Strikes.pdf>

Existing Community Retrofits Standard



<https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2019/01/Weathering-the-Storm.pdf>

Commercial Real Estate Retrofits Guideline



New Standards Supported by:

National Research Council Canada



Standards Council of Canada
Conseil canadien des normes



CSA
Group

... and experts across
Canada, who contribute to
research and standards
development...

A [framework](#) was developed for assessing the business case of natural infrastructure for climate adaptation.

Key finding: natural infrastructure can be a strong complement to grey (built) infrastructure for climate adaptation (e.g., flood/drought attenuation), but it's essential to quantify its total economic value for an informed investment analysis.



ASSESSING THE VALUE OF NATURAL INFRASTRUCTURE (CONT'D)



Naturally occurring **wetlands** in Waterloo, ON reduce flood damage costs to buildings in Uptown Waterloo by \$51M (Intact Centre, 2016)

Naturally occurring **ponds** in the coastal town of Gibsons, BC provide \$3.5M - \$4M of stormwater storage services annually (MNAI, 2018)

An **engineered wetland** in Manitoba is valued at \$3.7M for the flood reduction, water quality improvement, carbon sequestration and other benefits it provides (IISD, 2017)



TOTAL ECONOMIC VALUE ASSESSMENT NATURAL VS GREY INFRASTRUCTURE

Costs (examples)	Costs	NI	Grey
Pre-Construction			
• Baseline data collection		X	X
• Stakeholder consultation		X	X
• Site identification		X	X
• Assessment of design alternatives		X	X
• Detailed engineering design of selected alternative		X	X
• Land acquisition		X	X
• Environmental assessment		X	X
• Permitting and legal fees		X	X
• Development of construction specifications		X	X
• Development of monitoring program and key performance indicators (KPIs)		X	X
Construction			
• Site preparation		X	X
• Site construction		X	X
Post-construction			
• Infrastructure maintenance activities		X	X
• Infrastructure condition assessment		X	X
• Monitoring against KPIs		X	X
• Evaluation and reporting		X	X
• Carbon cost over project life cycle			X
Administration			
• Project management and oversight			
Benefits (Example)	Benefits	NI	Grey
• Storm water storage		X	X
• Water quality		X	
• Habitat creation / improvement		X	
• Microclimate stabilization (e.g., urban heat island reduction)		X	
• Air filtration		X	
• Recreational amenity and aesthetic services		X	
• Energy savings		X	
• Carbon savings		X	

A comprehensive assessment of the financial, environmental and social costs and benefits (i.e., a total economic value [TEV] assessment) is required to illuminate otherwise uncaptured benefits of natural infrastructure projects.

- Water quality improvement
- Habitat creation
- Urban heat island reduction
- Air filtration
- Recreational amenity
- Aesthetic services
- Carbon sequestration

*"Water damage is now the leading cause of personal property claims. Over the last 10 years, water losses for personal property claims have doubled to 40% (of \$ paid in losses). There are a number of improvements that Canadians can take to better protect their homes and communities against water damage. **By taking these steps, Canadians could lower their annual premiums - anywhere from 5 to 15%.** Those who live in municipalities who make climate resilient infrastructure a priority could also benefit from more affordable premiums, higher coverage limits and enhanced insurance coverage."*

Intact Financial Corporation, 2017

NEW AREAS OF FOCUS: FIRE AND EXTREME HEAT



Forest Fires / [FireSmart Canada](#)

- Wildfire risk in Canada is high – 11 million of Canadians are exposed to fire risk
- Intact Centre and **FireSmart Canada** have now committed to working together on:
 1. Developing Fire-Resilient standards
 2. Promoting **FireSmart** best practices implementation across Canada



Extreme Heat

- Heat in Canada will get more challenging
 - Daily maximum temperature
 - Heat waves (7 days in row above 30 °C)
- 90 heat-related deaths in Quebec (summer 2018)
- Toronto Resilience Office identified Extreme Heat as a challenge for approx. 1,200 towers, which were built before 1985
- **Intact Centre is working to develop best practices for reducing vulnerability to Extreme Heat**

DISCUSSION: HOW CAN WE COLLECTIVELY TO ADAPT TO CHANGING CLIMATE?



1. Adopting flood-resilience standards through storm water guideline updates, relevant standards, by-laws and policies
2. Considering natural infrastructure as part of the solution
3. Educating homeowners on actions they can take to get prepared to more extreme weather to come

Thank You!  **@ICCA_Canada**

The background features a series of concentric circles in light gray, some solid and some dashed, creating a ripple effect. A large, solid green oval is centered on the page, containing the title text. A thick, dark gray curved line sweeps across the bottom left, partially overlapping the green oval.

Climate Change Projections and Impacts in Burlington

Actual and Projected Climate in Burlington

Baseline	Annual mean temp.	Days over 30°C	Days over 35°C	Days with max temp < -10°C	Annual precip. (mm)
1971-2000	8.9°C	20	1	3	875.5

Period	Average annual increase (°C)	Days over 30°C	Days over 35°C	Days with max temp < -10°C	Annual precip. increase (mm)
2020s	1.2 to 1.5	37	4	2	+ 17.5 to 23.8
2050s	2.1 to 3.0	43 to 54	7 to 12	1	+ 38.5 to 65.7
2080s	2.6 to 4.7	51 to 76	9 to 24	0 to 1	+ 53.9 to 97.1



Climate Change Impacts in Burlington

Warmer temperatures year round

- Extreme heat in summer impacting people, animals and plants - need for city facilities as refuge
- Increased demand on energy supply
- Expansion of invasive species territory
- Decreased outdoor winter recreational opportunities
- Longer growing season



More mixed precipitation in winter

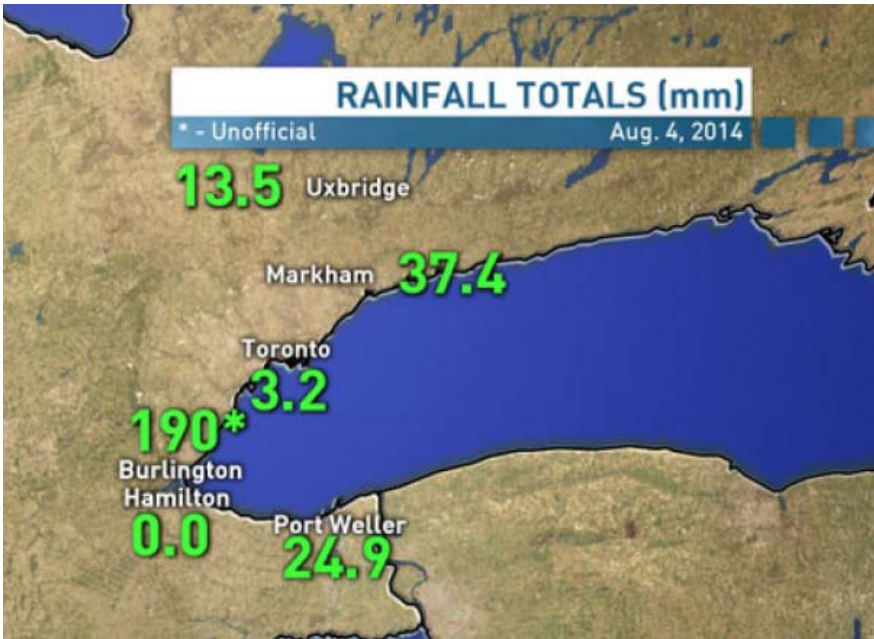
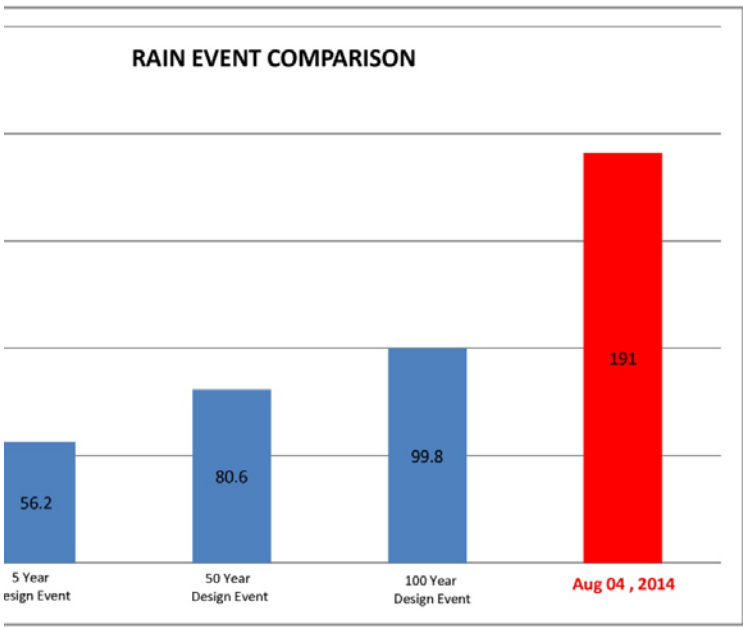
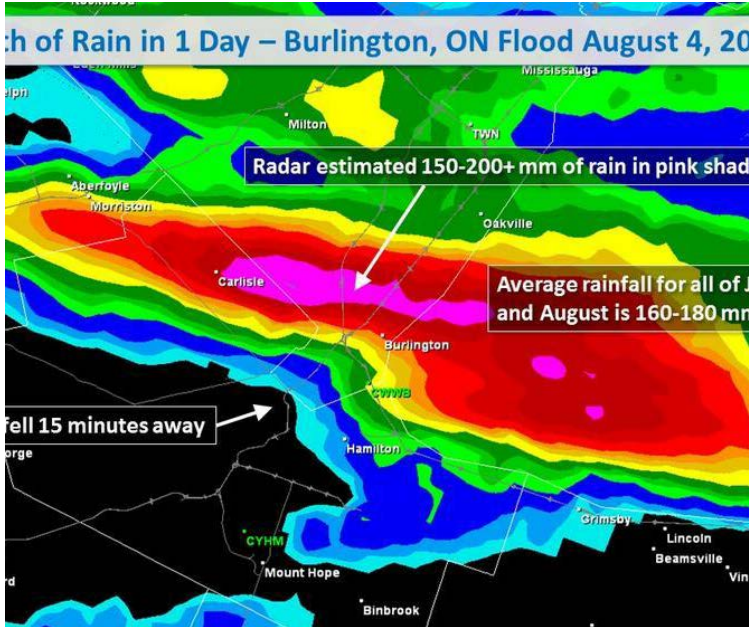
- Burlington's winter average temperature is -3.3°C
 - Increase by 1.3 to 1.6°C in 2020s
- Increased risk of freezing rain and ice storms
 - Dec. 2013 ice storm assistance program claim over \$2M
- More freeze-thaw cycles negatively impacting infrastructure





More frequent higher intensity and shorter duration storms

- Creek capacities are not able to handle the “new breed of storms”
 - Current infrastructure designed using old design standards for the predictable storms of the past
- Increased risk of flooding, erosion and sediment deposit
 - Increased risk of tree damage from erosion
 - Decreased water quality



More extreme events:
Burlington Flood - Aug. 4, '14



- Over 3,000 homes reported being flooded
- \$90 M in insured claims
- COB Disaster Relief Fund paid out over \$2.6M in claims
- \$20.4M added to existing 10 year SW capital budget



More intense wind storms

- Skyway closed after truck topples over due to high winds (March 8, 2017)
- April 4, 14 & 15 and May 4, 2018 wind storms = \$341K clean-up cost

Lake Ontario

- Less ice cover on lakes
 - Increased erosion and damage to shoreline protection infrastructure
 - Increased risk of lake effect snow
- Increased nearshore water temperatures impacting water quality
 - Beach closures
- High water lake levels in 2017
 - Record breaking precipitation
 - Beach and trail closures, private property damage, public infrastructure damage, etc.



Climate Change: Mitigation vs. Adaptation

Mitigation addresses the root causes of climate change.

- The need to reduce GHG emissions

Adaptation addresses the actions taken to limit the damage to people, communities, environment and infrastructure resulting from climate change.

- Addressing the symptoms
- Living with our new normal

Actions for Climate Change Adaptation and Mitigation

Cary Clark – Stormwater Management

Steve Robinson – Forestry

Tom Pedlar – Corporate Energy
Management

Jessica Wesolowski – Corporate Fleet
Management

Lynn Robichaud – Community Energy
Management



Stormwater Management

Flood Mitigation & Climate Change Adaptation

2014 Flood Study Recommendations

- Major creek & bridge reconstructions
- Neighbourhood-level projects
- New SW Design Stds
- Creek maintenance enhancements
- Drainage issues – inspections, Intact Centre
- Public education and Stakeholder engagement
- Municipal Best Practices
- Coord with Halton Region, CH, MTO, 407 & railways
- Update creek models
- Municipal Advisory Committees

Stormwater Design Standards

- Updating standards to include Climate Change Adaptation:
 - Planning & design process
 - Ecosystem approach
 - Sewer, culvert & bridge design
 - Creek design
 - “Low Impact Development” features
 - Erosion & sediment control

New Development & Re-Development

- New SWM design standards after 2014
 - Reduce: impacts on storm system & creeks, erosion & sediment.
- Low Impact Development (LID)
 - Permeable pavers
 - Infiltration
 - Bio-swales
 - Rain gardens
 - Enhanced tree plantings: “Silva Cells”
 - Tree rainwater harvesting/rain barrels/cisterns
 - Green roofs/green walls

Maintenance

- Creek Inventory inspections - erosion, infrastructure condition, debris
- Enhanced construction inspection
- Rural ditching
- SWM Pond dredging
- Road catch basin cleaning
- Oil & Grit Separator monitoring & clean outs
- Maintenance Management System (MMS)

Forestry – Current Challenges

Urban Heat Island Effect:

Warmer/dryer summers with seasonal droughts will lead to increased pressures for newly planted trees.

Tactic: Planting up to 120 different tree species – pushing boundary of **Carolinian species**



Forestry – Current Challenges

Impact to Biodiversity from Invasive Species Introduction:

Through the introduction of invasive species (purposefully or inadvertently), **climate change** has the potential to **exacerbate the problem** further due to **invasive** species ability to **colonize faster**, and respond better to changing environmental conditions than native species.

According to the NCC, invasives don't support the diversity of native insects, which also impacts birds.

Current liability to the City's remnant woodland environments. Solutions can be addressed through a Woodland Mgt Strategy



Forestry – Current Challenges

Climate Change increasing frequency of significant storm events:

Significant storms in 2018 cost the City \$341,000.00 in clean up costs (4 Storms; Forestry related costs only).

Additional costs associated with “trickle down” activities such as stumping and new tree placement.

Tactic: Grid maintenance program (overhauled in 2017) reducing frequency/quantity of non-critical tree failures. Some storms have such severe weather – some whole tree failures are unavoidable



Forestry – The Numbers

Stormwater Mitigation: (diversion of water from existing grey infrastructure to green infrastructure:

At present, municipal trees divert the equivalent volume of water required to fill **116 Olympic sized swimming pools** annually.



Energy Savings: Annually, City of Burlington trees save over 5 million kWh of energy. That's enough energy needed to run a **slow cooker for 3,500 years.**



Improved Air Quality: Annually, City of Burlington trees filter almost 30,000 kg of pollutants. That's the equivalent of **filling a City Salt truck 4 times.**



Stored Carbon: City of Burlington trees hold over 8,500,000 kg of carbon. That's enough carbon to **fill 65 train cars.**



Forestry – Emerging Opportunities

Identify strategies for increasing Urban Tree Canopy:

1) Private Tree Bylaw

Preservation of all trees greater than 30 cm and trees of significance (unique trees)

2) Aggressive Tree planting Program

2019 large tree planting program: 2,100 trees

2019 community partnerships: 2,100 small trees (whips)

2018 successes: 12 planting events with 10 partners

3) Incentive Programs for Private Tree Planting

Reforest London free tree giveaway

City of Toronto 40% Canopy Goal – LEAF; Tree for Me; Community Grants

4) Strategy Development for greenfield/brownfield infill of urban forests/woodlots



Incorporate Stormwater retention into urban planting guidelines:

-

[illegible]

Forestry – Emerging Opportunities

Urban Forest Master Plan Development - 2019

1) Woodland Management Strategy

- Complete analysis of woodlots throughout the City and develop plans to improve longevity (*removal of invasive species & planting new trees*)
- Seek out opportunities through PPP to purchase vacant land or hold land in trust for expansion of woodlots.



2) Invasive Species/Integrated Pest Mgt Strategy

Develop comprehensive strategy for monitoring and maintenance of invasive species in the Urban Forest



3) Urban Canopy growth target

Establish growth target for Urban Forest canopy with adequate resourcing to achieve within a given timeframe.



Forestry – Emerging Opportunities

Developing and Nurturing Partnerships

- 1) Develop relationships through PPP formats to preserve, maintain, and plant trees both small and large scale.
- 2) Nurture existing relationships with other public agencies: Halton Region, RBG, Conservation Halton, NGOs.

Identify opportunities to realize project efficiencies by partnering together



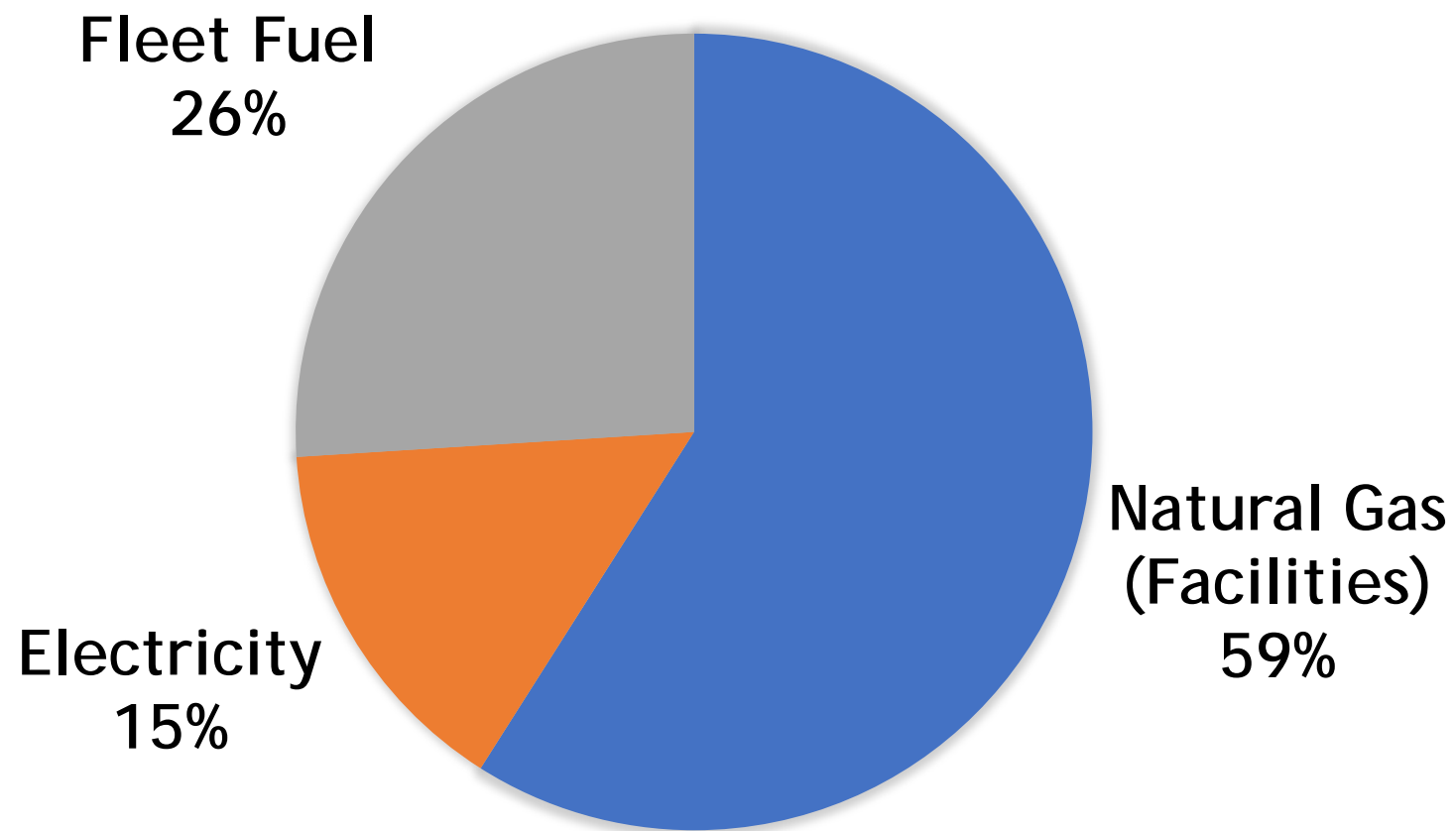
The City of Burlington Corporate Energy Management

A Healthy and Greener City: Our Future by 2040

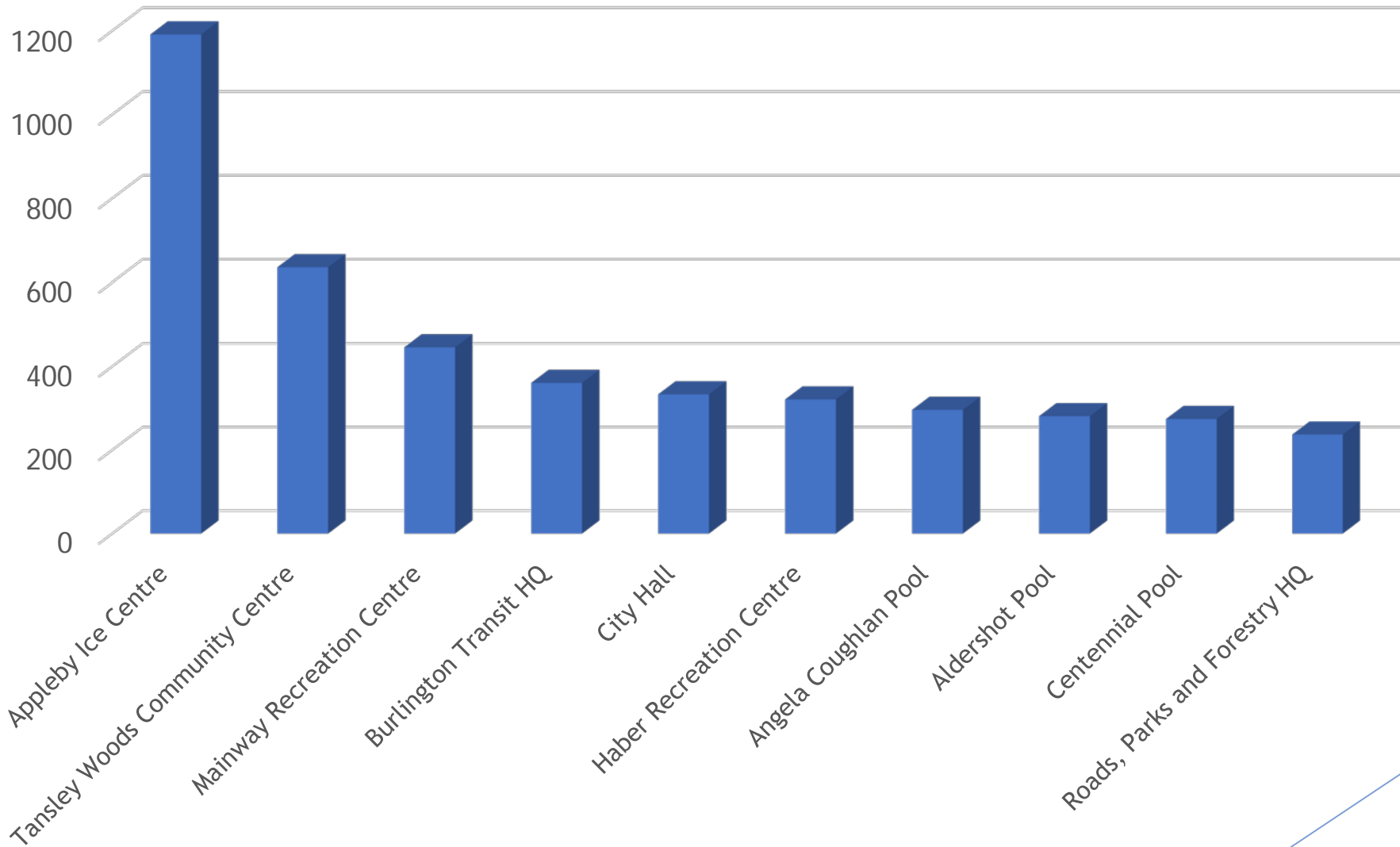
The city's operations are net carbon-neutral.

Tom Pedlar - Coordinator, Project Management - Energy

EMISSIONS FOR CITY OPERATIONS



Largest Emissions from Facilities



What's Next?



Optimize

- Training
- Awareness
- Commissioning and recommissioning



Reduce

- Capital renewal
- Energy Conservation Measures



Offset

- Solar PV
- Green Power
- Renewable Natural Gas

Fleet
Services –
Current State





Fleet Services – Future State

- Smart vehicles – AVL & telematics software
- Fleet Analyst Position
- New MMS Reporting Features

A Low Carbon Pathway for Burlington



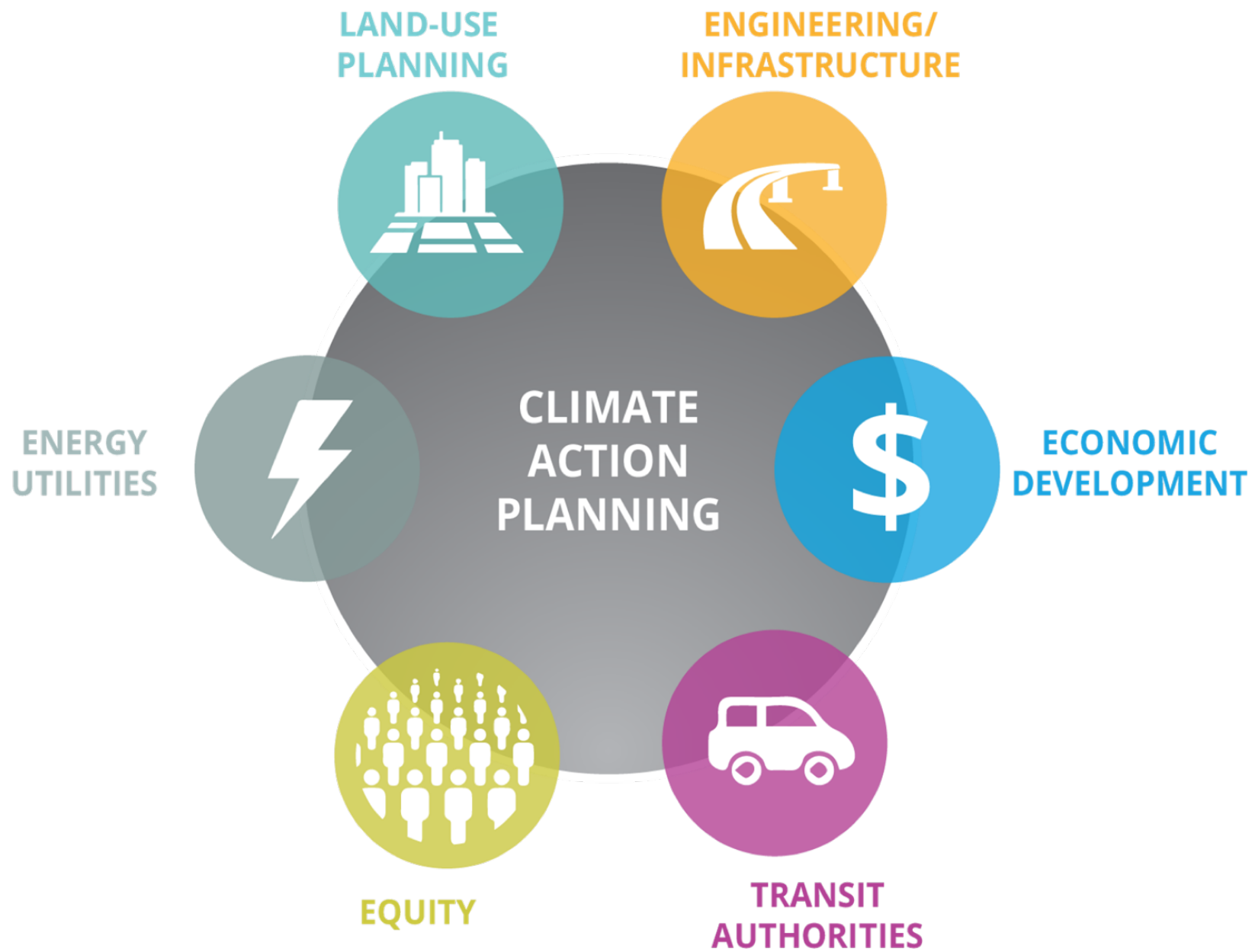
60%

Local governments have direct or indirect control over 60% of Ontario's GHG emissions.



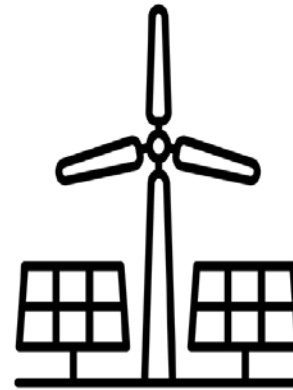
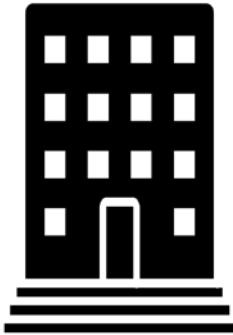
Local governments that are tackling climate change find that it helps with other goals and aspirations.



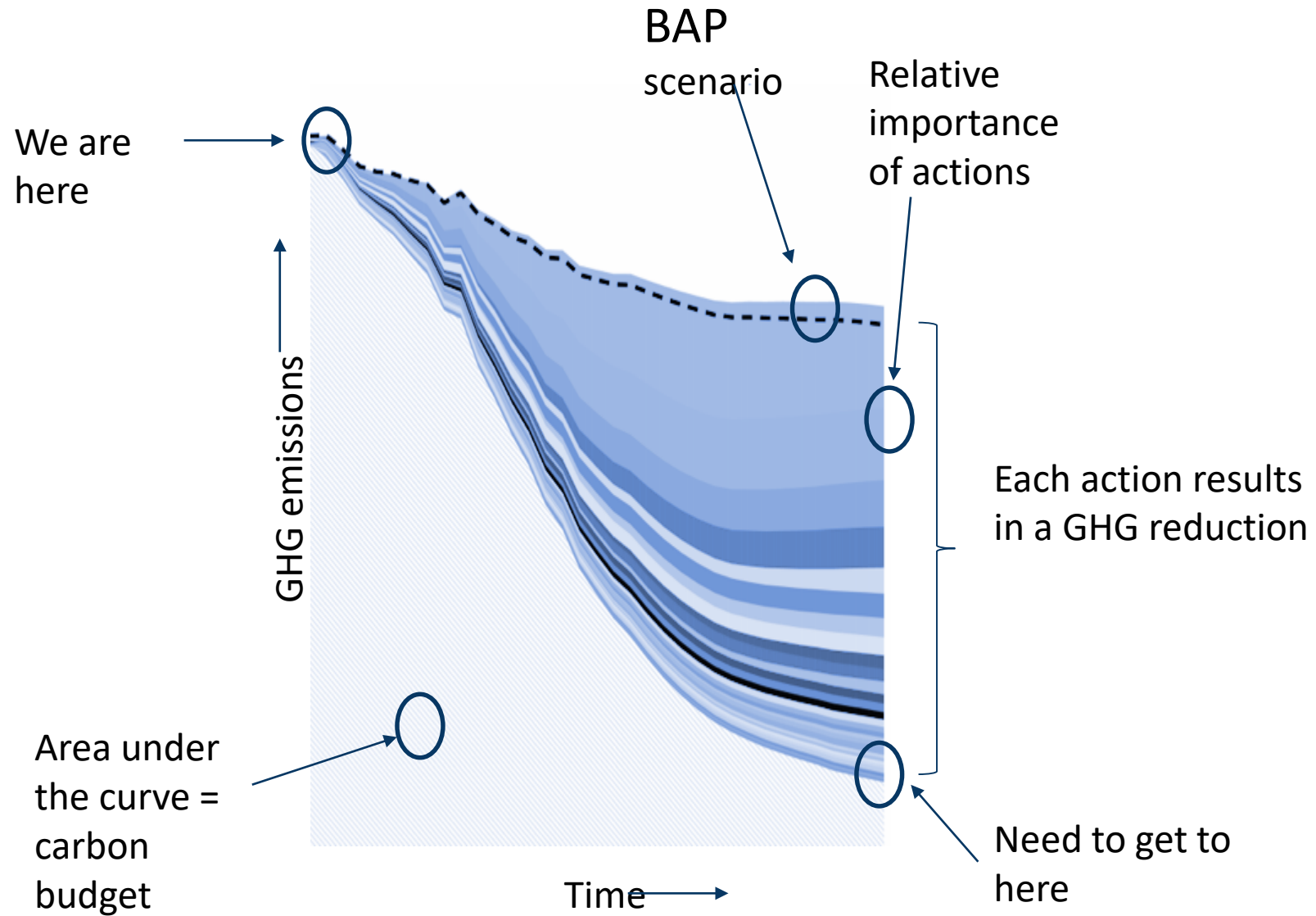


Objective

**Identify a detailed pathway
to achieve deep GHG
emissions reductions**

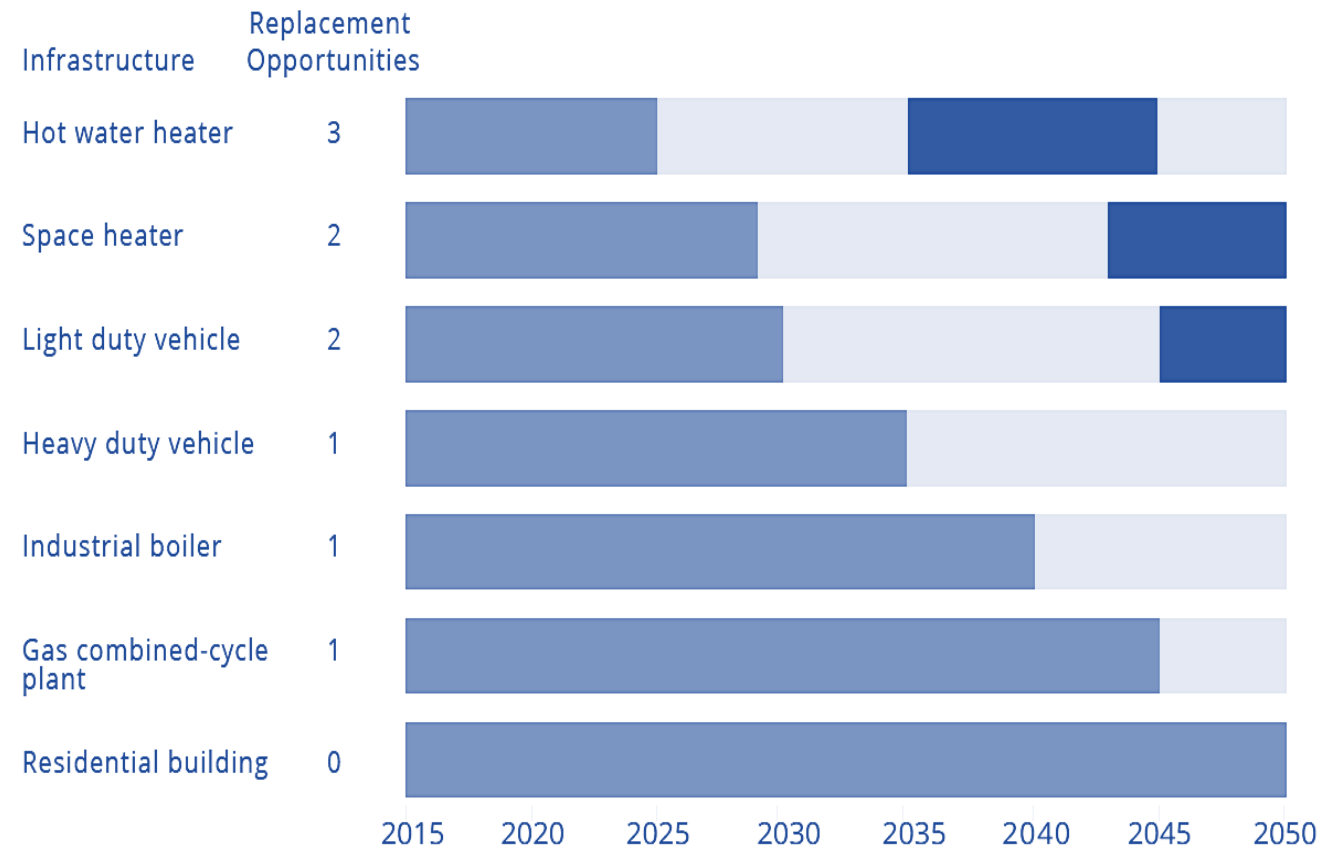


Anatomy of a LCS



Avoiding Lock-in

Infrastructure Replacement Opportunities for Selected Equipment and Facilities between 2015 and 2050



manufacturing
46
bags
of cement



a year's
trash
from **1** household



raising
a cow
for **6**
months



extracting **15**
barrels
of oil



in Canada,
1 TONNE of
Greenhouse Gases
comes from:



7 months
powering
a home



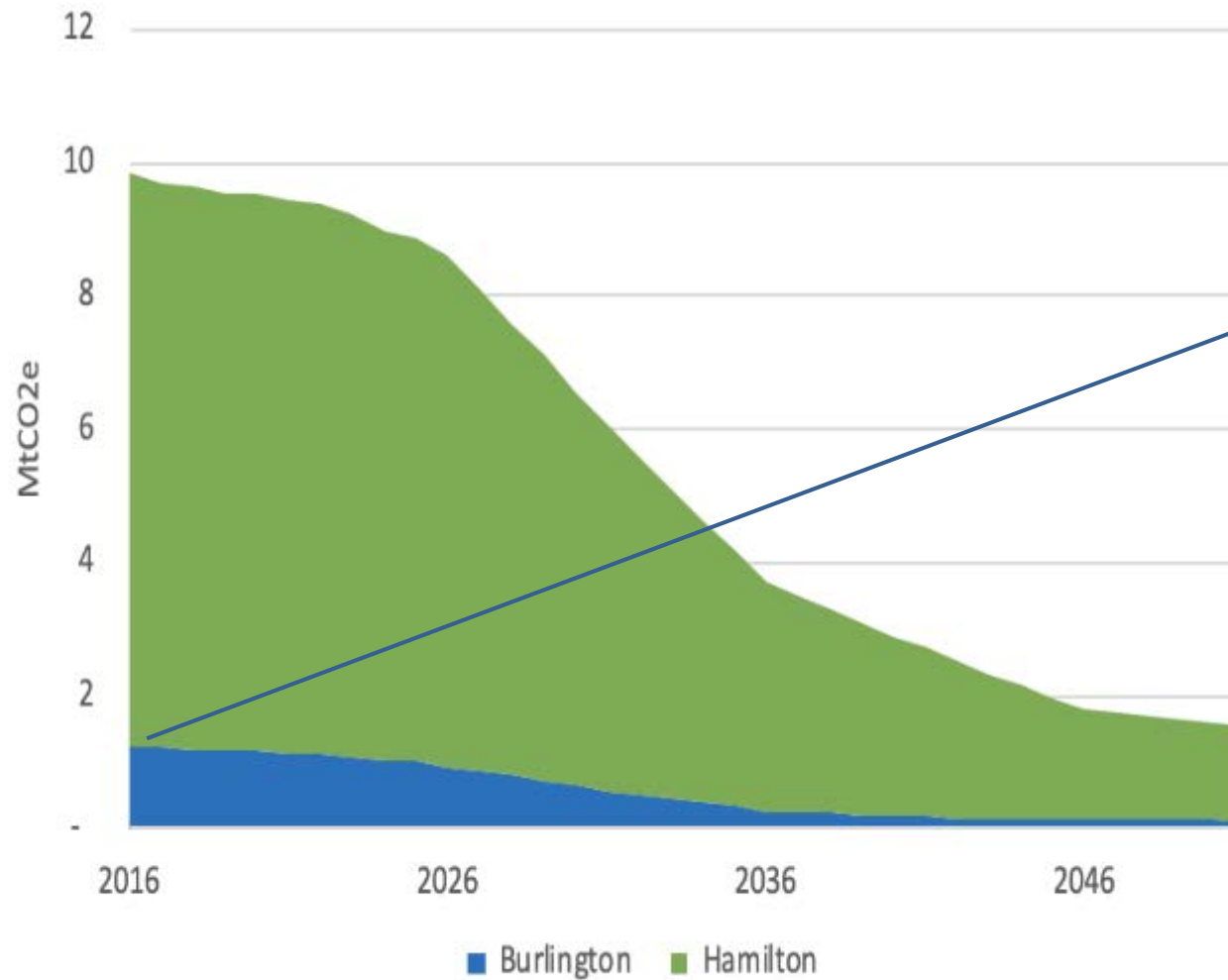
driving
4500
km



heating
a home
4
months

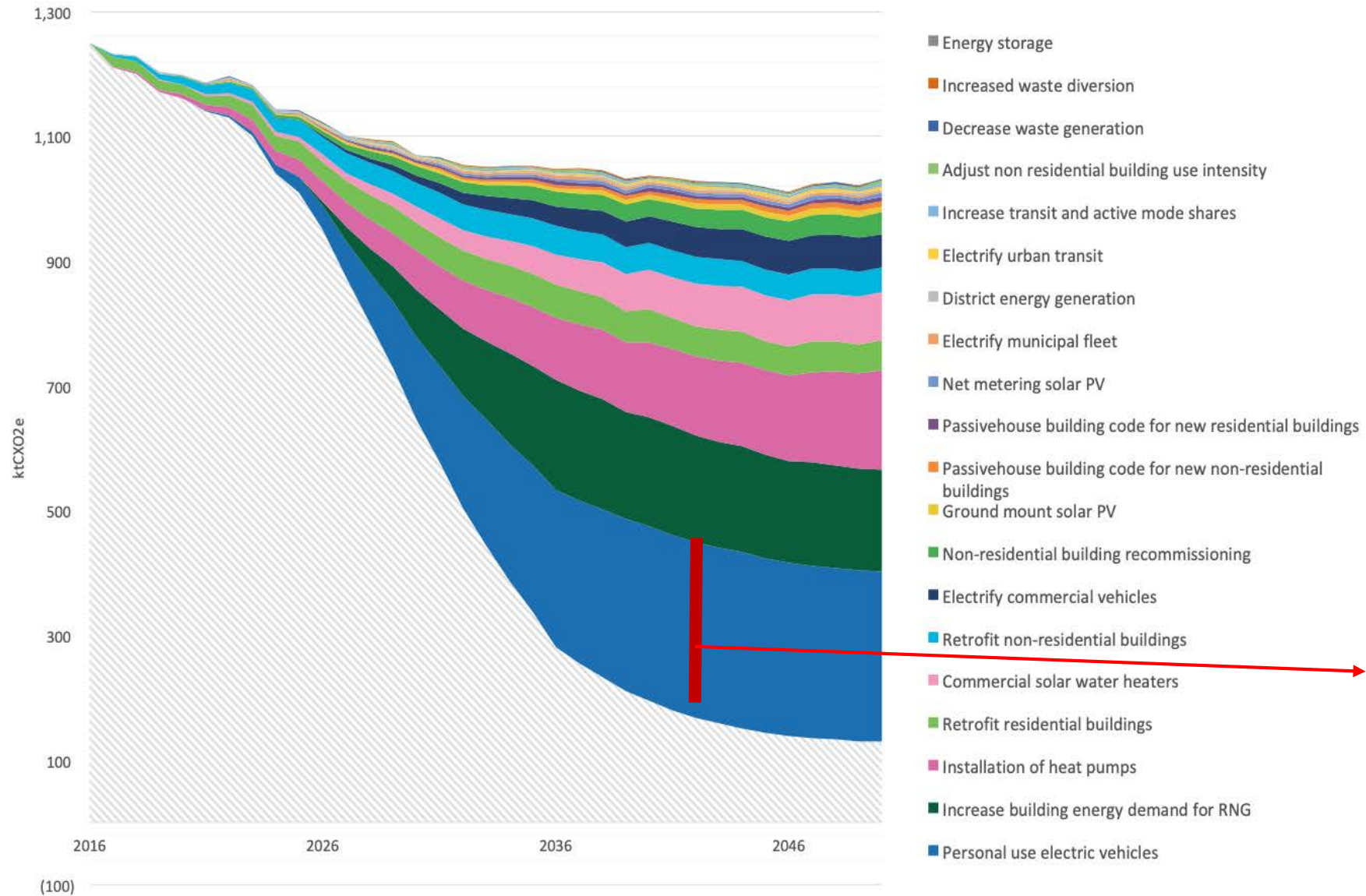


Total Emissions- Bay Area



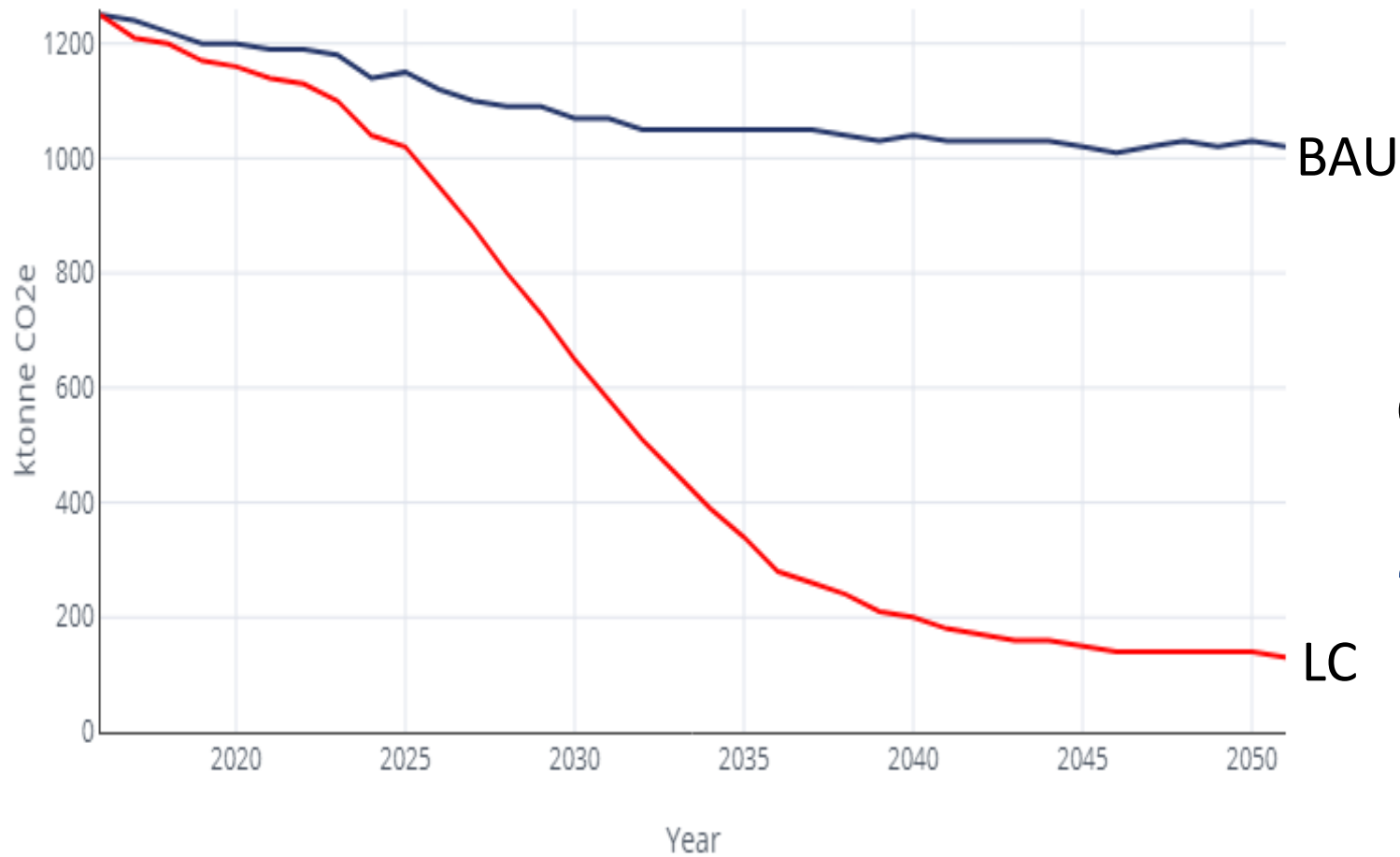
8.6 MtCO₂e
(Hamilton)
1.3 MtCO₂e
(Burlington)

Emissions Reductions- Burlington



Personal
vehicles

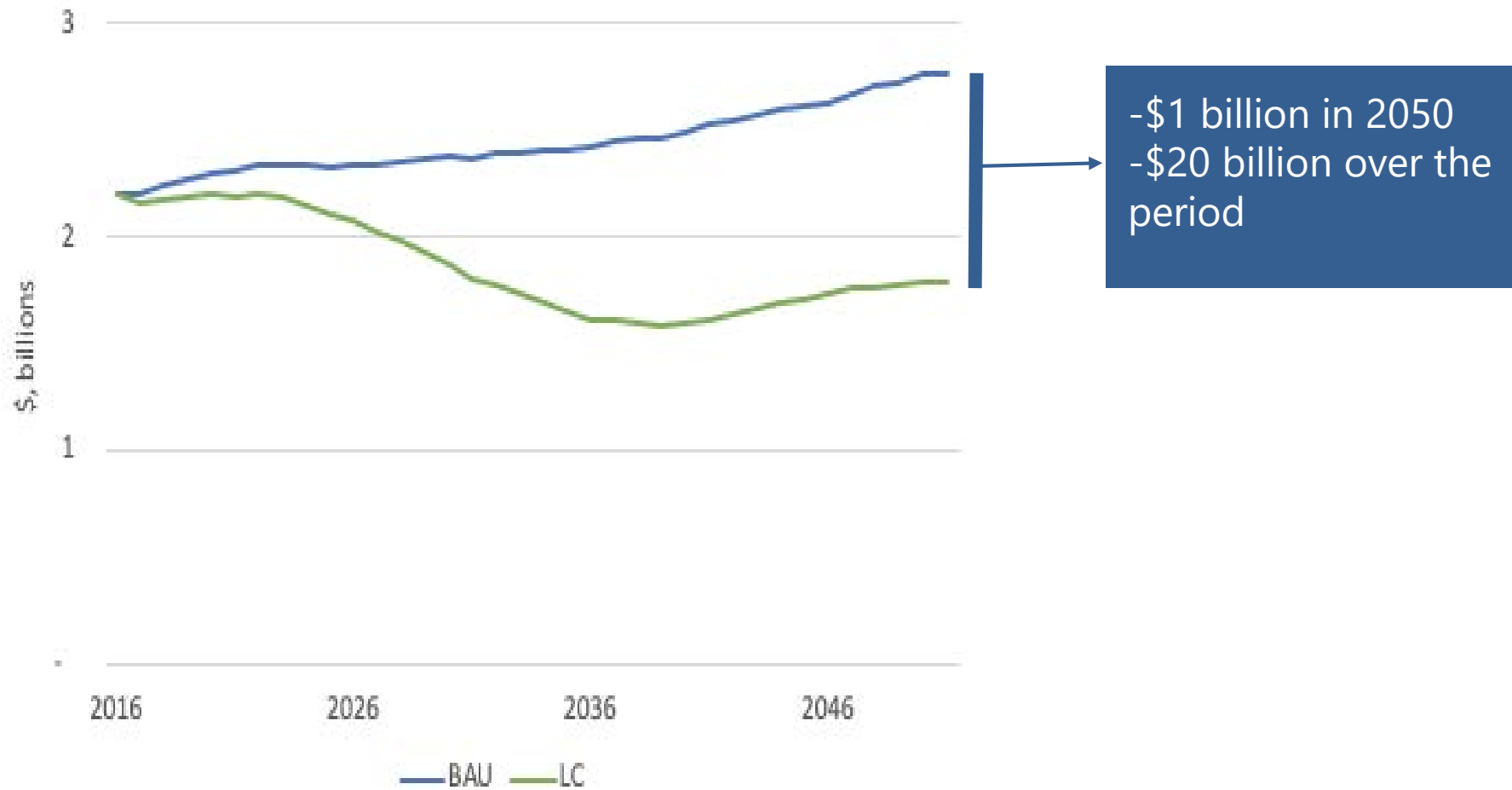
Total Emissions- Burlington



**Emissions
decline**

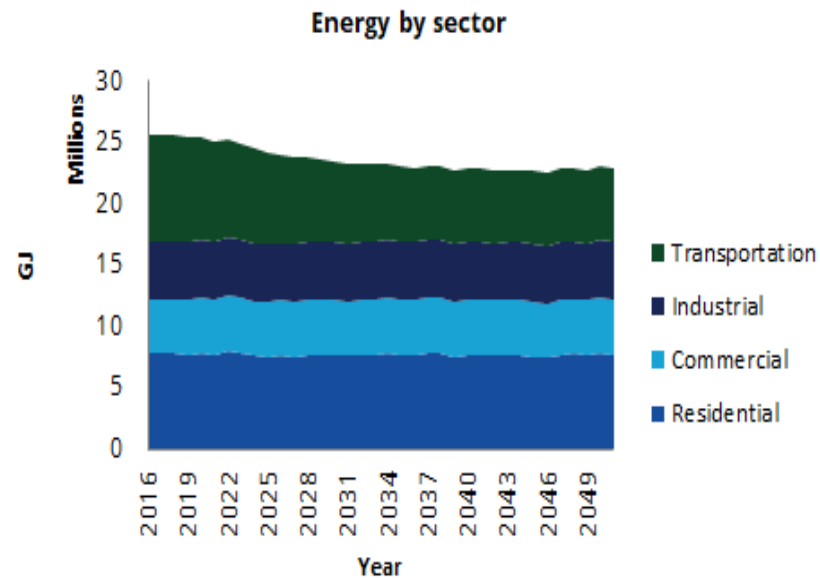
By 89% between
2016 and 2050

Total Energy Costs – Hamilton & Burlington

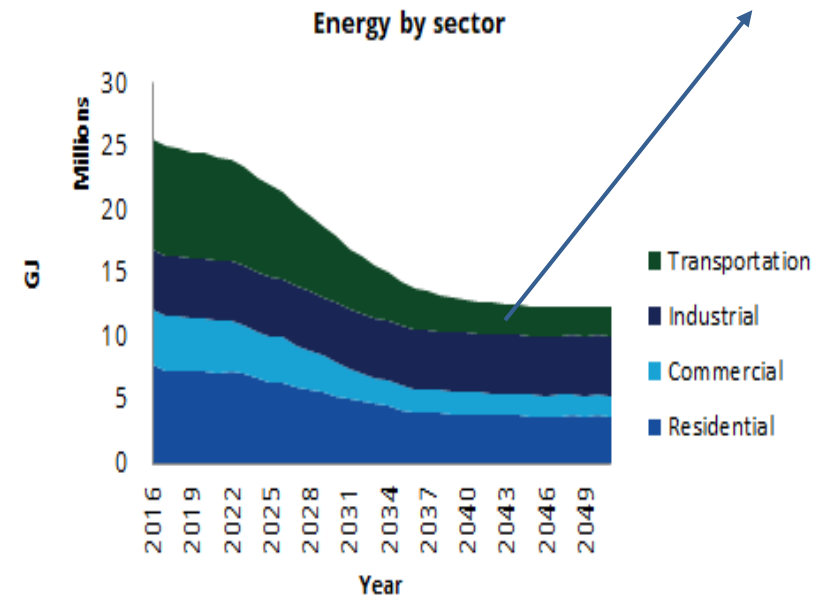


Total Energy By Sector- Burlington

Business as
Usual

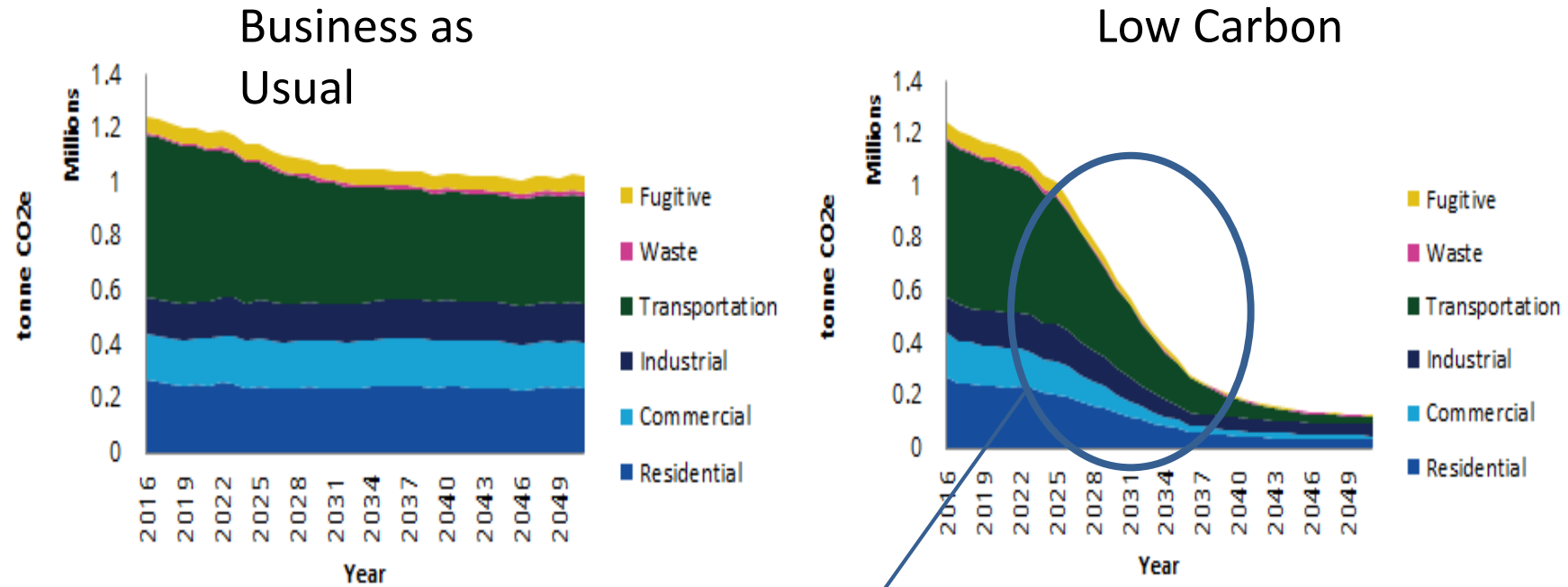


Low Carbon



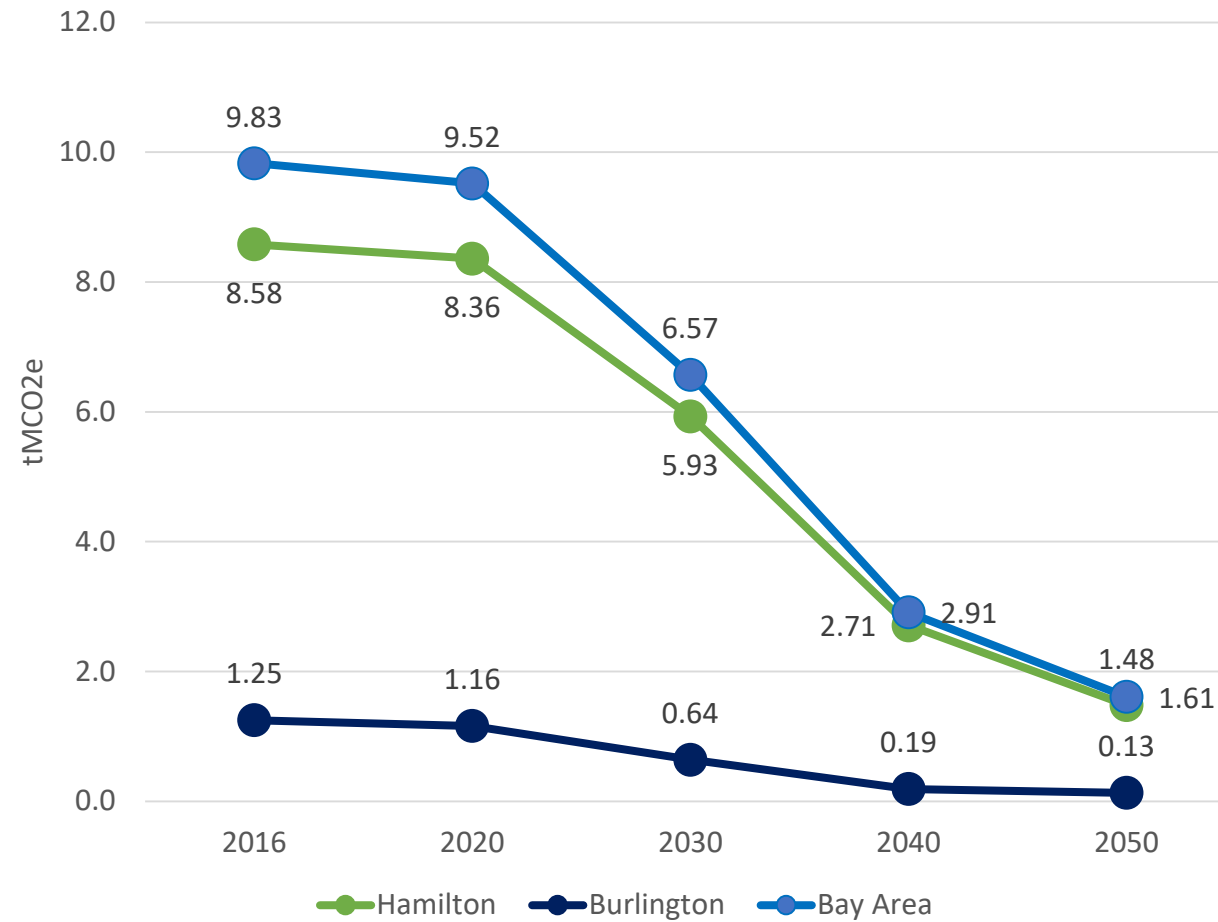
Electrification

Total Emissions By Sector- Burlington



2025 to 2040 is
a key period in
all sectors

Targets



Climate change & energy

- Transformational change
- Community engagement
- Partnerships & collaboration
- Co-benefits to livability, well being, jobs



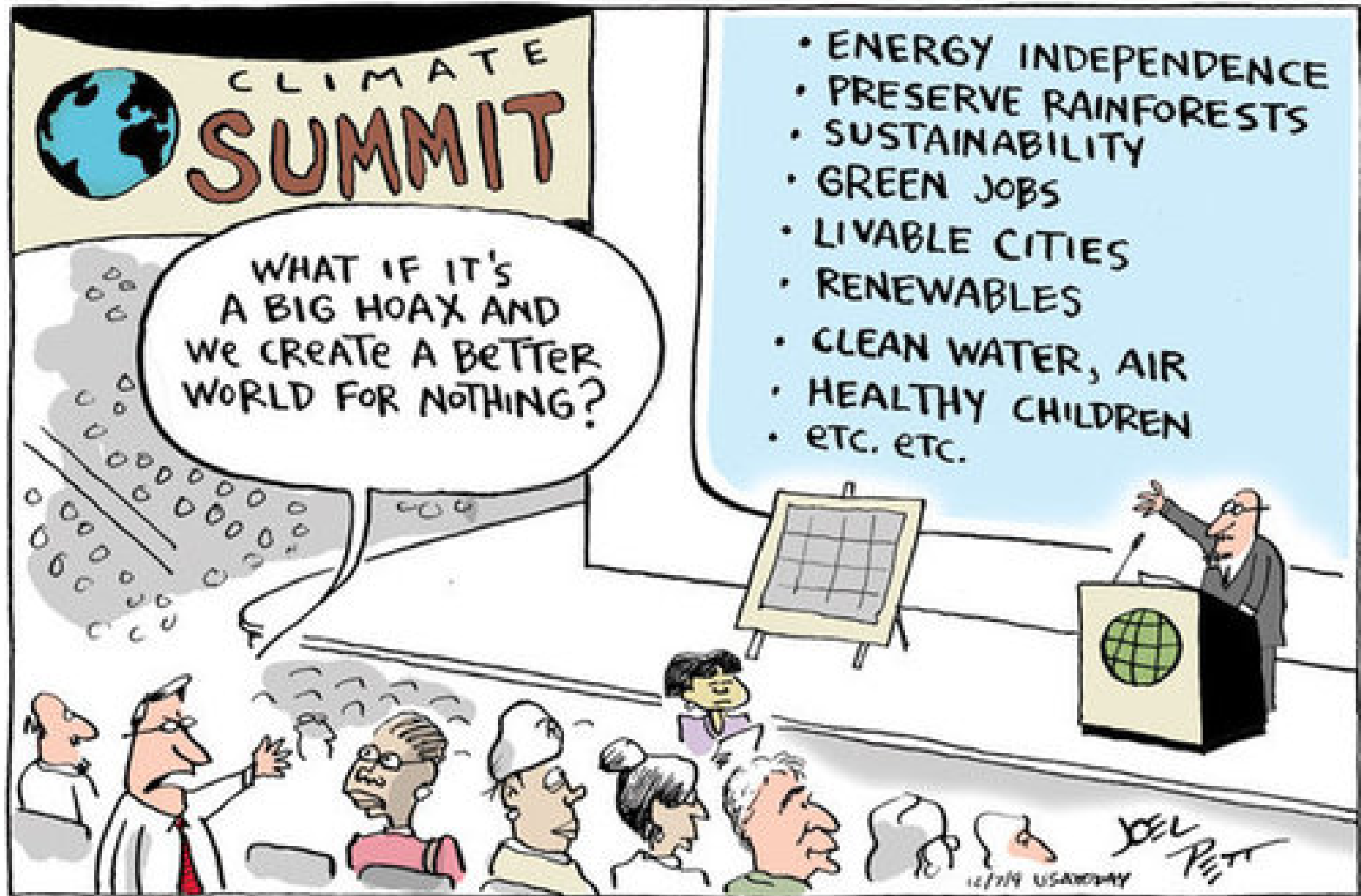
Actions

- **Robust, Comprehensive Community Engagement**
 - Demonstration, pilot projects
- **Buildings**
 - Existing older stock
 - Fuel switching
- **Transportation**
 - Electric Vehicles
 - Active & Sustainable Transportation
- **Energy generation**
 - Renewables
 - Community system



Climate Change Initiatives







Wrap up and Next Steps

Upcoming Reports to Council

Report	Date
Climate Change Report	May
Take Action Burlington – Environment Update	June
Corporate Energy Management Plan	July
Flood – Stormwater Management	July
A Resilient Community Energy and Climate Plan	September

*Changing
Together*



COP24 · KATOWICE
UNITED NATIONS CLIMATE CHANGE CONFERENCE
POLAND 2018

