ESMIA
Energy Super Modelers and International Analysts

The Policy Driver: National regulations push for action

Panel 1: Bridging the Provinces – Strengthening Interprovincial Energy Modelling Collaboration

2025 Atlantic Conference on System Energy Modelling

June 18th, 2025

Agenda

1. About ESMIA
2. CER implementation and scenarios
3. Emissions, generation mix, costs, trade and electricity rates
4. Main takeaways

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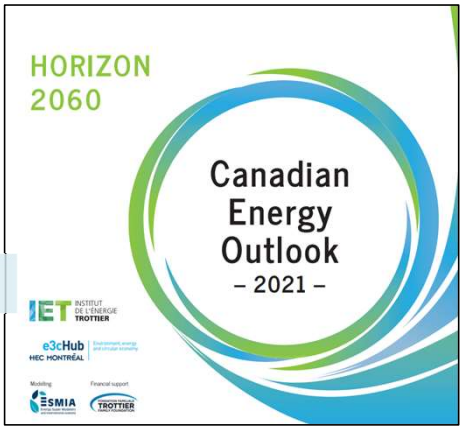
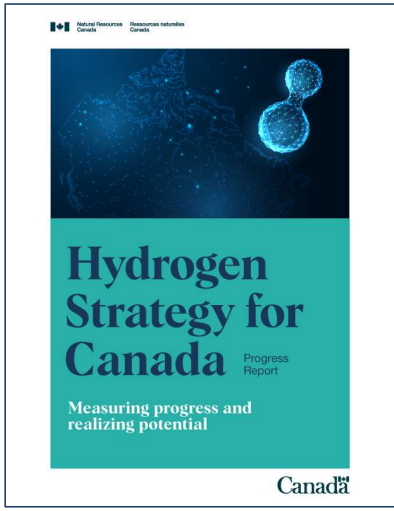
About ESMIA

One-stop shop for 3E integrated system modelling for strategic decision-making

ESMIA offers cutting-edge expertise in **3E (energy-economy-environment)** system modelling for the analysis of optimal energy strategies at the global, national, provincial and urban scales.





Development of turnkey techno-economic models

A full range of services for the development of economy-wide energy system models for high-profile organizations worldwide

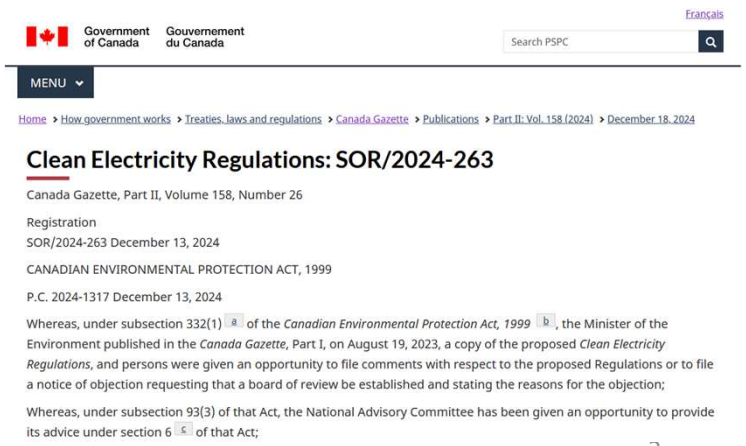
Model application for optimal energy and climate policy analysis

Advisory services for the analysis of complex problems including energy security and climate change mitigation

NATEM RateVision

Training and support

For clients wishing to develop their own energy system model



CER implementation and scenarios

Two load projections with and without CER policy

Load projections

Modelled policies

2021-2050	Current measures load	High electrification load
Current policy measures	**REF**	
Current policy measures + **CER**	**REF-CER**	
Current policy measures + **CER**		**REF-CER-HighELC**

Detailed implementation of CER in NATEM

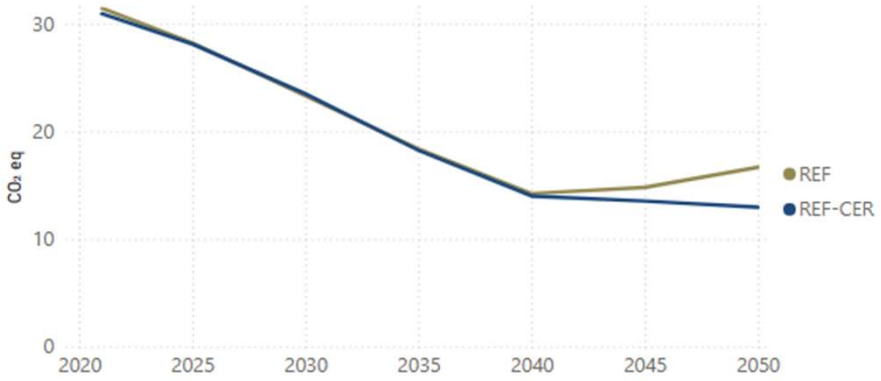
- ✓ **Inclusion and exclusion of power units** based on capacity and connection type (e.g., units under 25 MW and those not connected to the grid)
- ✓ **Annual Emissions Limit** is based on plant capacity
- ✓ **Underlying performance standard:** 65 t/GWh (2035–2049), decreasing to 0 t/GWh in 2050 and beyond
- ✓ Demarcation date for plant applicability
- ✓ **Allowable Offsets:** 35 t/GWh (2035–2049), increasing to 42 t/GWh in 2050 and beyond
- ✓ **Pooling restrictions:** limited to units within the same province; applicable only to non-cogeneration units and utility units using liquid, gas, or biomass fuels; AO pooling is not allowed
- ✓ **Advanced modelling of combined heat and power** (CHP) plants, including CCS retrofit availability at the plant level

GHG emissions – Atlantic provinces

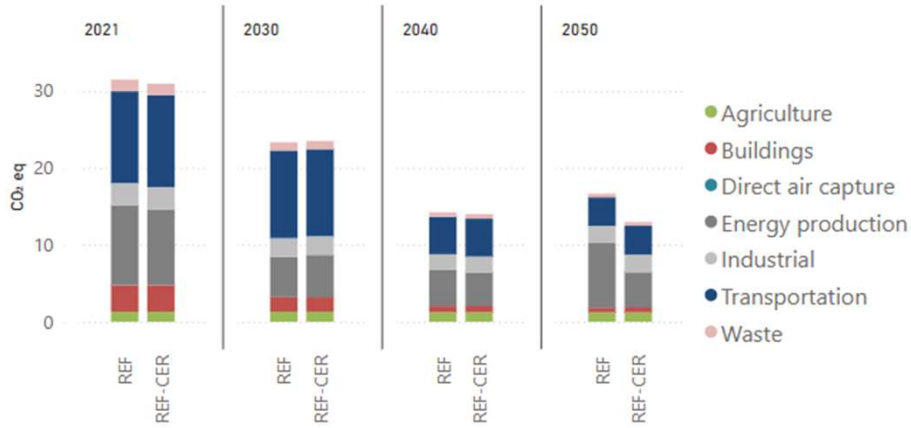
REF policies in place (mostly effective until 2040) drive a reduction in GHG emissions, while CER leads to further emissions reductions beyond 2040

- **Cumulative economy-wide emissions reduction between 2025 and 2050**: 3.71 $MtCO_2eq$ for Nova Scotia and 2.06 $MtCO_2eq$ for New Brunswick
- **Most of the reduction comes from the electricity sector**, though emissions also decrease in the buildings and transportation under both scenarios

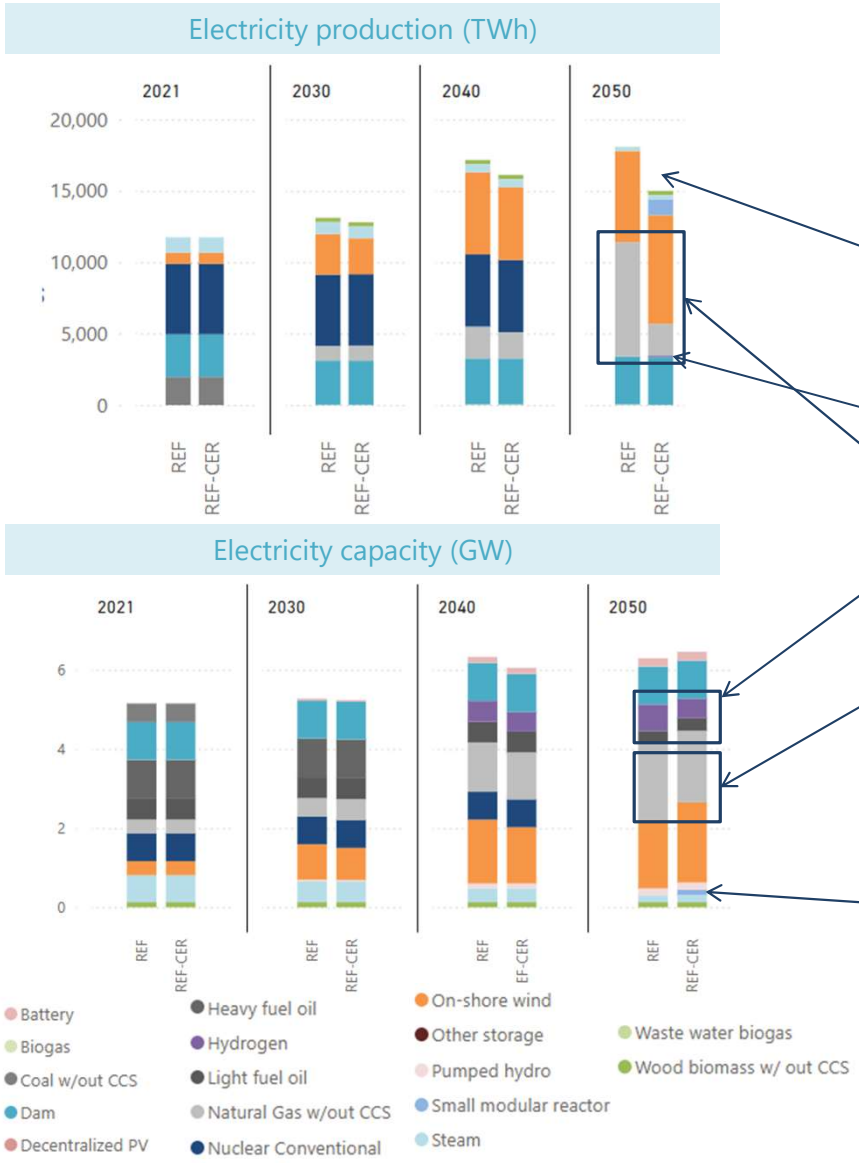
Total GHG emissions in Atlantic provinces (MtCO2eq)



GHG emissions per sector (MtCO2eq)



Resource mix – New Brunswick



1. Decrease of electricity generation – less electricity is needed due to **efficiency gains** in different sectors and **decrease of domestic trade**

2. **Hydrogen used only occasionally for peaking**, oil-based capacities appear in the mix, but are not used

3. Almost the same gas capacities in both scenarios, but in REF it is used for baseload and peaking, in **REF-CER only for peaking and balancing**

4. **Natural gas capacities substitute coal and oil-based capacities** (coal is retired, oil-based capacities decrease by 80%). Retrofit with CCS appears not cost optimal

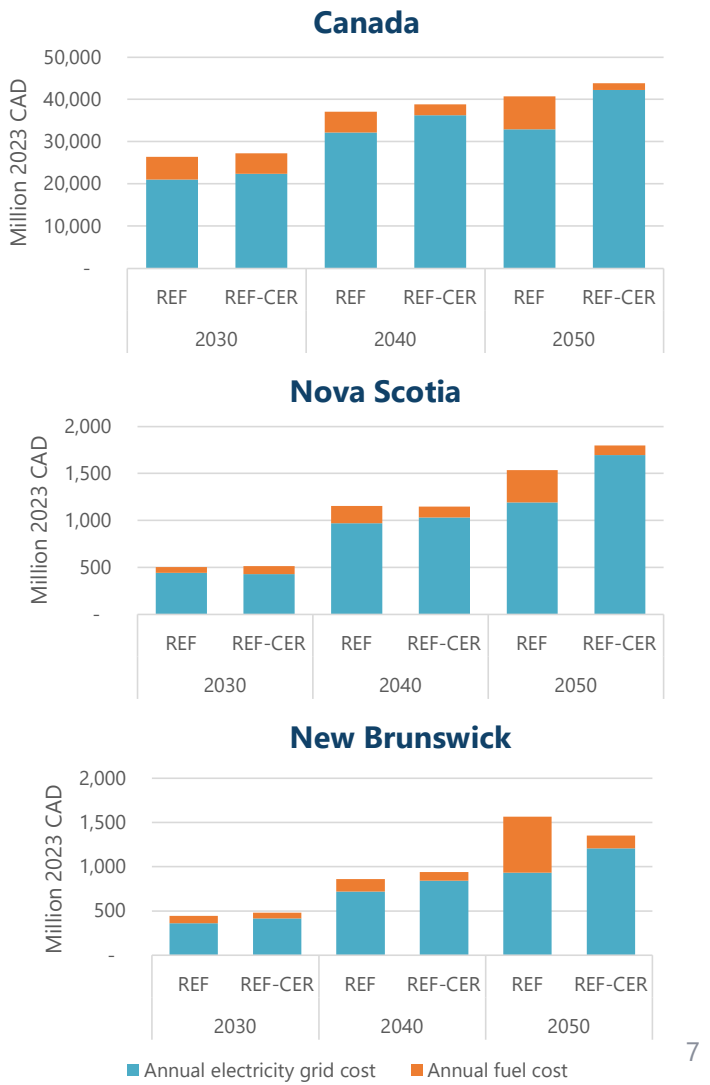
5. By 2050 conventional nuclear capacity is retired, in REF-CER it is partly substituted by **SMRs to cover the baseload**

Cost in the electricity sector

Higher investments required to comply with CER may be partially or fully offset by long-term reductions in fuel costs

- **CER drives up electricity sector investment costs**, primarily due to new energy production and the expansion of nuclear and wind development.
- **Fuel costs are reduced under REF-CER**, due to changes in the production mix.
  - In New Brunswick, CER may become more cost-advantageous than REF by 2050 due **to reduced fuel costs** (no coal, limited oil and gas).

Annual electricity sector cost comparison REF and REF-CER



Affordability – Nova Scotia

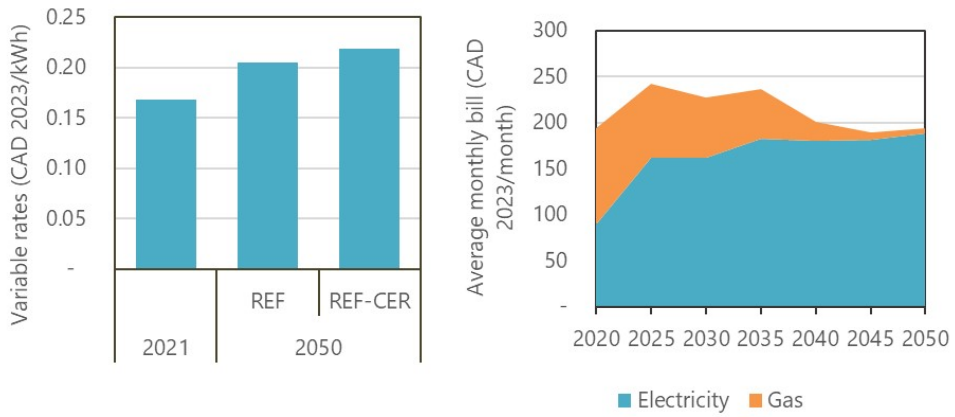
Residential rates increase faster under REF-CER compared to REF

- Between 2021 and 2050, **total variable rate may see an increase** between 12% and 45% depending on the province under REF-CER
- The impact on Nova Scotia rates is among the highest
- **Residential bills may increase** even under switch from gas to more efficient heat pump heating

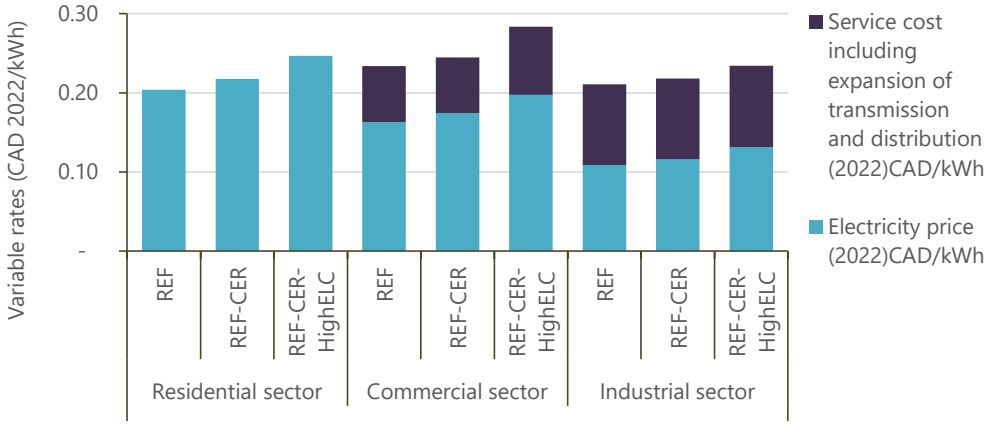
High electrification drive up total variable rates for all categories by 2050

- **High electrification scenarios show the increase in demand peaks**, driving up service costs

Residential rate and typical monthly bill



Variable electricity rates in different categories in 2050



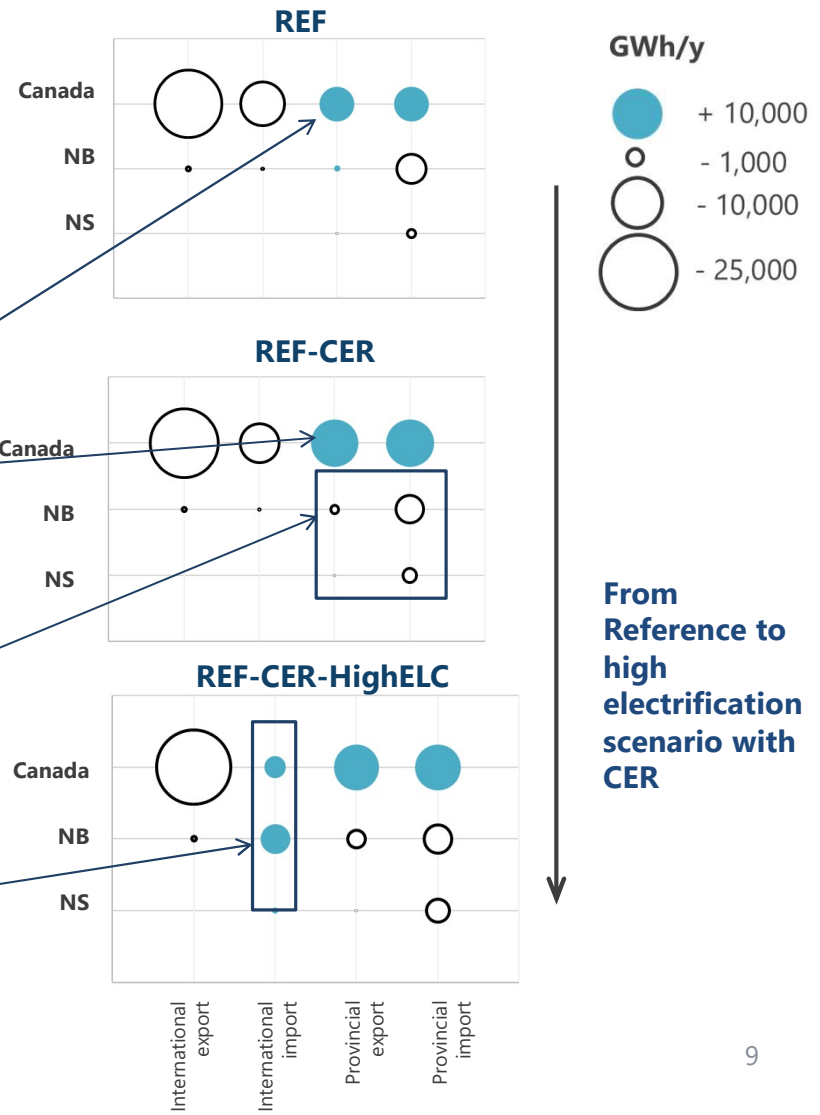
Note: Per kW service cost is included in per kWh service rate. Transmission rate for consumers in ON is embedded into commodity rate

Shift in interprovincial and international trade

CER stimulates increased reliance on domestic Canadian resources and reinforces provincial electricity trade within Canada

- In 2050, interprovincial electricity imports and exports **increase by 10% under REF-CER** compared to REF
  - Provinces facing higher costs under CER may increasingly rely on neighboring regions
- However, **interprovincial trade opportunities remain limited for Atlantic Canada** due to limited transmission infrastructure and high costs for new interconnections
- Scenarios with **higher electrification may also increase the need for international imports** to meet rising electricity demand

Difference in annual trade flows in 2050 versus 2025 (GWh/y)



Main takeaways

- **Decarbonization:** CER drives GHG reductions for all provinces, primarily through electricity sector transformation (coal phase-out, oil generation reduction, peaking gas, increase of renewable generation).
- **Investments vs. fuel costs trade-off:** CER increases generation investment needs (nuclear, wind), yet long-term fuel savings (e.g., no coal, limited oil/gas) may offset costs, especially in NB.
- **Affordability pressure:** Electricity rates increases with up to +45% increase between 2021 and 2050 (for NS), and higher electrification may increase rates even further due to rising peaks and associated service costs.
- **Stronger interprovincial links:** CER boosts electricity trade within Canada (+10% in 2050), but Atlantic provinces benefit less due to costly and limited interconnections. **However, high electrification increases reliance on international imports, exposing provinces to tariff uncertainties**.

Thank you

Questions?

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