Ontario Electricity Emissions Factors & Guidelines

Maryam Shekarrizfard
Manager, Research and Innovation
mshekarrizfard@taf.ca

Ekaterina Tzekova
Director, Research and Innovation
etzekova@taf.ca

MODERATED BY:
Julie Leach
Senior Manager, Communications and Campaigns
jleach@taf.ca

TAF

TAF

A regional climate agency investing in low-carbon solutions for the Greater Toronto and Hamilton Area + illuminating paths to scale implementation.

Team

Experienced team co-creates with private, public and non-profit sector stakeholders to reduce carbon emissions.

Impact

We invest in, grant, influence policies, and run programs to advance promising concepts.

Flexible Funding

We're game to collaborate to define innovative funding structures that help businesses establish important ideas.

LC3

Low Carbon Cities Canada member.

01 Context →

02 Best Practices →

03 TAF Guidelines →

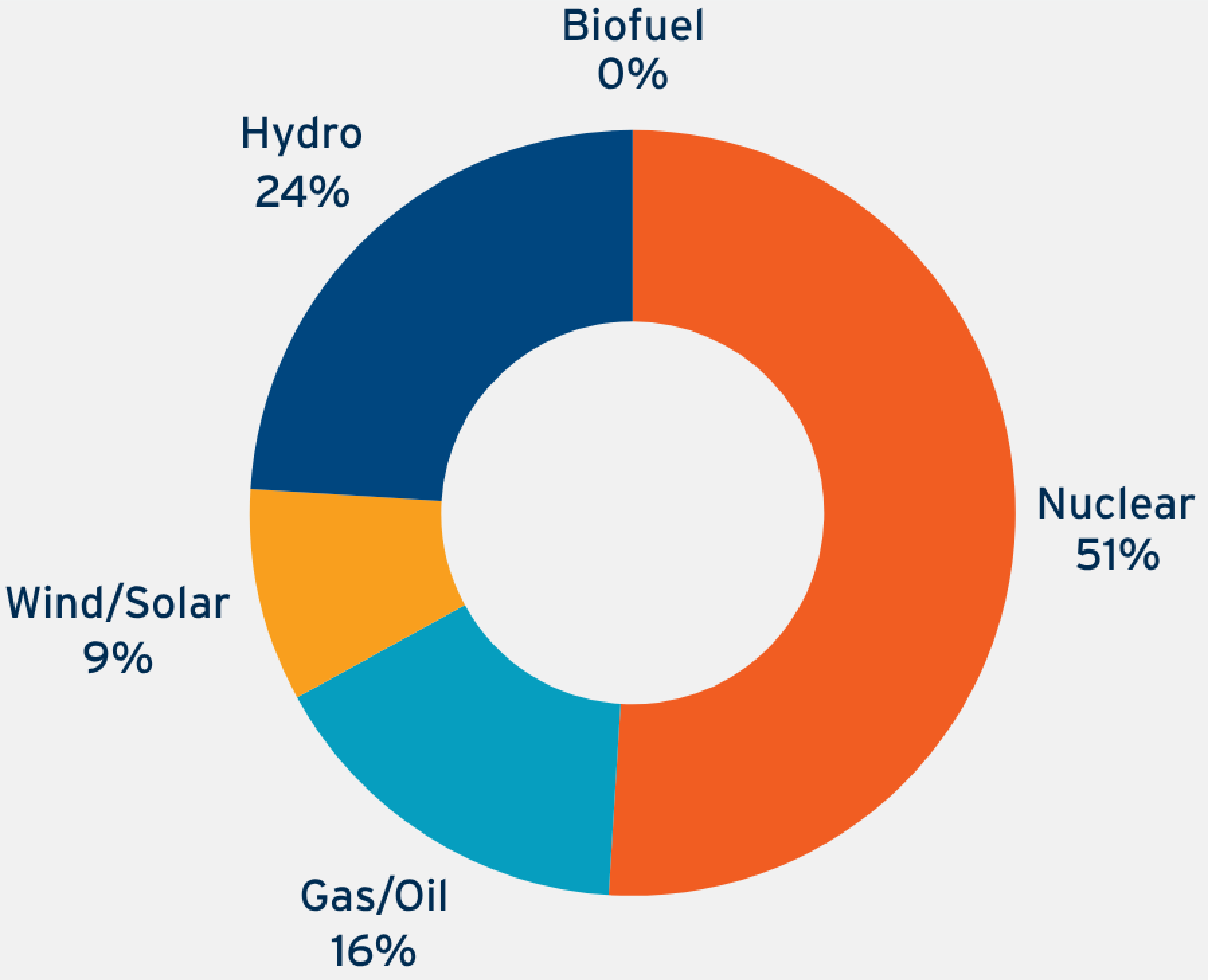
04 Methodology →

05 Examples →

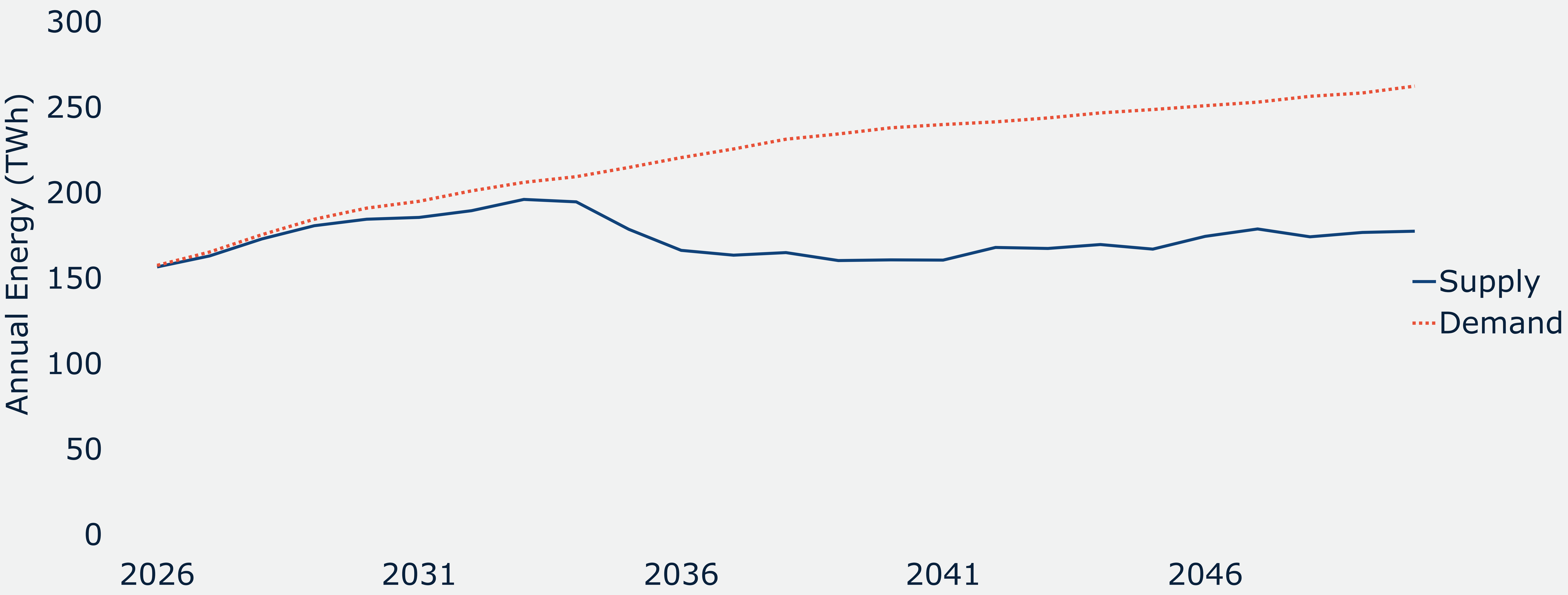
06 Recommendations →

Context →

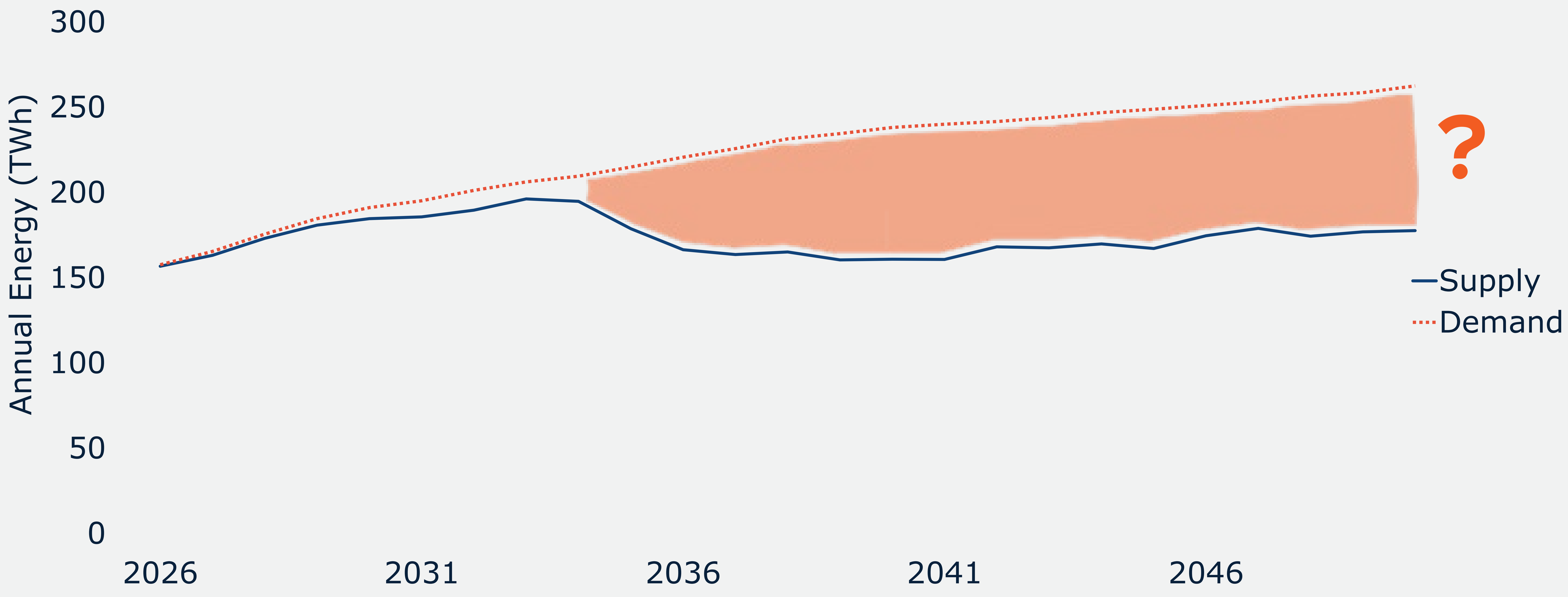
Ontario's Electricity Mix in 2024



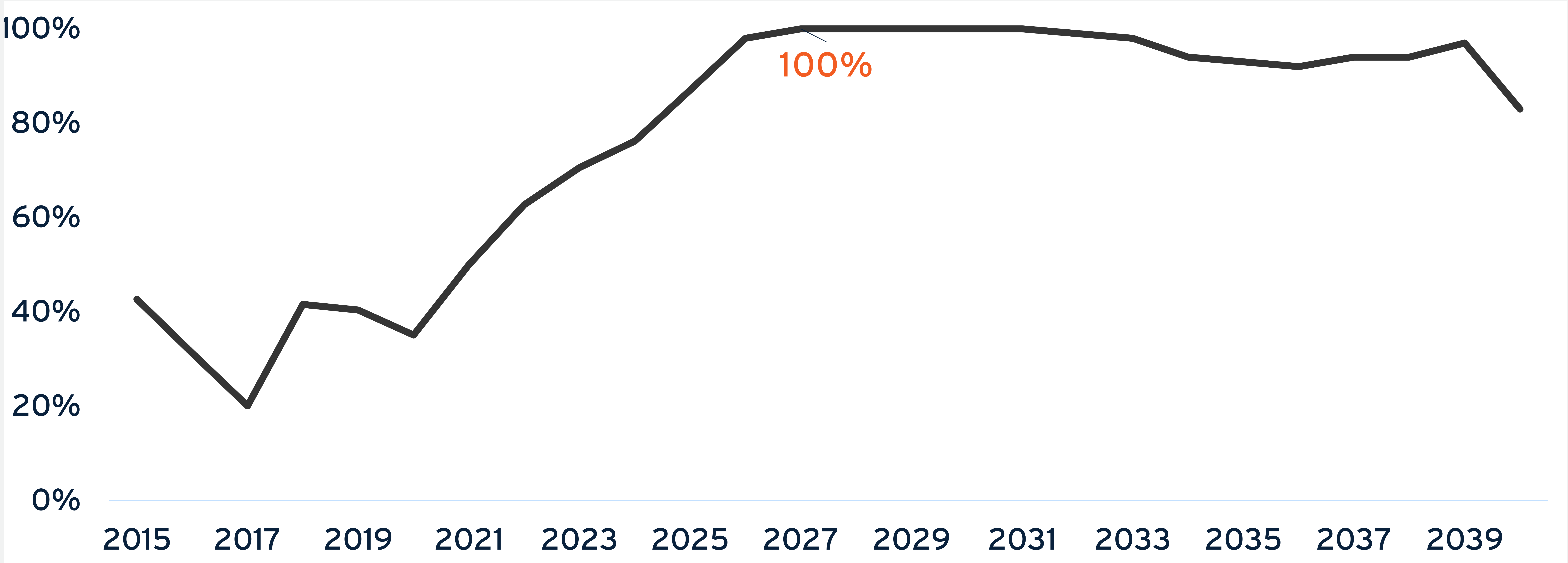
Energy Adequacy 2026 to 2050



Energy Adequacy 2026 to 2050



Gas on the margin 2015-2040



Best Practices →

Two Categories: Marginal Factors

Short-Run Factors

Electricity grid does not structurally change or rebalance due to interventions.

Long-Run Factors

Electricity grid rebalances and accommodates interventions.

Use Cases

- ✓ Load shifting smart appliances
- ✓ Time of use
- ✓ Energy/battery storage

Use Cases

- ✓ Electrification
- ✓ Energy efficiency

Ontario Context

Short-Run Factors

Lack of data: We need published data indicating which resources are on the margin.

Long-Run Factors

Lack of policy certainty: Will non-emitting resources be used to meet new, incremental energy demand?

TAF recommends the use of marginal emissions factors for short-term demand changes.

TAF recommends the use of average emissions factors for long-term demand changes.

TAF Guidelines →

TAF Guidelines

Project Type	Recommended Factors	Use Cases
Preparing an inventory/ Assessing a footprint	Annual AEF	✓ Historical ✓ Forecast
	Hourly AEF	✓ Historical (where more precision is needed) X Forecast
Evaluating long-term changes in demand	Annual AEF*	✓ Historical ✓ Forecast (majority of scenarios)
Evaluating short-term changes in demand	Annual MEF Monthly/Seasonal MEF	✓ Historical (where more precision is needed) ✓ Forecast (specific use cases like load shifting, battery storage)
Evaluating the impact of new electricity generation	Combination of Annual MEF and Annual AEF*	✓ Historical ✓ Forecast

** Proxy for long-run MEFs*

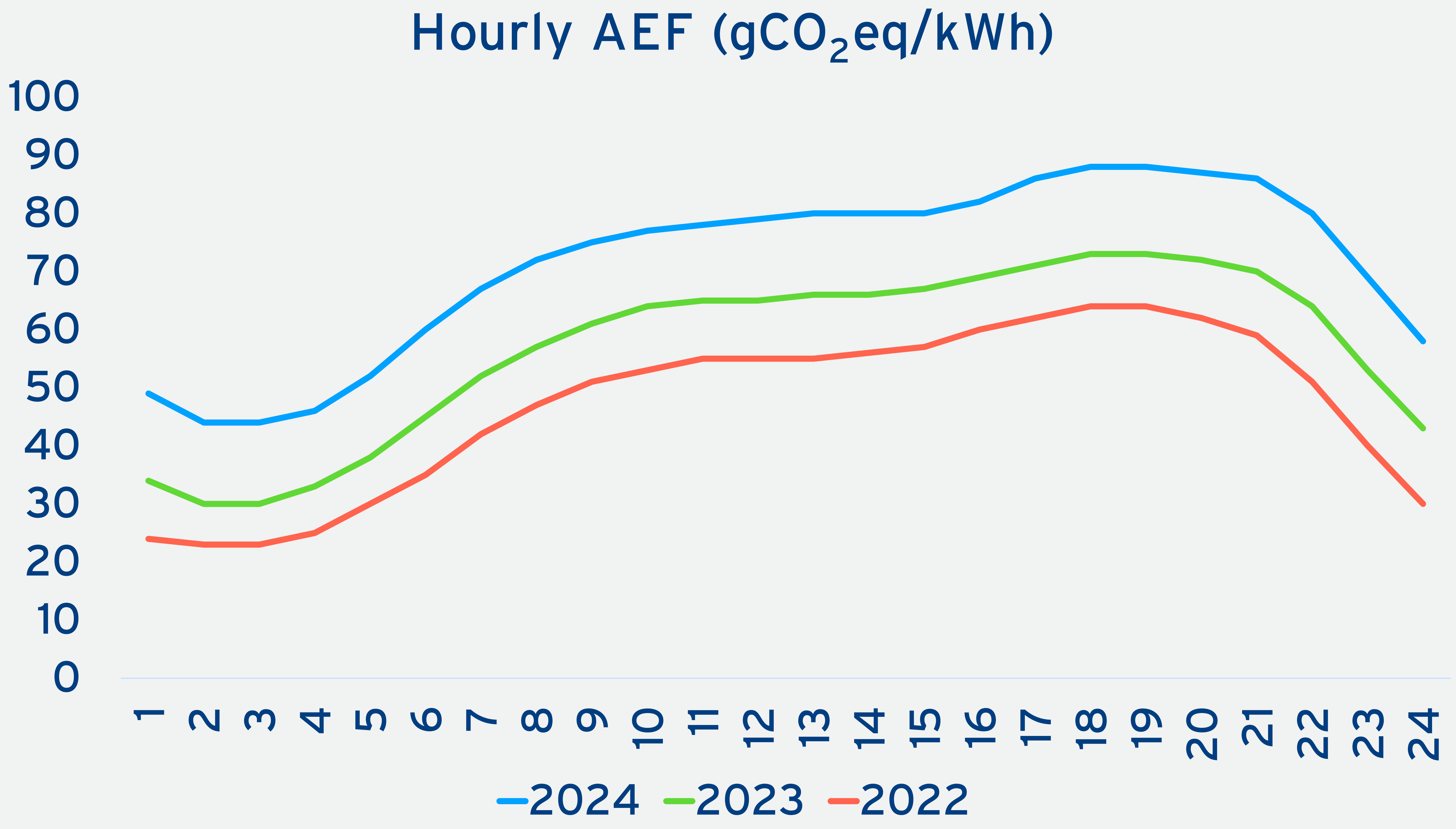
AVERAGE EMISSIONS FACTORS →

Historical Annual AEF

Annual AEF (gCO_2eq/kWh)	
2015	46
2016	40
2017	18
2018	29
2019	29
2020	35
2021	43
2022	49
2023	59
2024	73

The total emissions from electricity production in Ontario (gCO_2eq) divided by the total electricity produced (kWh) in any given year.

Historical Hourly AEF



The total emissions from electricity production in Ontario divided by the total electricity produced in a specific hour of the day, averaged over the year.

Factors 2015-2024 are available as a downloadable file.

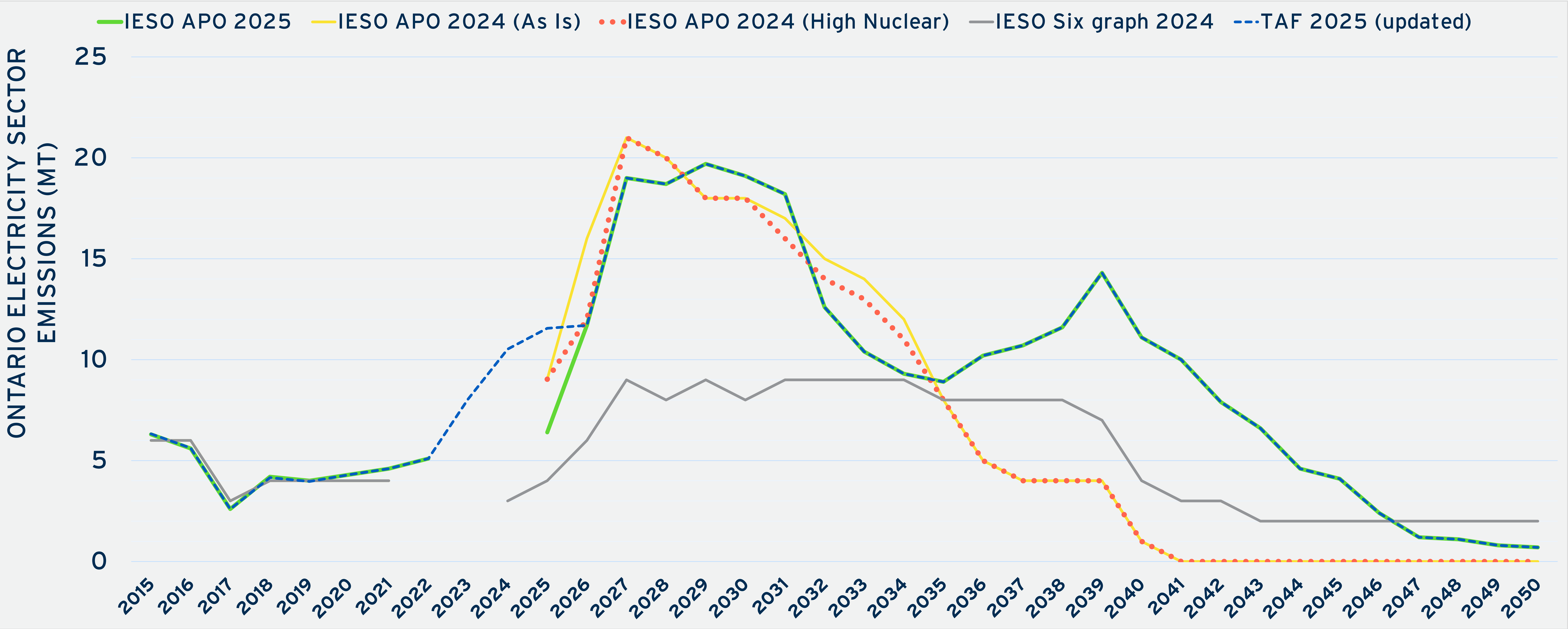
Forecasted AEF

Forecasted AEFs (gCO_2eq/kWh)	
2025	75
2026	81
2027	124
2028	113
2029	113
2030	106

Based on IESO's 2025 generation forecast in Capacity Expansion Scenario, Cost and Emissions Module.

Factors forecasted to 2050, available as a downloadable file.

Forecasted AEF



MARGINAL EMISSIONS FACTORS →

Historical Annual MEF

Annual AEF (gCO_2eq/kWh)	
2015	190
2016	143
2017	84
2018	181
2019	178
2020	180
2021	241
2022	288
2023	312
2024	343

The percentage of gas on the margin multiplied by the average emission intensity of natural gas plants in a given year.

Forecasted MEF

Forecasted AEFs (gCO_2eq/kWh)	
2025	392
2026	349
2027	434
2028	442
2029	382
2030	397

Based on percentage of natural gas on the margin for annual and seasonal times (provided by IESO) and grid gas generation intensity.

Factors forecasted to 2040 are available as a downloadable file.

Examples →

EV Charging

Estimating the total carbon emissions associated with charging several electric vehicles (EVs) in a multi-family residential building across an entire year.

EV Charging

Estimating the total carbon emissions associated with charging several electric vehicles (EVs) in a multi-family residential building across an entire year.

01

Hourly consumption data

Date/Time Ending	Hour Ending	Total Consumption (kWh)
01/01/2023 01:00	1	41.3
01/01/2023 02:00	2	37.4
01/01/2023 03:00	3	36.8
01/01/2023 04:00	4	36.2
...	...	...
12/31/2023 20:00	20	28.3
12/31/2023 21:00	21	29.2
12/31/2023 22:00	22	33.7
12/31/2023 23:00	23	37.4
01/01/2024 00:00	24	38.3

EV Charging

Estimating the total carbon emissions associated with charging several electric vehicles (EVs) in a multi-family residential building across an entire year.

02

Hourly data is aggregated across the year, by hour

Hour Ending	Total Consumption (kWh)
1	10,950
2	11,680
3	9,855
4	9,125
5	5,475
6	7,665
7	3,650
8	5,110
9	5,475
10	5,110
11	5,110
12	4,745
13	4,380
14	4,745
15	5,110
16	5,110
17	5,840
18	5,475
19	7,665
20	9,855
21	9,490
22	11,315
23	10,220
24	8,760
Total:	171,915

EV Charging

Estimating the to[...] emissions associa[...] charging several e[...] vehicles (EVs) in a [...] residential buildin[...] entire year.

03

Apply 2024 AEFs then add together for total emissions

Hour Ending	Total Consumption (kWh)	2024 AEF (gCO2eq/kWh)	Total Emissions (t)
1	10,950	49	0.54
2	11,680	44	0.51
3	9,855	44	0.43
4	9,125	46	0.42
...			
21	9,490	86	0.82
22	11,315	80	0.91
23	10,220	69	0.71
24	8,760	58	0.51
Total:	**171,915**	**-**	**11.85**

Fuel Switching

Estimating the change in carbon emissions from electrifying a large building.

Fuel Switching

Estimating the change in ca
from electrifying a large bui

01

The feasibility study revealed the impacts of replacing the existing gas boilers with a high-efficiency electric heat pump system:

30,000 m^3/year
Decrease in natural gas consumption from the gas boilers

150,000 kWh/year
Increase in electricity consumption the heat pump system

Fuel Switching

Estimating the change in carbon e
from electrifying a large building

Expected carbon reduction

$(150{,}000\ \text{kWh/year} \times 73\ \text{gCO}_2\text{eq/kWh} \times 0.000001\ \text{tCO}_2\text{eq/gCO}_2\text{eq})$
$-\ (30{,}000\ \text{m}^3\text{/year} \times 0.001931\ \text{tCO}_2\text{eq/m}^3)$

$= -47\ \text{tCO}_2\text{eq/year}$ (savings)

Recommendations →

Regulatory Recommendations

IESO: Publish historical and forecasted marginal resource data.

✓ To enable better understanding of the carbon impacts of load shifting and or using battery storage to mitigate carbon emissions.

Ontario Government: Increase the speed at which new non-emitting generation is built.

✓ To fully realize emissions reductions through electrification efforts.

Thank you



Maryam Shekarrizfard
Manager, Research and Innovation
mshekarrizfard@taf.ca

Julie Leach
Senior Manager, Communications and Campaigns
jleach@taf.ca

Ekaterina Tzekova
Director, Research and Innovation
etzekova@taf.ca