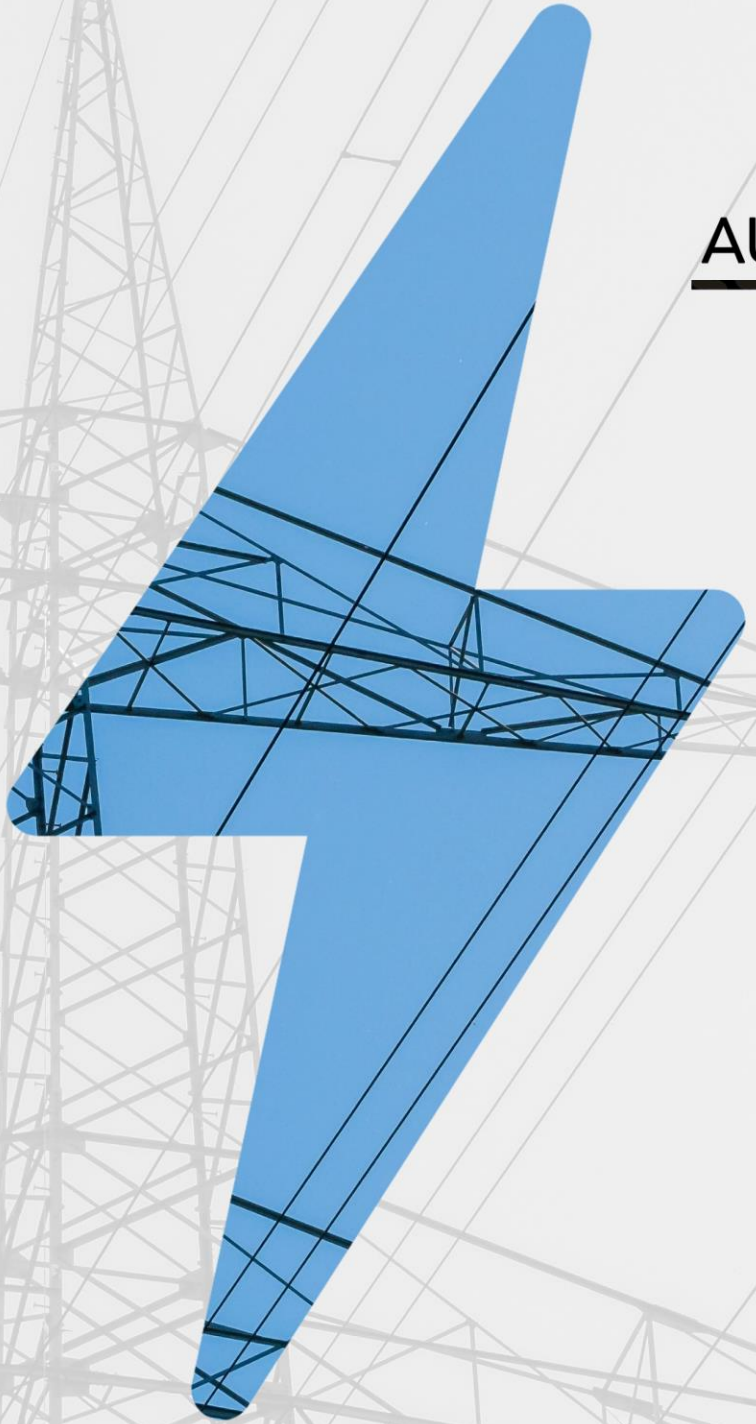
INSTITUT DE L'ÉNERGIE TROTTIER

AUGUST 31, 2022

WEBINAR

A STRATEGIC PERSPECTIVE ON ELECTRICITY IN CENTRAL AND EASTERN CANADA



The IET's mission

The academic training of a new generation of engineers, scientists and innovators with a **systemic understanding** of energy issues;

The research for sustainable solutions for our energy future, while supporting knowledge generation and innovation in the energy sector to help face the coming decades challenges;

The dissemination of knowledge on energy related topics, contributing to **societal dialogue** on energy issues.

POLYTECHNIQUE MONTRÉAL
UNIVERSITÉ D'INGÉNIERIE

FONDATION FAMILIALE TROTTIER FAMILY FOUNDATION

Collaborations and initiatives

CANADIAN CLIMATE INSTITUTE | L'INSTITUT CLIMATIQUE DU CANADA

The Transition Accelerator | L'Accélérateur de transition

CCEI

Energy Modelling Initiative
Bringing the Tools to Support Canada's Energy Transition

Initiative de modélisation énergétique
Outiller le Canada pour réussir la transition

OURANOS

Chaire en Transformation du Transport

CARREFOUR DE MODÉLISATION ÉNERGÉTIQUE
ENERGY MODELLING HUB

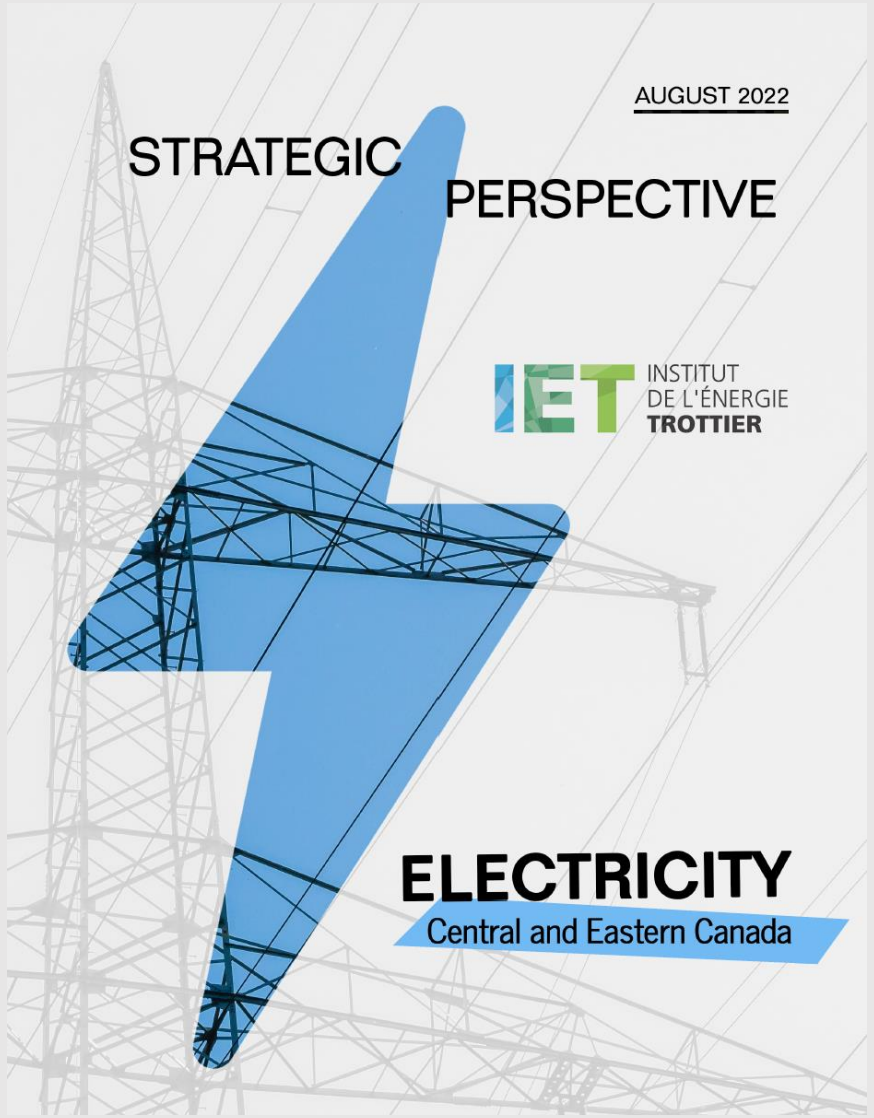
IVEY foundation

Énergie et Ressources naturelles Québec

CHEMINS DE TRANSITION
Ensemble pour un futur souhaitable
Espace pour la vie | Université de Montréal

Natural Resources Canada | Ressources naturelles Canada

Publications



Objectives

- Provide an overview of the electricity sector in Central and Eastern Canada
- Analyze the challenges inherent to massive electrification in these regions
- Identify and propose work to be undertaken to support and accelerate transformation

Approach

- First version of the white paper used as a working document for the workshops
- Series of three workshops (Atlantic, Ontario, Quebec)
  - Validate / refine the analysis
  - Identify priority actions / challenges to be addressed
  - Develop a plan to move forward
- Updated white paper with outcomes from workshops and other meetings
- Feedback to stakeholders (next step)

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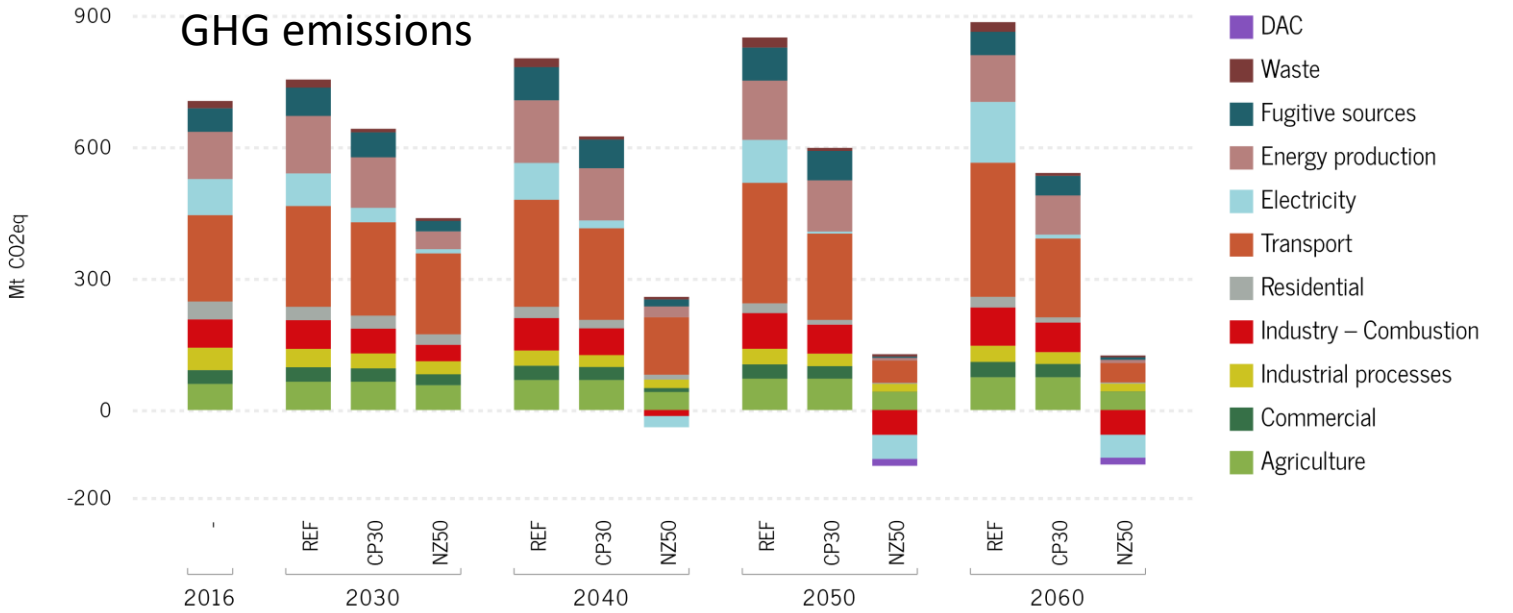
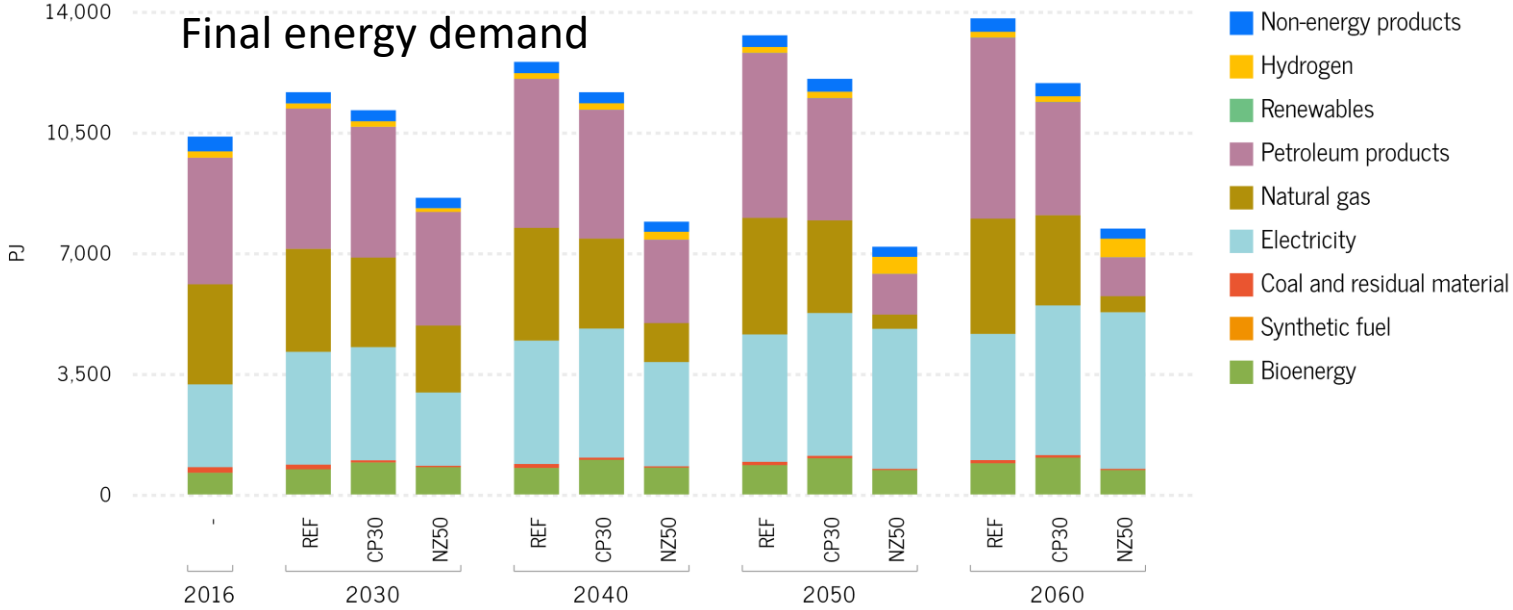
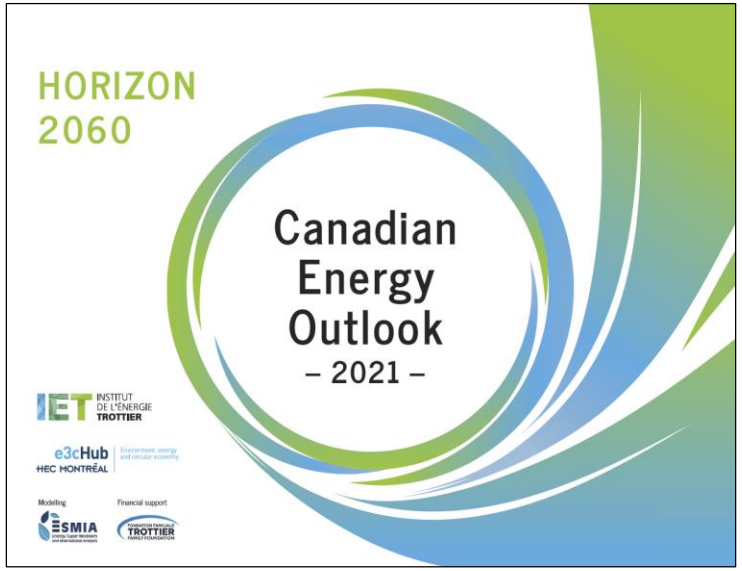
Context

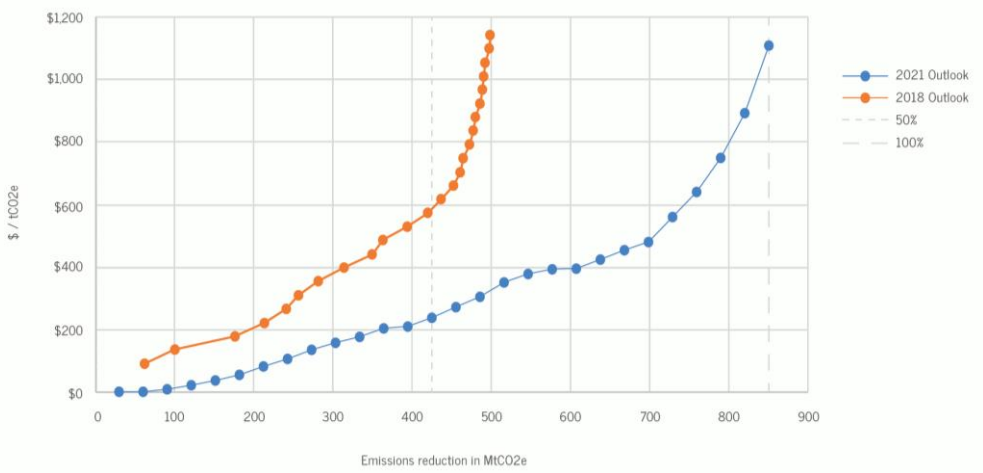
The Net-Zero ambition





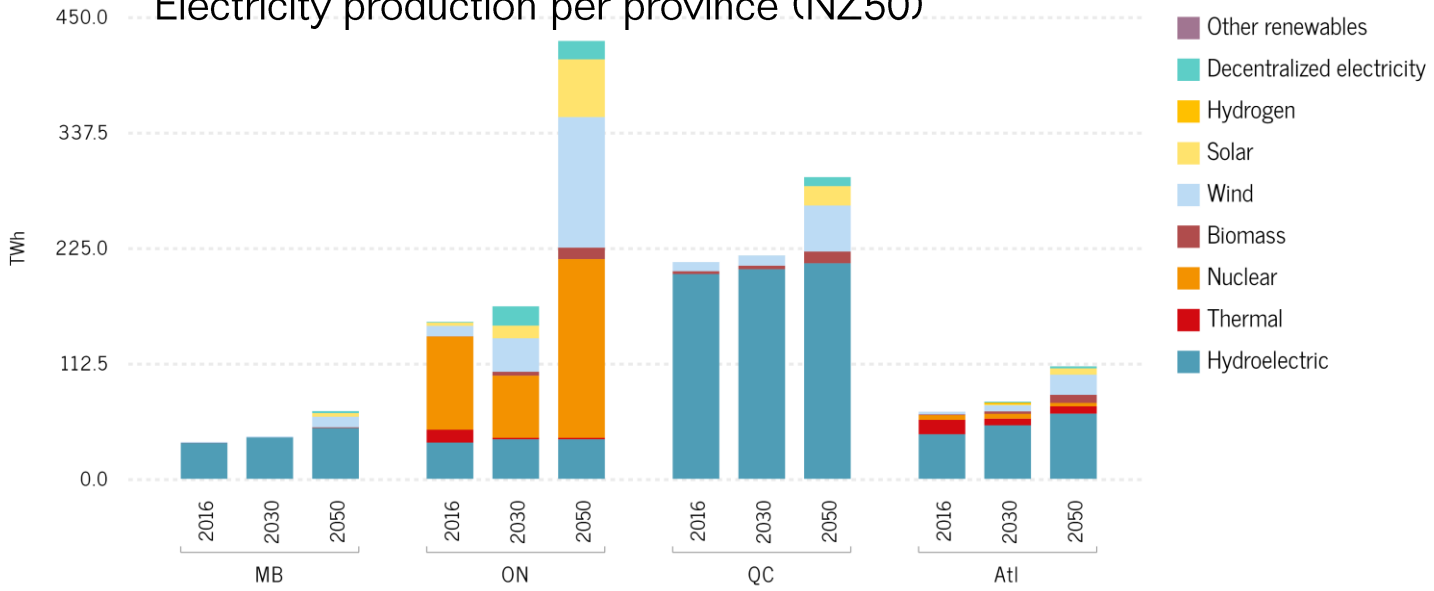


Marginal cost of reduction, NZ50 vs REF

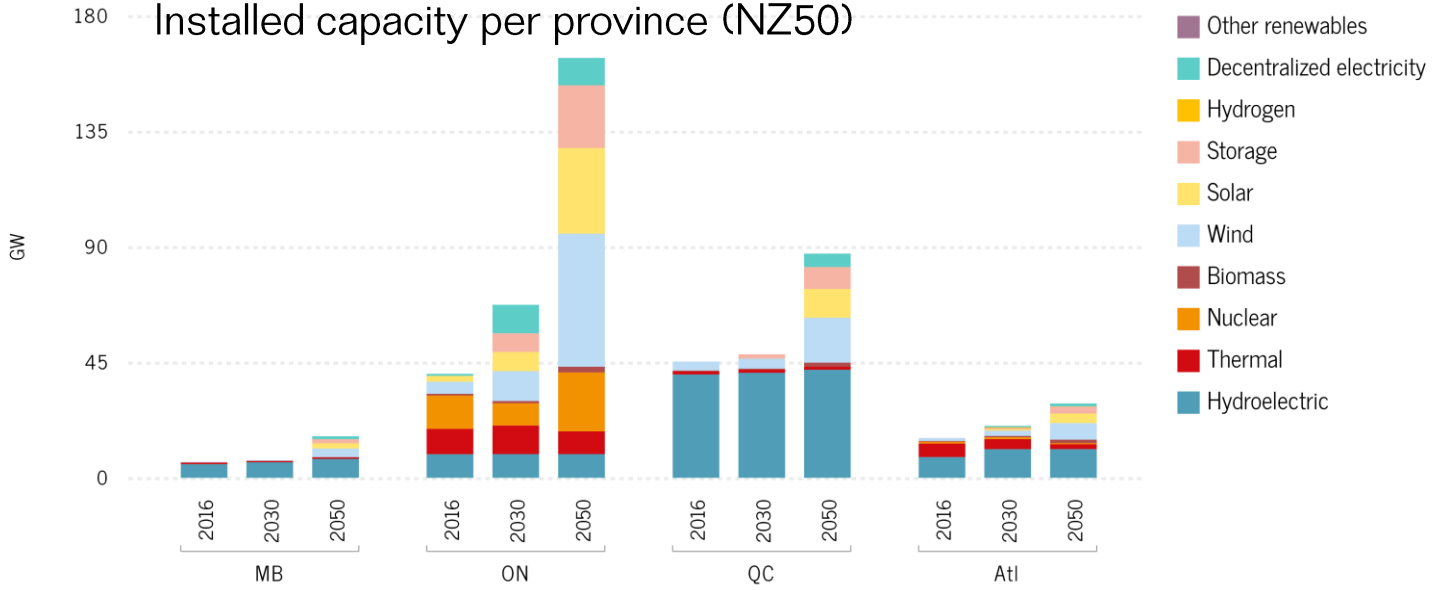


Impact on the electricity sector

Electricity production per province (NZ50)



Installed capacity per province (NZ50)



Growth and share of electricity in final energy consumption (CN50)

	2016	2030	2050
Electricity Production	1	1,04	2,10
Buildings	43 %	53 %	90 %
Industry	31 %	33 %	47 %
Transport	1 %	2,6 %	39 %

Great expectation from electricity

Projections of GHG emissions on the 2030 horizon (in MtCO2e)

Sector [1]	CEO2021				ECCC2020 [3]			
	2016	2030			2018	2030		
		REF	CP30	CP30 - REF		REF*	HEHE	HEHE - REF*
Buildings	72	64	60	-4	92	82	65	-17
Oil and gas	161	196	173	-23	193	194	138	-56
Electricity	82	75	33	-42	64	21	11	-10
Industry	116	108	91	-17	78	82	61	-21
Transport	197	230	213	-17	186	178	151	-27
Waste	17	18	8	-10	42	41	31	-10
Agriculture	60	65	65	0	73	77	74	-3
TOTAL [2]	705	754	642	-112	728	674	531	-144
LULUCF						-17	-27	

Targets : -30% = 511 ; -45% = 401

1: Sectors definitions and reference years differ in the two models: CEO2021 is aligned with international definitions and Canada's National GHG Inventory; ECCC adopts the economic sectorial classification. This explains why there are some discrepancies in how the emissions are distributed among sectors, even though the total emissions match.

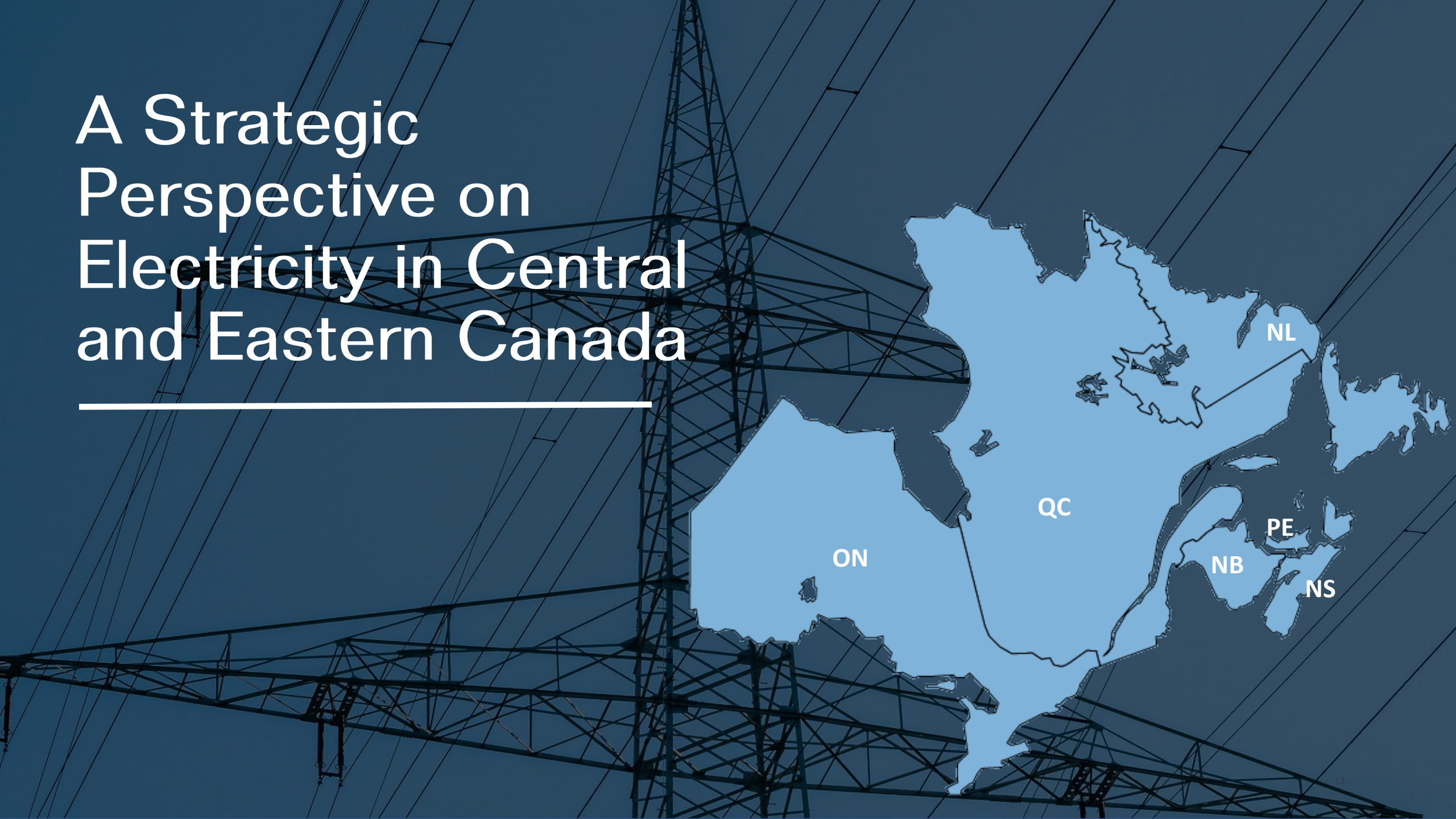
2: Due to round-up of numbers, totals might not match the sum of separate items

3: Canada's Greenhouse Gas and Air Pollutant Emissions Projections 2020 by Environment and Climate Change Canada

Some of the work on electricity and decarbonization in Canada

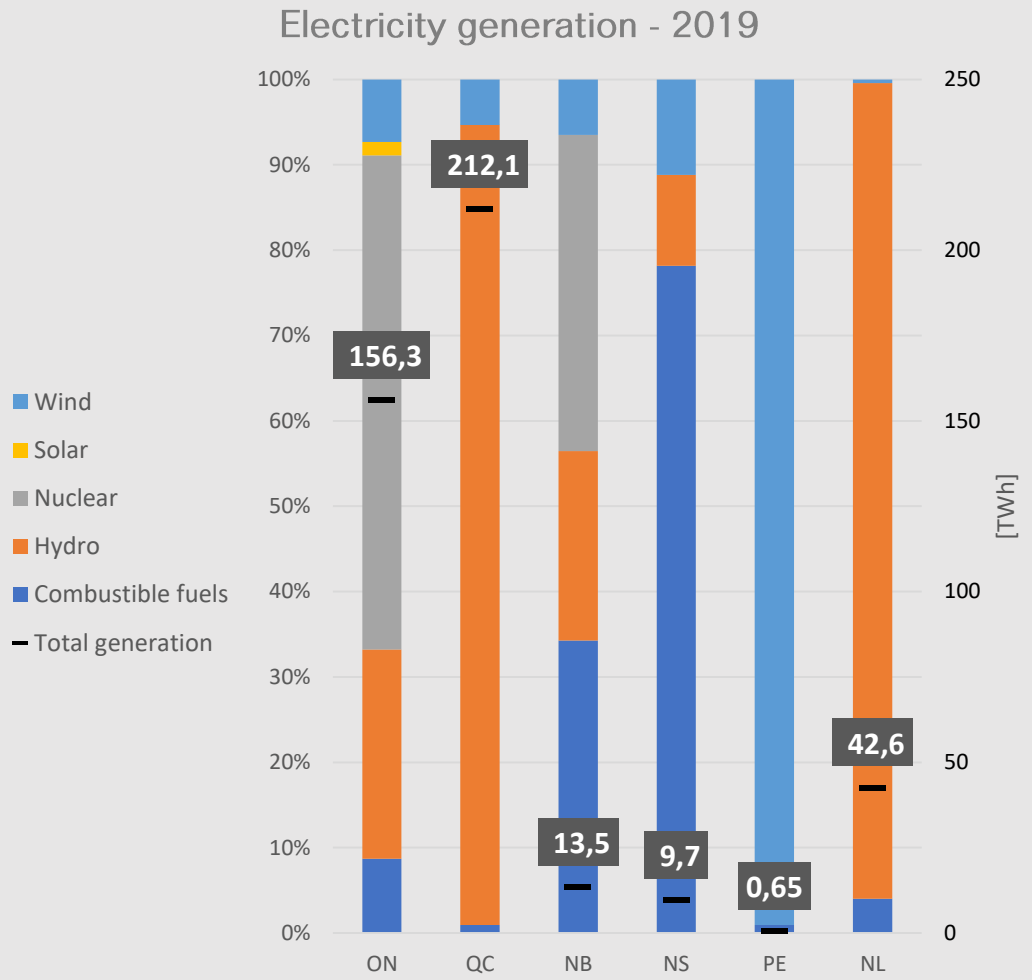
The costs associated with the lack of grid integration across neighboring provinces and U.S. states	• Pineau, P.-O., & Langlois-Bertrand, S. (2020). *Northeast Decarbonization – Opportunities and Challenges of Regional Electricity Sector Integration for High Renewable Penetration*.
The opportunities and difficulties of implementing such integration	• Rodríguez-Sarasty, J. A., Debia, S., & Pineau, P.-O. (2021). *Deep decarbonization in Northeastern North America : The value of electricity market integration and hydropower.* • Pineau, P.-O., & Ba, A. (2021). *Getting on an Efficient Decarbonization Track*. Accélérateur de Transition.
Potential roles for the Government of Canada in linking provincial grids	• Lee, C., Dion, J. et Guertin, C. (2022). *Bigger, Cleaner, Smarter: Pathways for aligning Canadian electricity systems with net zero*. Canadian Climate Institute. • Kanduth, A., & Dion, J. (2022). *Electric Federalism: Policy for aligning Canadian electricity systems with net zero*. Canadian Climate Institute.

A Strategic Perspective on Electricity in Central and Eastern Canada



Electricity systems in Eastern Canada: a general overview

- Unequal availability of ressources across provinces
- Carbon intensity stable for a decade
- More NG, higher carbon intensity to come in ON and NS
- Installed capacity of variable RE does not translate in the same proportion in the generation mix
- Proportion of installed capacity for combustible fuels much higher than in generation mix to meet peak
- Decarbonization + Electrification



GHG reduction targets and current planning

	Provincial GHG reduction targets		Planning	Main demand drivers
	2030	2050		
ON[1]	-30%	-	Reinforcement of electricity transmission infrastructures	Agriculture, transport
			Refurbishment and closing of nuclear powerplants	
			New generation capacity needs at strategic locations	
QC[2]	-37,5%	Net-zero*	Optimization of available supplies	Agriculture, transport, data centers
			Important efforts to improve demand management	
			New supply sources	
			Development of export markets	

1: With respect to 2005 levels
2: With respect to 1990 levels
* Target announced by the Quebec government but not legally adopted.

GHG reduction targets and current planning

	Provincial GHG reduction targets		Planning	Main demand drivers
	2030	2050		
NB[1,3]	-35%	-80%	Extend life of Bayside NG generating station	Residential sector and the industry
			Upgrade transmission infrastructure; and strategically locate any new generation	
			Focus on DSM (Energy Smart NB)	
NS[2]	-53%	Net-zero	80% RE by 2030	Transportation and building sectors
			More imports (Maritime Link), need to strengthen transmission structures	
			Addition of two NG power plants: 150 MW in 2026, and 100 MW in 2030	
PE[2]	-40%	Net-zero[4]	Energy independence	Transportation and building sectors
NL[2,3]	-30%	-80%	Retirement of 3/4 steam generating units at Holyrood power plant	Transportation and building sectors; data centers

1: With respect to 1990 levels;
2: With respect to 2005 levels;
3: With respect to 2001 levels;
4: Objective for 2040.

Electricity demand growth projections

	Electricity demand growth projections compared to 2016							
	Forecasted by utilities		CEO2021 REF scenario			CEO2021 NZ50 scenario		
	2030	2040	2030	2040	2050	2030	2040	2050
QC	12,3%	-	8%	18%	27%	2%	25%	54%
ON	16,8%	46%	43%	72%	98%	23%	97%	202%
NB	18,90%	26%	-3%	5%	5%	7%	44%	62%
NS	0,6%	-	24%	33%	38%	39%	102%	155%
PE	38,70%	-	15%	28%	41%	30%	76%	118%
NL	16,50%	-	13%	13%	3%	67%	126%	82%

- All economically viable energy efficiency measures are applied

Electricity demand growth is projected to be sizeable even without further efforts to reduce GHG

Provinces appear to be underestimating the growth in electricity demand implied by the **carbon neutrality targets**

Lack of long-term forecasting

-CEO2021 does not include include industry growth in its demand growth forecast


Challenges

Overarching challenges (1/2)

INTERNAL

- Integration of large amounts of variable generation
- Replacement and upgrade of aging transmission and distribution infrastructure
- **Adaptation of the regulating agencies to the privatization of production**
- **Adaptation of tariff structures to the evolution of costs structures**
- Clarification of the role of emerging technologies
- Decision on the potential future role for hydrogen
- **Planning for the overall increase in society's reliance on electricity**

Overarching challenges (2/2)

EXTERNAL
with partial influence

- Meeting demand projections implied by GHG reduction efforts
- Adaptation to new demand drivers
- Adaptation to new patterns of consumption

EXTERNAL

- Meeting increased cybersecurity threats arising from the use of some technologies
- Adaptation of electricity systems to the impacts of climate change

Province-specific challenges (1/2)

ONTARIO

- Capacity shortages due to nuclear refurbishments
- Incompatibility of new natural gas generation and GHG targets
- Transmission infrastructure upgrade needs

QUÉBEC

- Cost of new supply + long-term procurement contracts expiration
- Profitability of exports and transmission line projects (given natural gas prices)
- Potential role of HQ's large dams with regard to variable generation in the northeast grid
- Electrifying transport and industry

Province-specific challenges (2/2)

Nova Scotia

- How to replace coal-fired baseload without resorting to NG
- Capacity deficit

Prince Edward Island

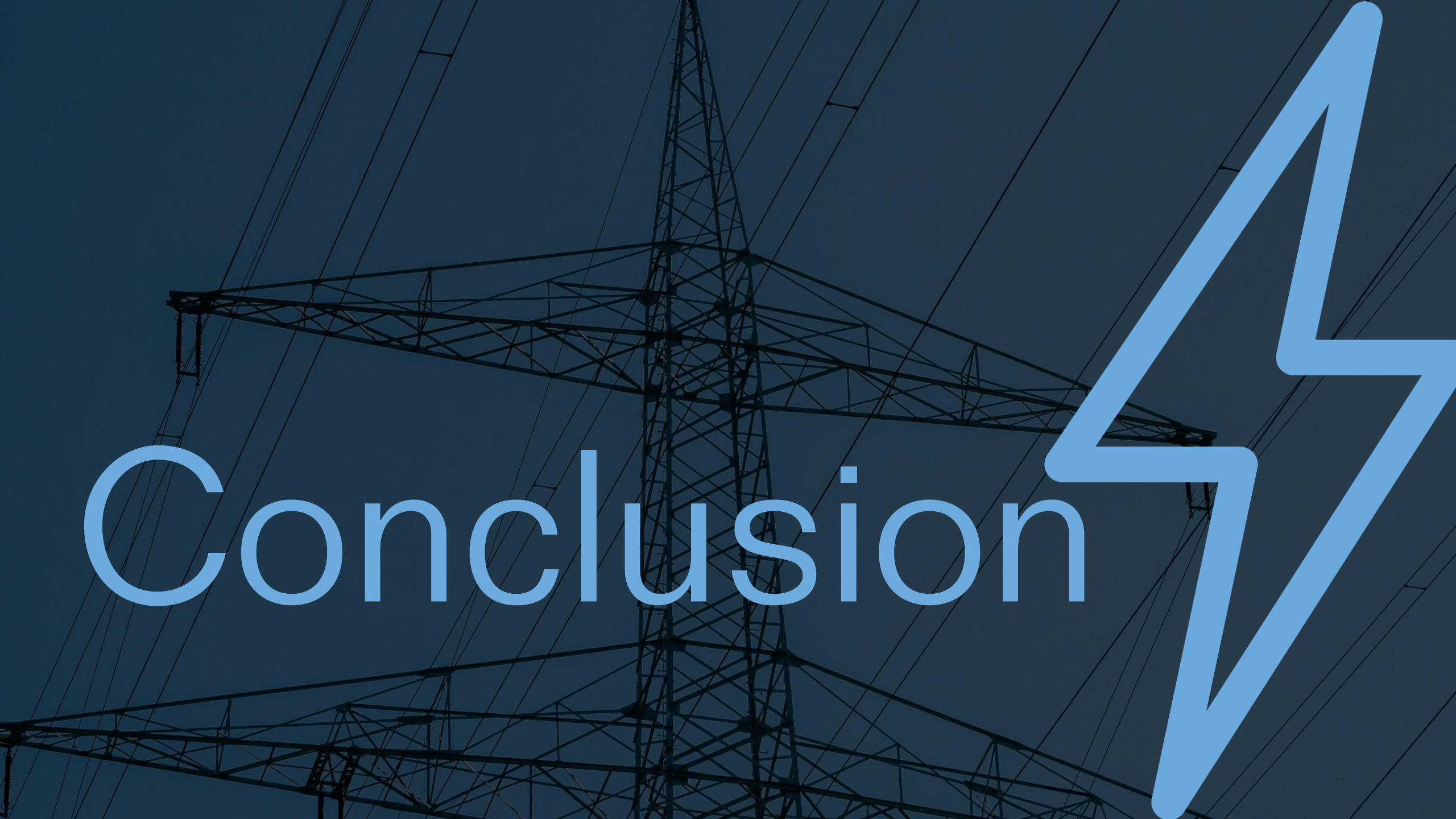
- How to meet expanding demand

New Brunswick

- How to replace coal-fired baseload without resorting to NG
- Upgrade transmission infrastructure

Newfoundland and Labrador

- Muskrat Falls costs
- Electrification infrastructure
- Transmission upgrades
- Development of exports



Conclusion

Conclusion

FINDINGS

- Gulf between current planning and efforts to deploy.
- The current planning is based on failure to achieve climate targets put forward by governements.

RISKS

- Several provinces are already facing dead ends to meet the expected demand in clean electricity.
- The electricity sector risks becoming a major factor slowing the deep decarbonization process of our societies.

Upcoming work : proposed initiatives

6 avenues

Regulation
Pricing
Demand management
Resilience
Data
Support for implementation

Upcoming work : description of working groups

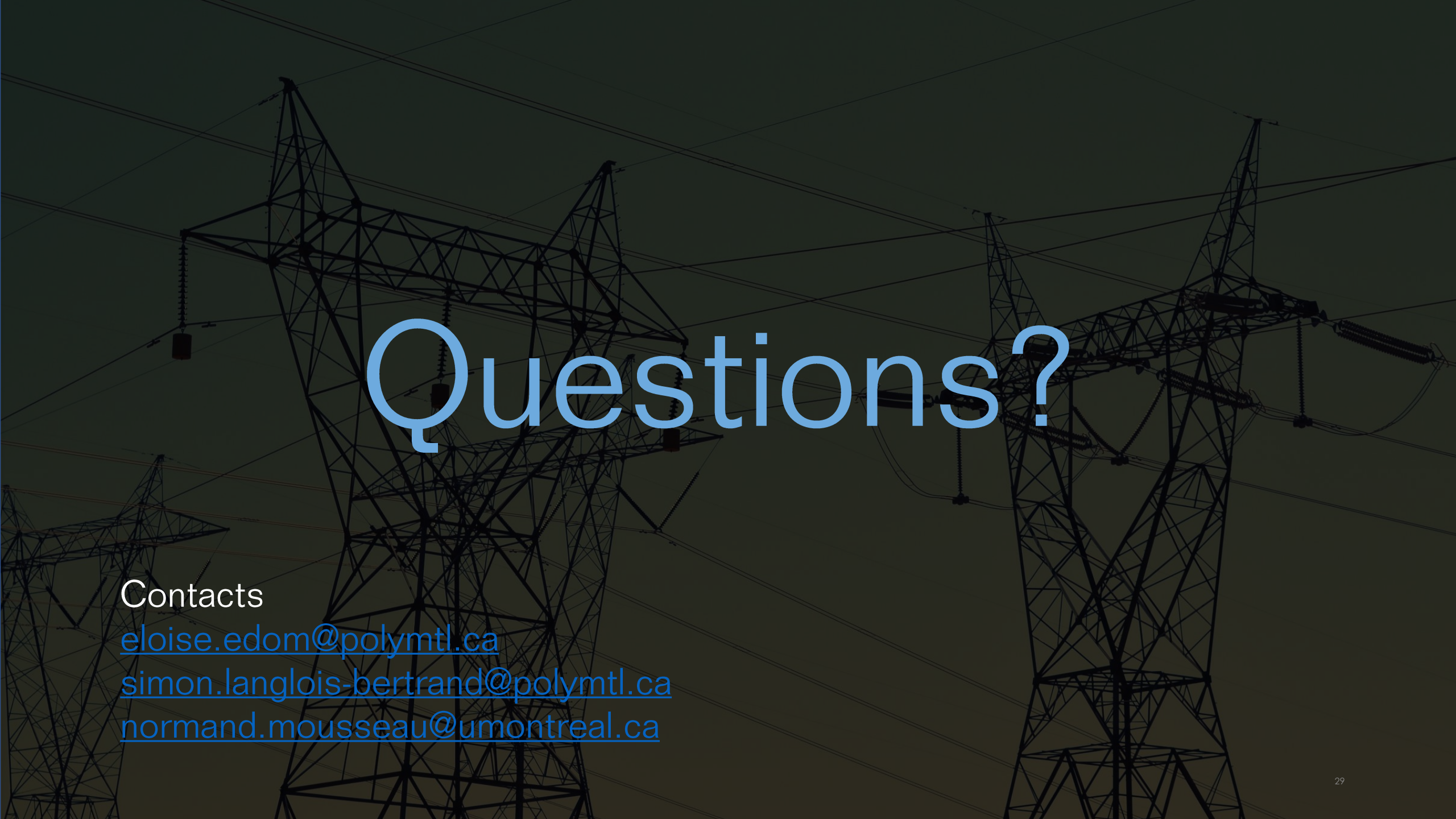
Regulation 	How can the mandate of the public utility commissions and power utilities be updated so that these authorities account for decarbonization issues more systematically?
Pricing $	Would it be relevant to adopt an overall pricing approach for the energy service instead of setting a price for customers per unit of energy consumed?

Upcoming work : description of working groups

Demand management 	How can demand management strategies best be integrated to be able to meet the challenges of managing peak demand and the current and future infrastructure development needs?
Resilience 	How can this growing need for resilience be more systematically taken into account in the planning and transformation of electrical infrastructure?

Upcoming work : description of working groups

Data 	How can access to the data be facilitated sustainably? And how can the data be standardized
Support for implementation 	How can the dissemination of knowledge and needs be improved among the different parties involved in the transformation of the electricity sector (governments, power utility companies, universities, etc.) so the implementation of this transformation is accelerated?



Questions?

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