A renewable energy future for Ontario – positive, practical, affordable

Presentation for the Port Hope Community Health Concerns Committee

Ralph Torrie, Director of Research, Corporate Knights

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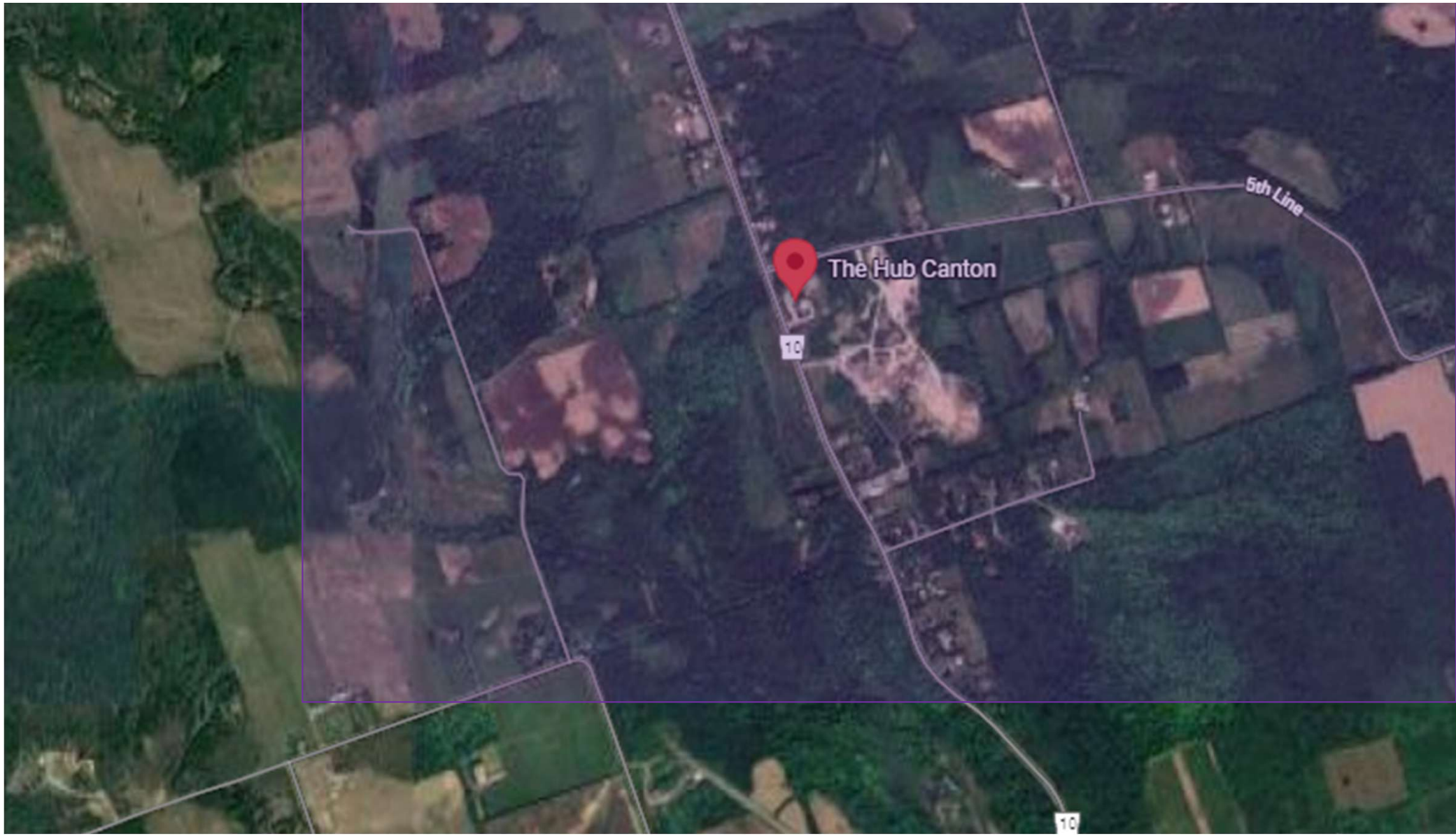
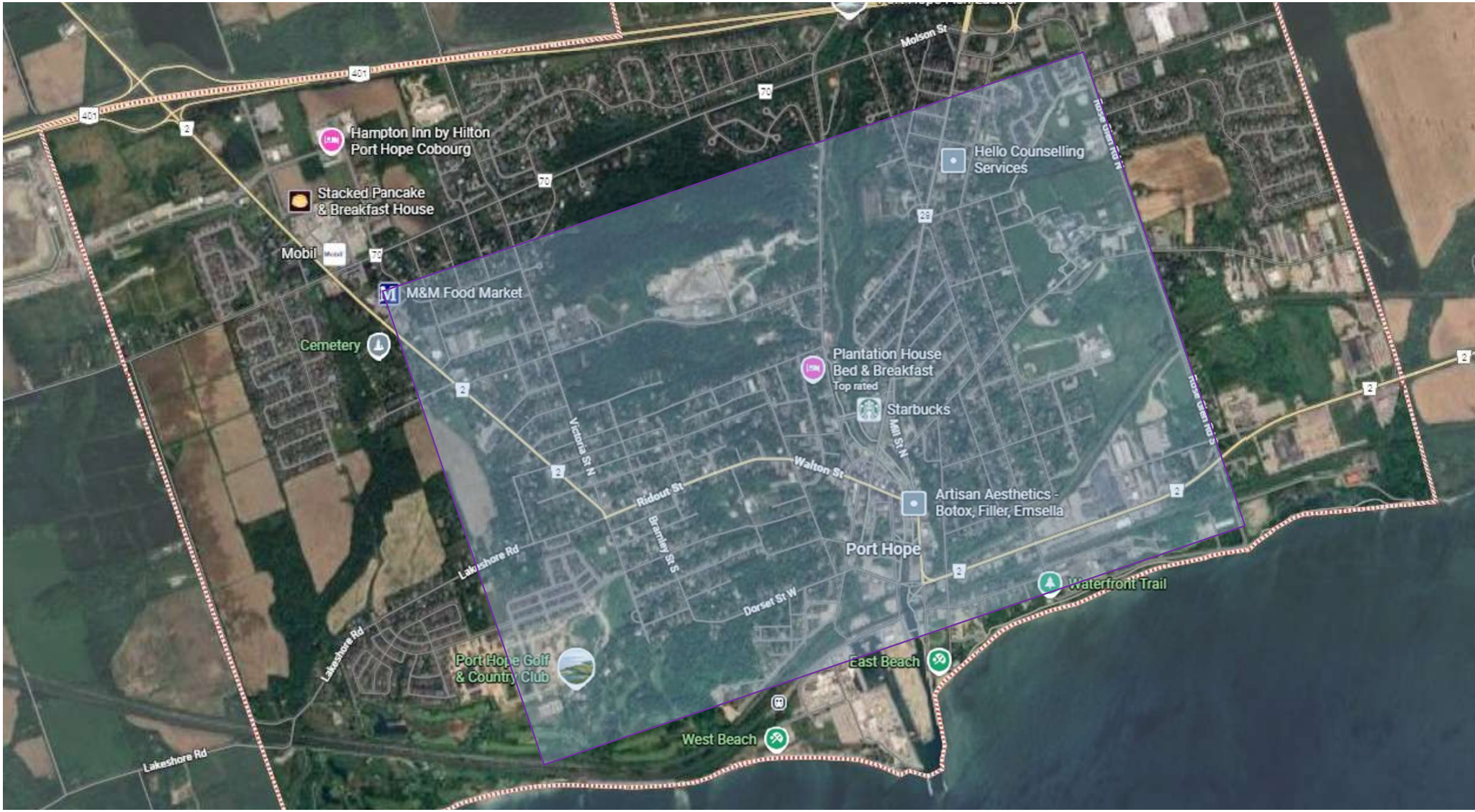
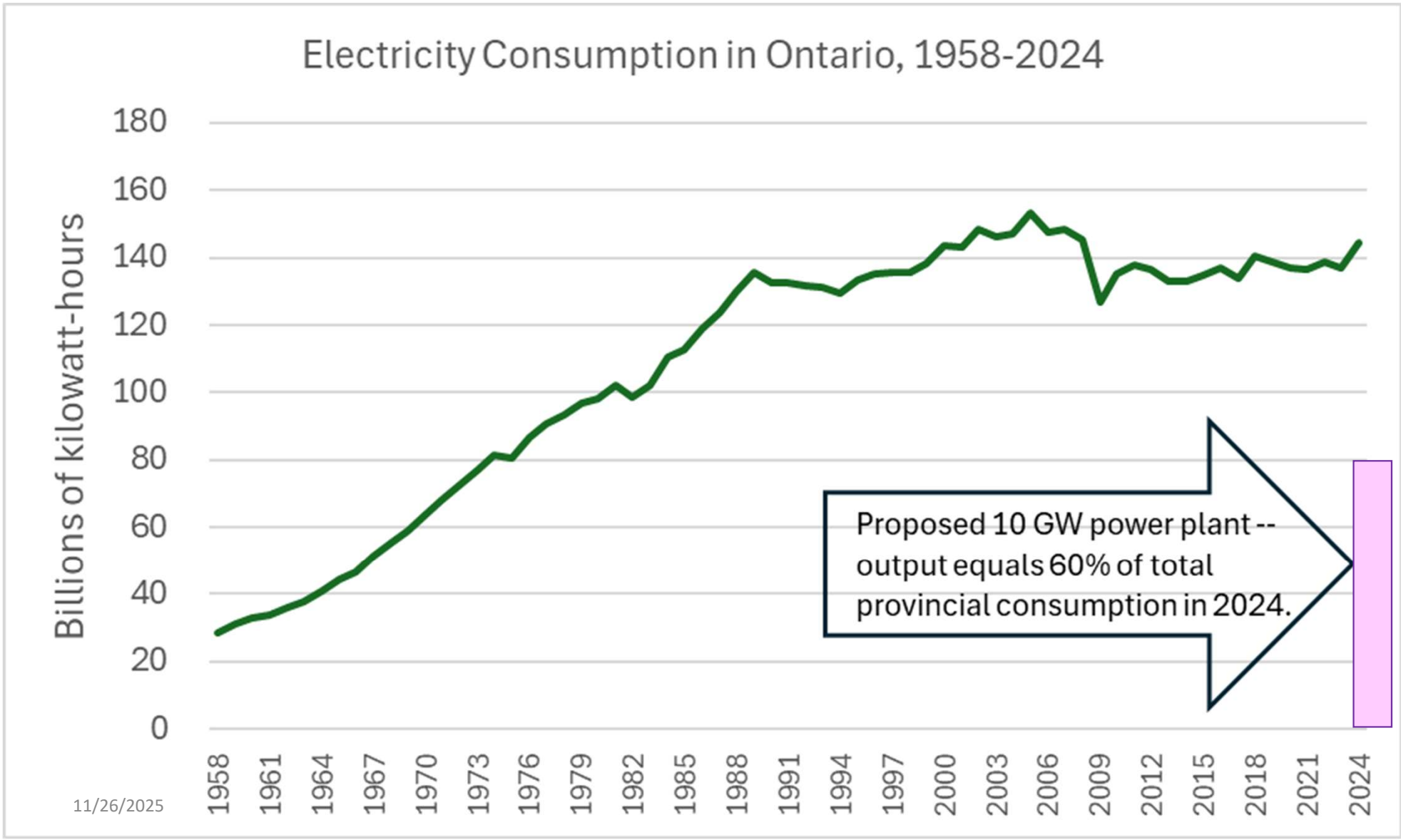
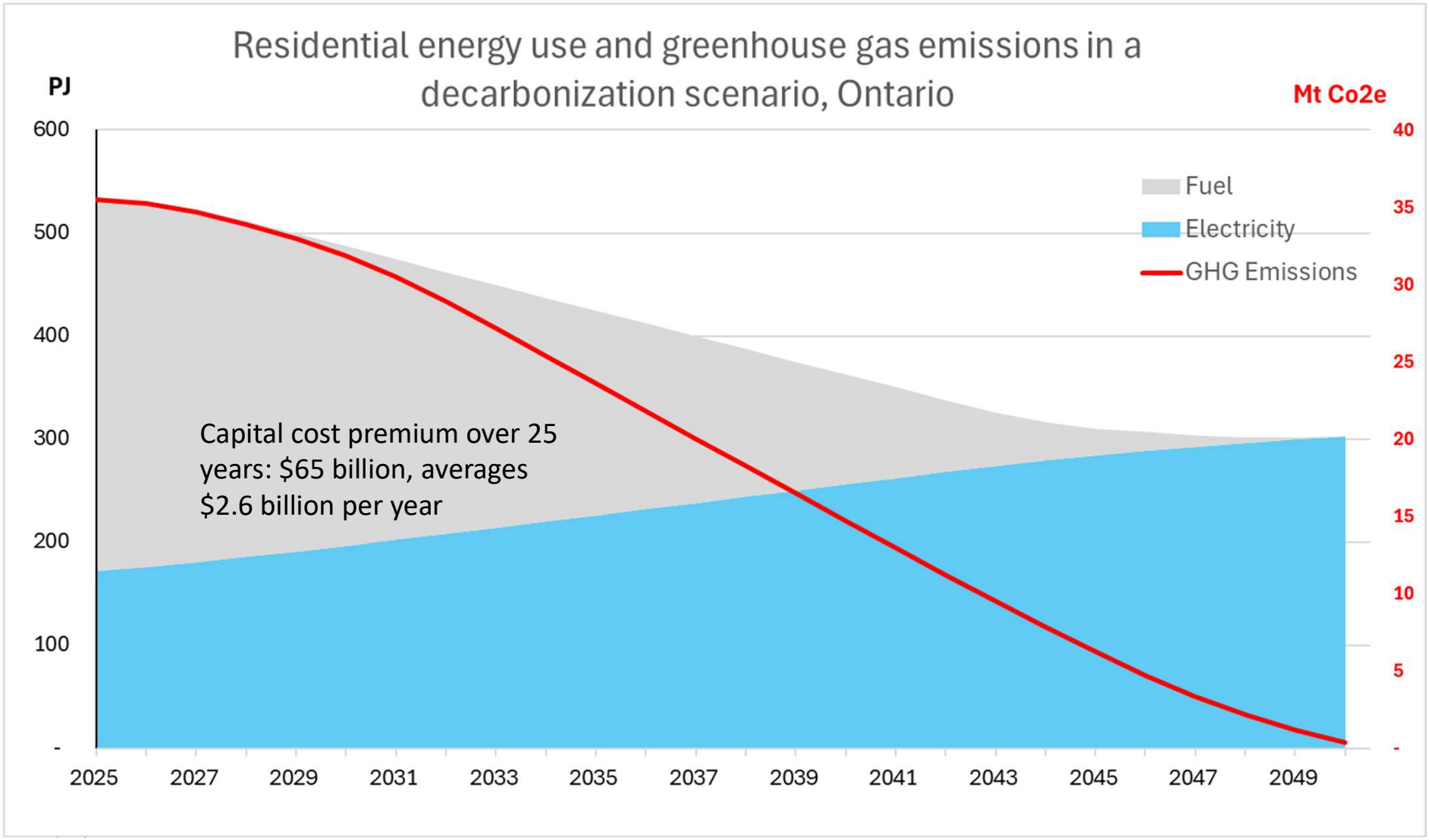
Lakeshore Rd
McColl Apiaries
Lakeshore Rd
Lakeshore Rd
Mobile Truck Tire Repair
Ontario Power
Generation Wesleyville
Wesleyville

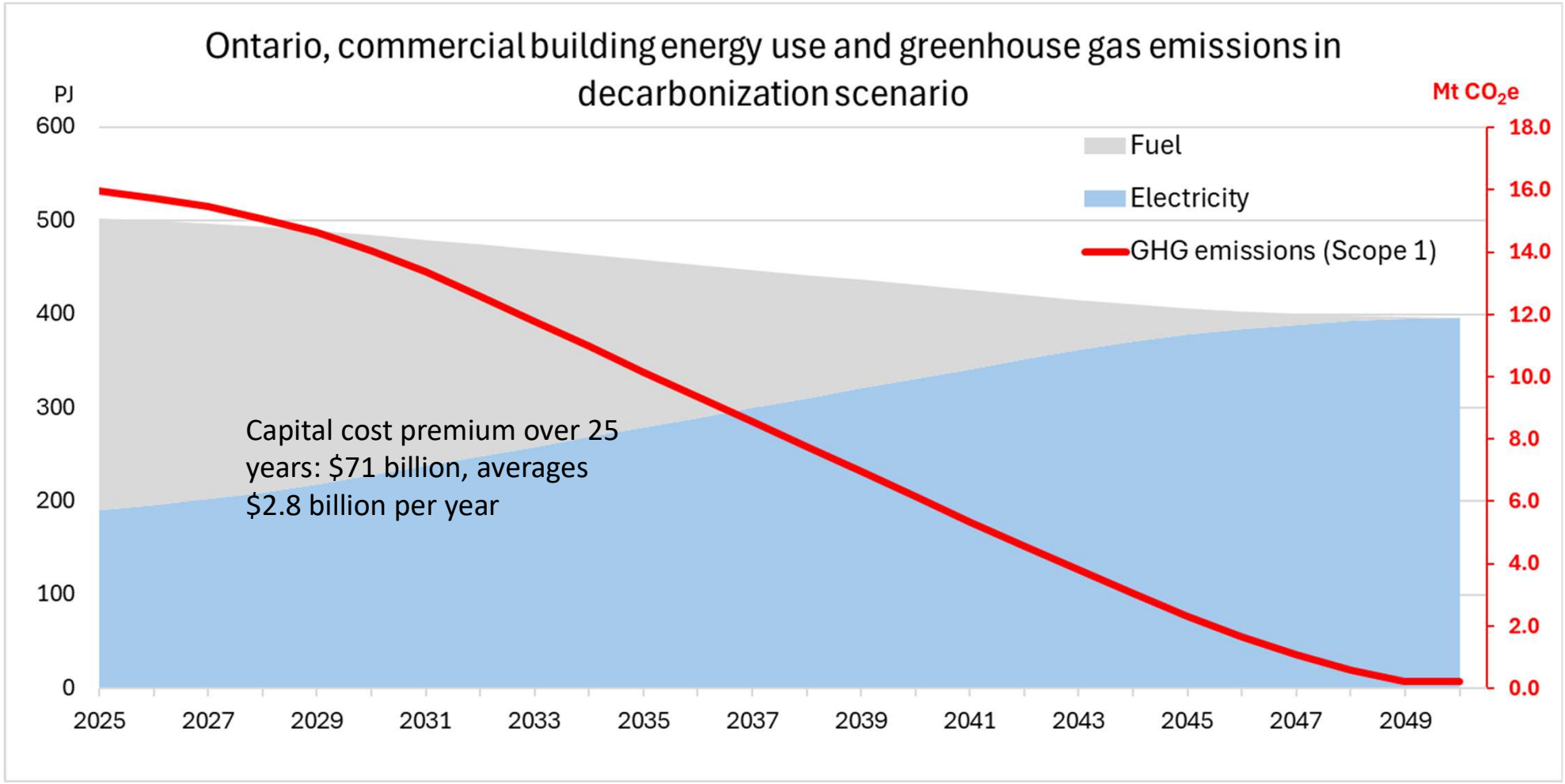

The Hub Canton
5th Line
10
10

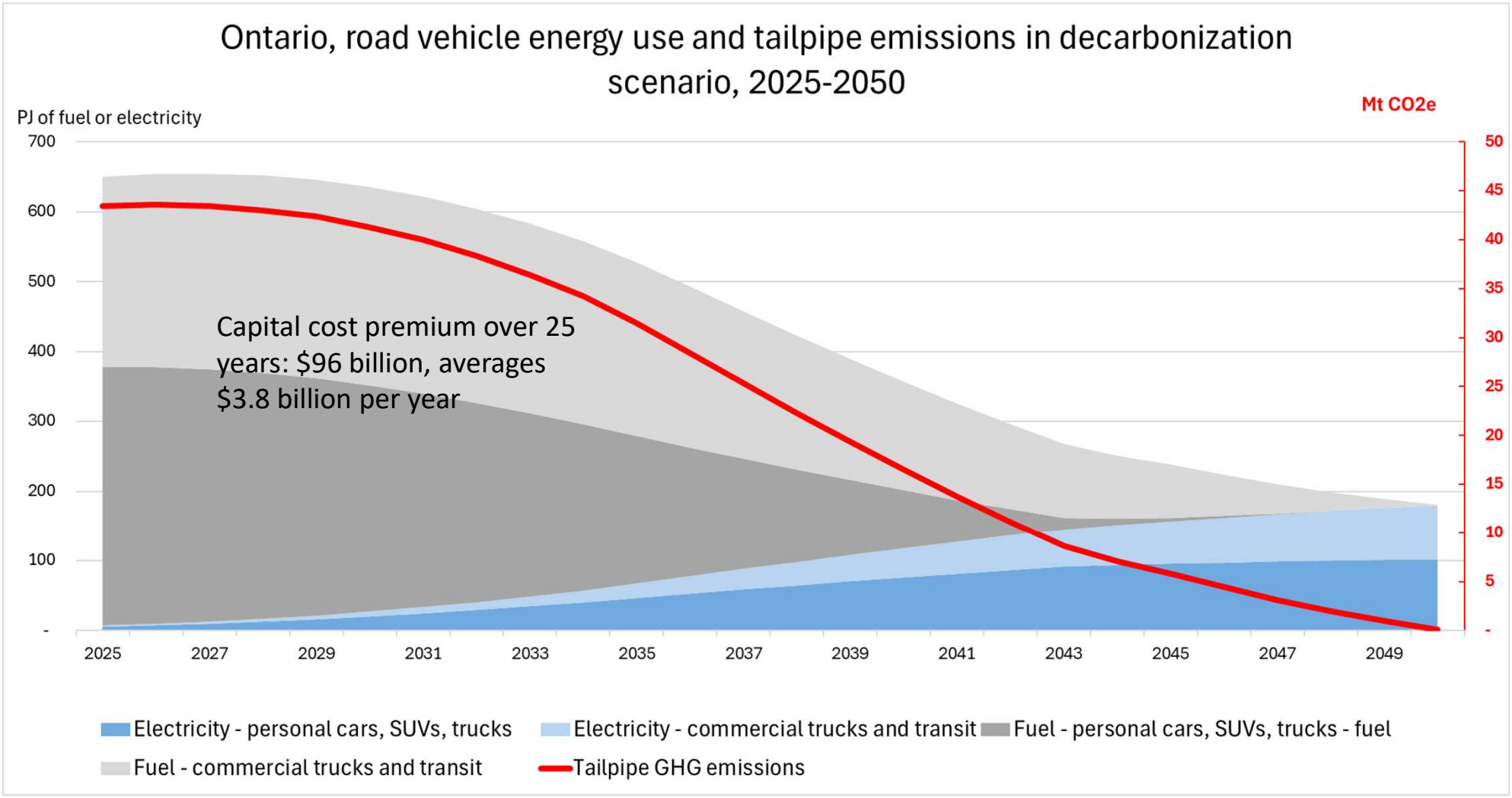

Welcome
Port Hope Fish Ladder
Molson St
Morrish
Plantation House
Bed & Breakfast
Top rated
Ridout St
Walton St
Mill St N
Port Hope
Port Hope Golf
& Country Club
East Beach
Lakeshore Rd
Lakeshore Rd
Lakeshore Rd
Port Britain
Wesleyville
401
2
70
28

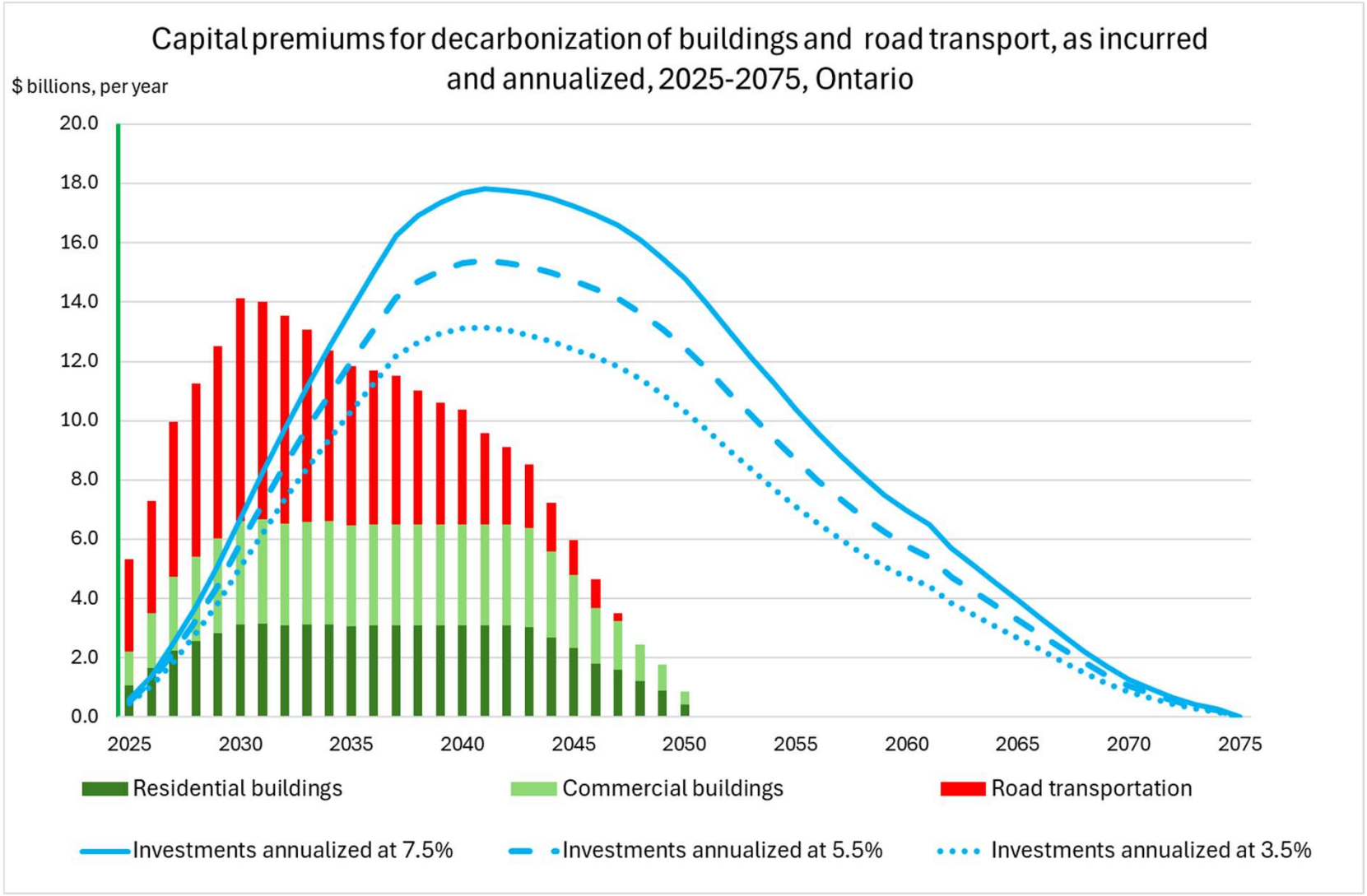

Molson St
401
2
70
Hampton Inn by Hilton
Port Hope Cobourg
Stacked Pancake
& Breakfast House
Mobil
M&M Food Market
Cemetery
Hello Counselling
Services
Plantation House
Bed & Breakfast
Top rated
Starbucks
Victoria St N
Mill St N
Walton St
Ridout St
Branley St S
Artisan Aesthetics -
Botox, Filler, Emsella
Port Hope
Lakeshore Rd
Dorset St W
Waterfront Trail
Port Hope Golf
& Country Club
East Beach
West Beach
Lakeshore Rd
Lakeshore Rd


Electricity Consumption in Ontario, 1958-2024
Billions of kilowatt-hours
180
160
140
120
100
80
60
40
20
0
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021
2024
Proposed 10 GW power plant -- output equals 60% of total provincial consumption in 2024.

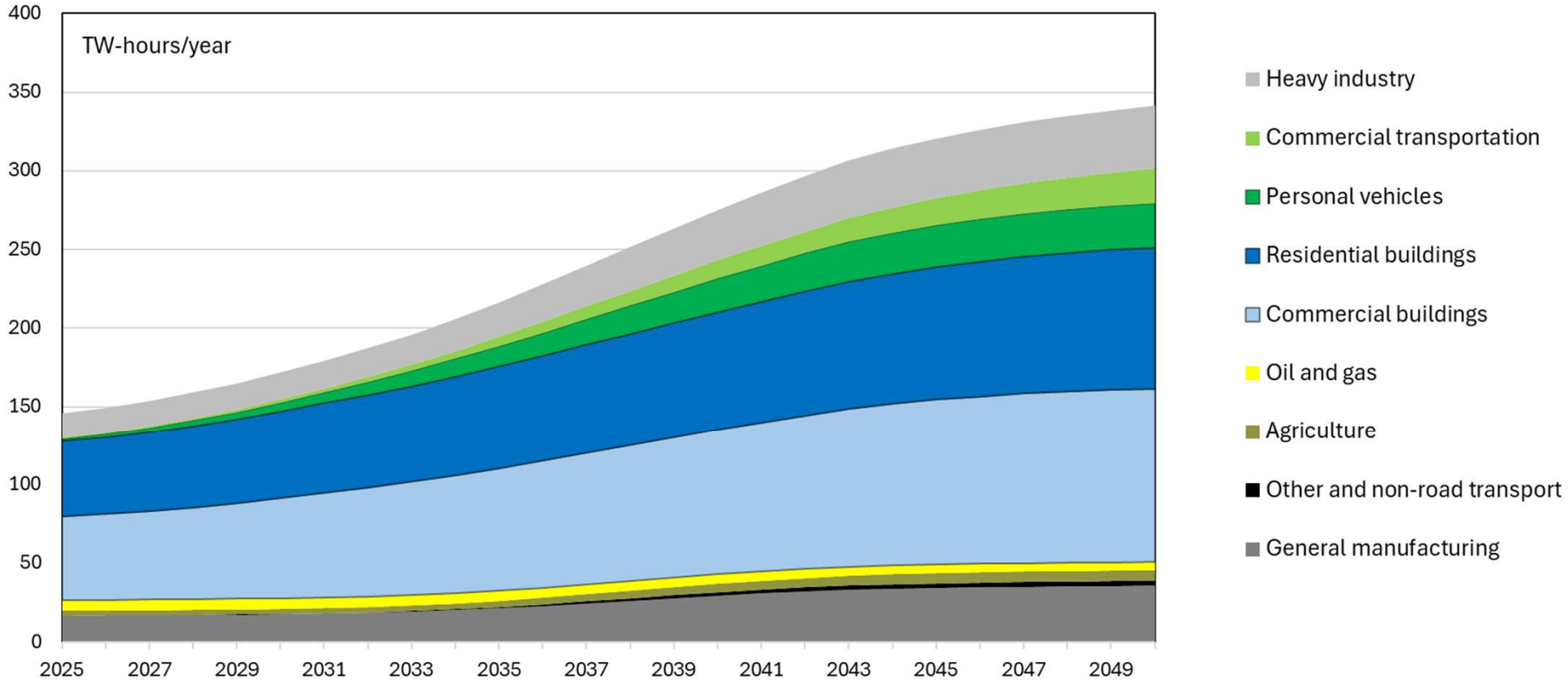

Residential energy use and greenhouse gas emissions in a decarbonization scenario, Ontario
PJ
Mt Co2e
600
500
400
300
200
100
-
40
35
30
25
20
15
10
5
-
Fuel
Electricity
GHG Emissions
Capital cost premium over 25 years: $65 billion, averages $2.6 billion per year
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049


Ontario, commercial building energy use and greenhouse gas emissions in decarbonization scenario
PJ
Mt CO_2e
600
500
400
300
200
100
0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Fuel
Electricity
GHG emissions (Scope 1)
Capital cost premium over 25 years: $71 billion, averages $2.8 billion per year
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049


Ontario, road vehicle energy use and tailpipe emissions in decarbonization scenario, 2025-2050
PJ of fuel or electricity
Mt CO2e
700
600
500
400
300
200
100
-
50
45
40
35
30
25
20
15
10
5
-
Capital cost premium over 25 years: $96 billion, averages $3.8 billion per year
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
Electricity - personal cars, SUVs, trucks
Electricity - commercial trucks and transit
Fuel - personal cars, SUVs, trucks - fuel
Fuel - commercial trucks and transit
Tailpipe GHG emissions

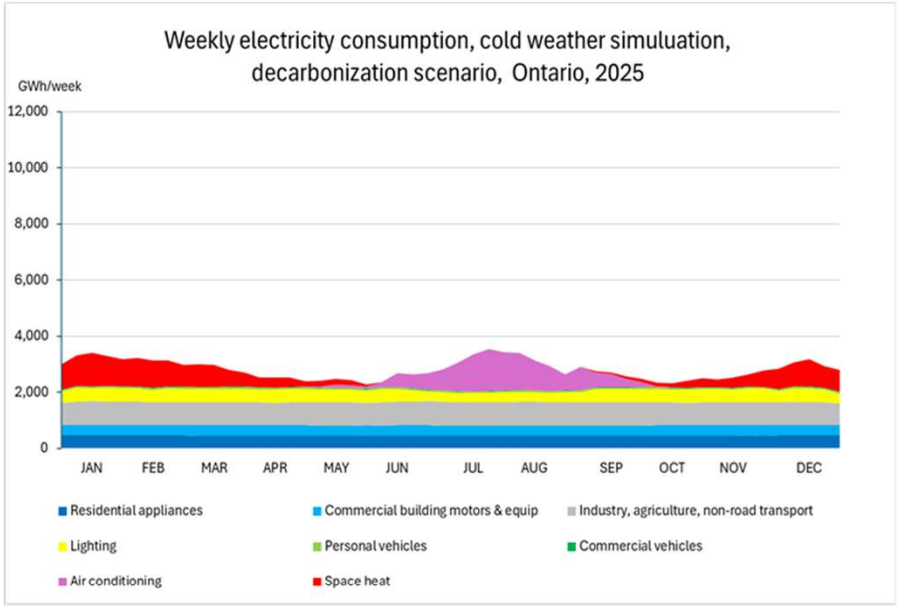

Capital premiums for decarbonization of buildings and road transport, as incurred and annualized, 2025-2075, Ontario
$ billions, per year
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Residential buildings
Commercial buildings
Road transportation
Investments annualized at 7.5%
Investments annualized at 5.5%
Investments annualized at 3.5%

Electricity use by sector, decarbonization scenario, Ontario, 2025-2050



2025, BEFORE electrification

2050, AFTER electrification



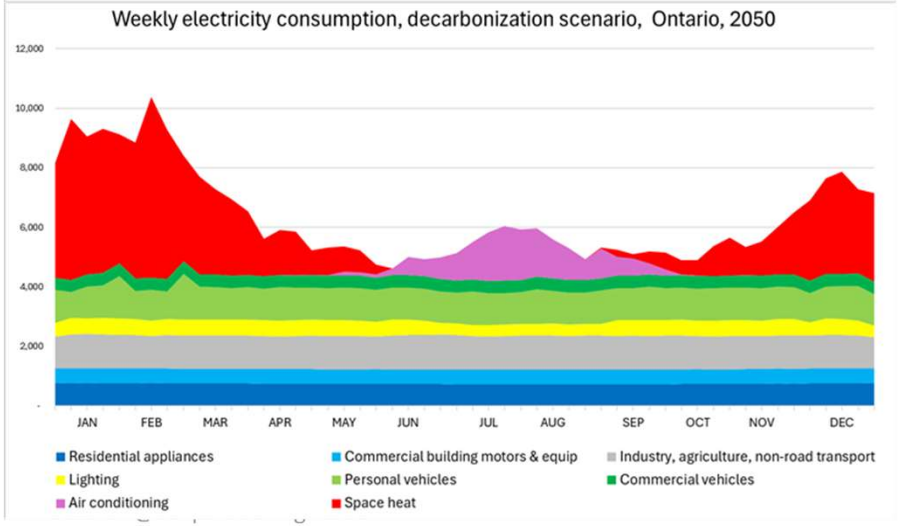


Figure 1. Weekly electricity consumption in Ontario, 2025 vs. 2050

Electricity supply options

Supply Option	Capacity in 2050	Capital cost	Notes	Total capital over 25 years
Solar	27.3 GW, mix of residential rooftop and larger commercial systems	$2-$3.4k per kW and declining over time, as per NREL ATB	Average yield 811 kWh/kW for rooftop and 1,166 kWh/kW for commercial scale. Annual capacity factors 9-13%.	$40.5 billion
Wind	62/56/49 GW in L/M/H nuclear scenarios	$2.3k/kW and declining as per NREL ATB	Annual capacity factor 35%	$122/$109/$96 billion in L/M/H nuclear scenarios
Nuclear	0.3, 10.5 and 20.1 GW in L/M/H nuclear scenarios	About $3.5 B per rebuild, $21 billion for Darlington 300 MWs, and $10.4 k per kW for Bruce C and Wesleyville	Assume capacity factor of 90%, reference case forecasting used for plant lifetimes	$12/$98/$225 billion in L/M/H nuclear scenarios
Grid connection and T&D	Scales with new capacity added	$750 million per GW of new capacity, plus Ontario share of $35 billion TransCanada line	T&D costs are moderated when nuclear plant retirements free up capacity, moderating incremental capex of high wind/low nuclear scenario	$59/$56/$53 billion in L/M/H nuclear scenarios

All figures are for scenarios in which vehicle-to-grid supplies short term storage by 2050, $2 billion is invested in hydro refurbishment, and the TransCanada Transmission Line (TCTL) is built out. Without the TCTL, Ontario capital expenditures for wind and T&D more than double. Using utility batteries rather than V2G adds $73 billion to total decarbonization costs after netting out the cost of the smart, bidirectional charging network.

Capital investment in electricity supply system by province, reference scenario with national grid, 2025-2050, $ billions						
	Wind	Solar	Hydro	Nuclear	T&D	Total
British Columbia	53	8			26	87
Alberta	89	9			43	141
Saskatchewan	25	4			12	41
Manitoba	25	1	8		12	45
Ontario	122	40	2	12	59	235
Quebec	164	11	32		79	286
Maritimes	30	3			15	48
Newfoundland and Labrador	29	0	26		14	69
Canada	**536**	**78**	**68**	**12**	**260**	**954**

2025-11-26 cdtable

Total decarbonization capital costs for Ontario

Item	Capital cost
Building electrification (heat pumps, retrofits)	$136 billion
Road transport electrification (EVs, charging network)	$96 billion
Electricity system – low nuclear	$235 billion
Electricity system – high nuclear with Wesleyville	$392 billion
TOTAL CAPITAL COSTS, LOW NUCLEAR	**$475 billion**
TOTAL CAPITAL COSTS, HIGH NUCLEAR, WITH WESLEYVILLE	**$655 billion**

New nuclear builds drive up the cost of electricity while a commitment to renewables can hold them steady or even bring power rates down. Higher cost electricity slows down both the decarbonization of the electricity supply and the electrification of buildings and transport. Other items that will drive up the cost of electrification are over-reliance on utility batteries instead of V2G, failure to build the TransCanada Transmission Line, overspending climate mitigation funds on deep retrofits, and multi-billion-dollar mass transit projects that yield low emission reductions per dollar invested, especially as vehicles electrify. Bad choices can add tens and even hundreds of billions to the total cost of decarbonization.

Summary of nuclear power inclusions in decarbonization scenarios				
		Low	**Medium**	**High**
Committed rebuilds	Darlington, Bruce A and Bruce 6	Yes	Yes	Yes
Planned rebuilds	Pickering B, Bruce 6,7 & 8	No	Yes	Yes
Darlington 4X300 BWR Prototype	Online 2030-2040	Unit 1 only	All units	All units
Bruce C (4X1200 MW)	Online 2046-2049	No	Yes	Yes
Wesleyville (8X1200 MW)	Online 2043-2050	No	No	Yes
Total GW on line in 2040		7.3	10.6	10.6
Total MW on line in 2050		0.3	11	20
Total capital costs (billion $)		12	98	223

2025-11-26 CDBalance

Impact of nuclear supply on decarbonization capex (all figures in $ billions)

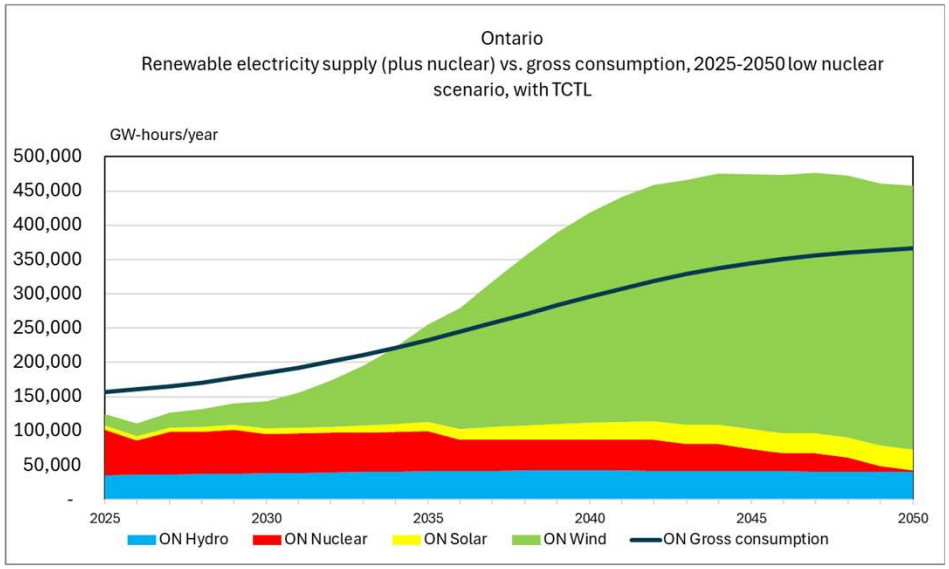
Nuclear Scenario	Siloed grids					TCTL - National grid				
	Ontario			Rest of CA	All of Canada	Ontario			Rest of CA	Al of Canada
	Nuclear	Wind and T&D	Total	Wind and T&D	Nuclear, wind and T&D	Nuclear	Wind and T&D	Total	Wind and T&D	Nuclear, wind and T&D
Nuclear A	12	450	462	454	**916**	12	181	193	615	**808**
Nuclear B	98	378	476	454	**931**	98	164	262	559	**821**
Nuclear C	223	312	536	454	**990**	223	149	373	507	**880**

The data are for capital costs only. With a national grid and unrestricted trade in electricity, if Ontario builds more nuclear capacity then wind investment declines in the provinces that would otherwise be building renewable generation to supply Ontario. Regardless of whether there is interprovincial trade, new nuclear capacity drives up the net capital cost of decarbonization.

2025-11-26 Cdtable

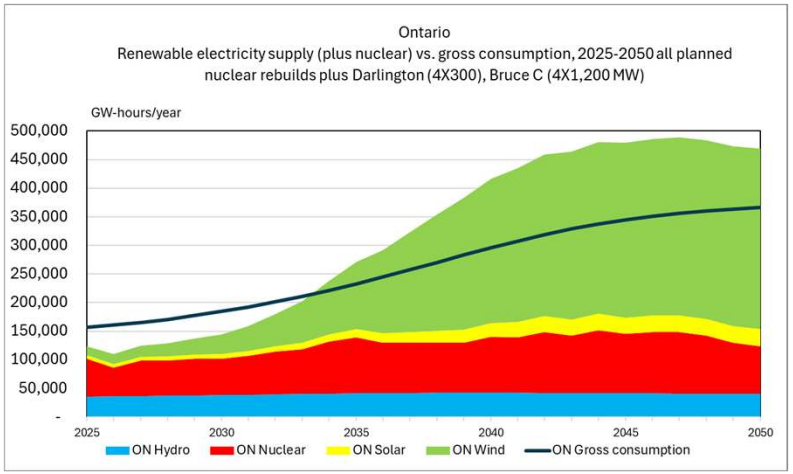
New nuclear builds – Wesleyville would add $60 billion to the cost of decarbonizing the Ontario economy, after allowing for reduced wind investment and T&D savings.

Low nuclear case - $462 billion (no TCTL)

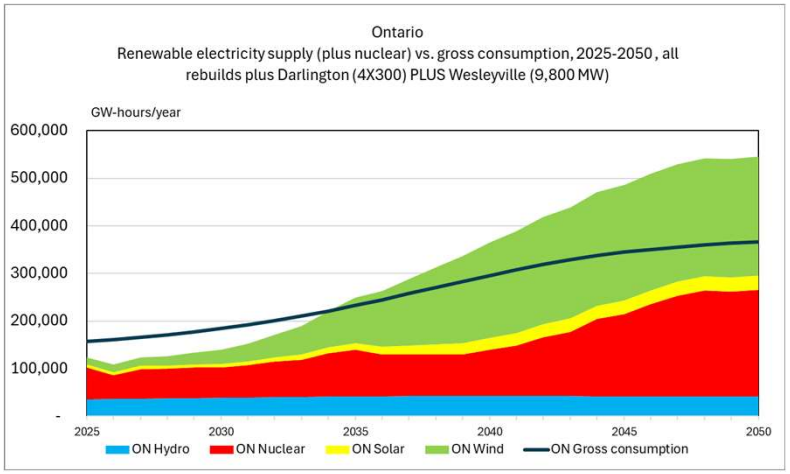


Variations on the reference case were developed to test different contributions from nuclear power in Ontario. All variations supply the same amount of electricity. Transmission and distribution costs are lower with the medium and high nuclear scenarios, and investment in wind generation is lower than in the low nuclear case. New nuclear builds drive up the overall capital cost of decarbonization, even after these offsetting impacts, and the higher operations and maintenance costs further disadvantage nuclear.

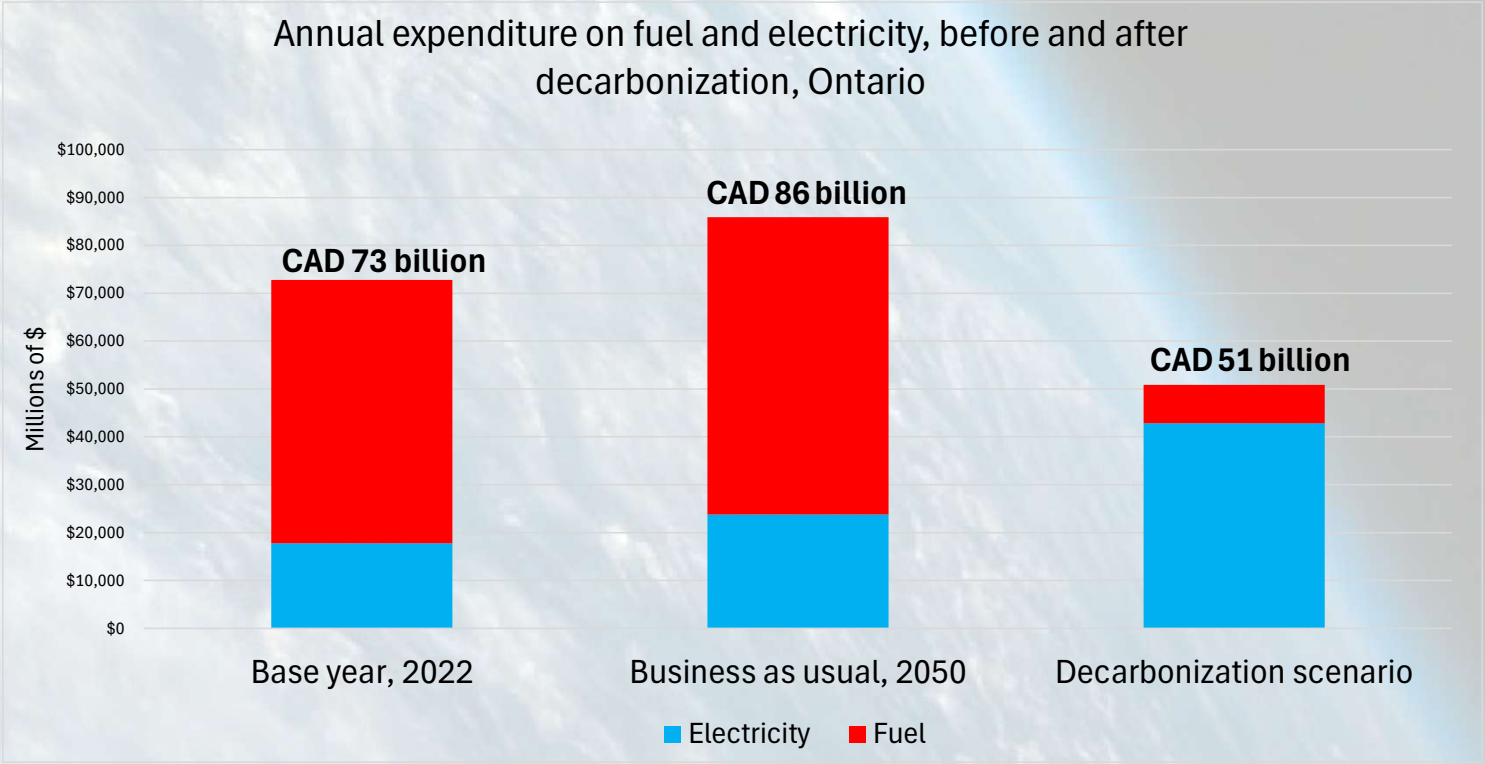
Medium nuclear, with Bruce C - $476 billion



High nuclear, with Bruce C & Wesleyville - $536 billion



If we make smart choices (i.e. build the TCTL, build out V2G infrastructure, and avoid overspending on deep retrofits, transit Gigaprojects and expensive and untried nuclear options), electrification will largely pay for itself. How often can we say that about an emergency response?



Spending on fuel and electricity declines in the electrified, decarbonized future. By 2050, after allow for the growth in spending on electricity (which carries the capital cost of the electricity system expansion) there are still annual savings of $22 billion per year compared to current spending, more than enough to cover the $10-$11 billion annual carrying costs of the capital premiums for building and road transport electricity.

We need energy technologies with the following attributes that support a sustainable energy system:

- Low or no greenhouse gas emissions
- Renewable
- Efficient, including cost efficient
- Circular and waste free
- Safe fail, resilient, diverse, free of ecocidal and geopolitical risk
- Aligned with cultural values

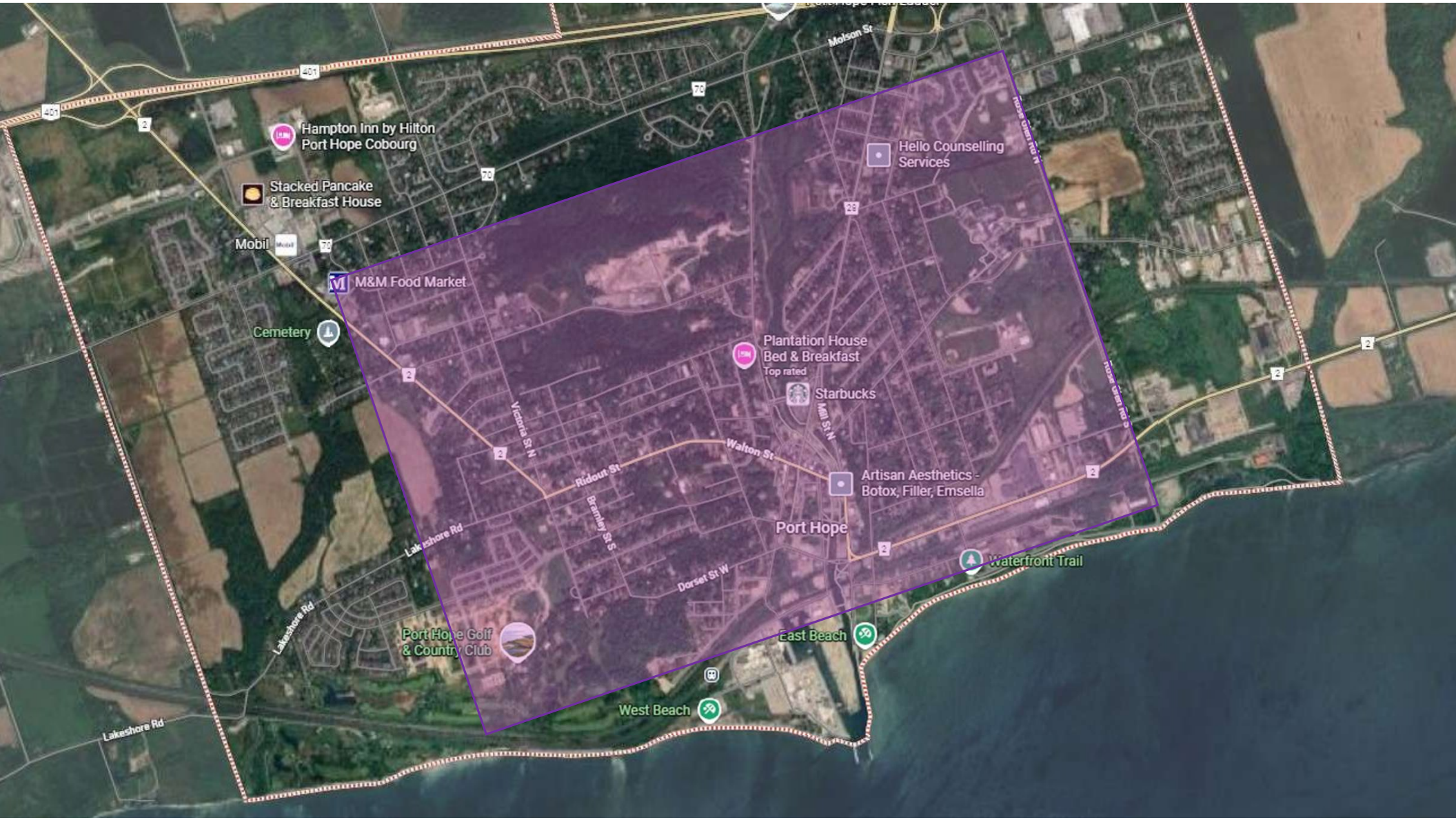
Is nuclear power aligned with sustainability?

- Low or no greenhouse gas emissions?
- Renewable?
- Efficient? Cost efficient?
- Circular and waste free?
- Safe, fail, resilient, diverse, free of ecocidal and geopolitical risk?
- Aligned with cultural values?

Is it aligned with your values?

Bruce Power's award-winning nuclear response team. Source: Bruce Power.

A guard stands watch at the Darlington nuclear facility in Courtice, Ontario, on Thursday, October 30, 2014. (Frank Gunn/The Canadian Press)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