

2050 Net Zero Natural Gas Pathways – How do we get to 2050?

ICF



Duncan Rotherham
Vice President

Peter Narbaitz
Senior Manager

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Presenters



Duncan Rotherham

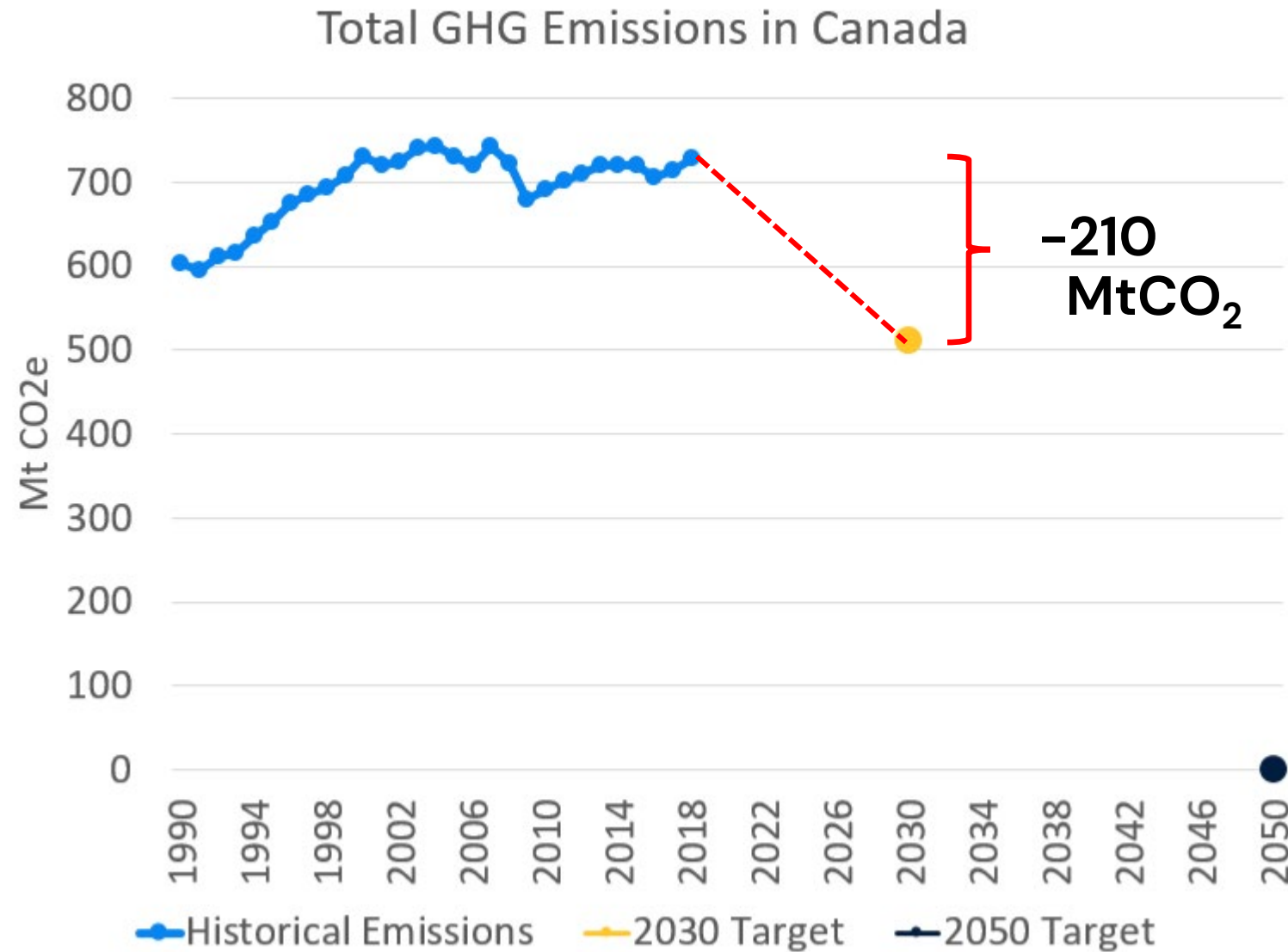
*Vice President,
Utility Programs and Services*



Peter Narbaitz

*Senior Manager,
Energy Markets – Gas*

Transparent GHG Targets and Abatement Incentivizing Policy and Mechanisms but No Clear Prescribed Pathway



GHG Emissions have been Stagnant for 20 Years Despite More and More Aggressive Targets

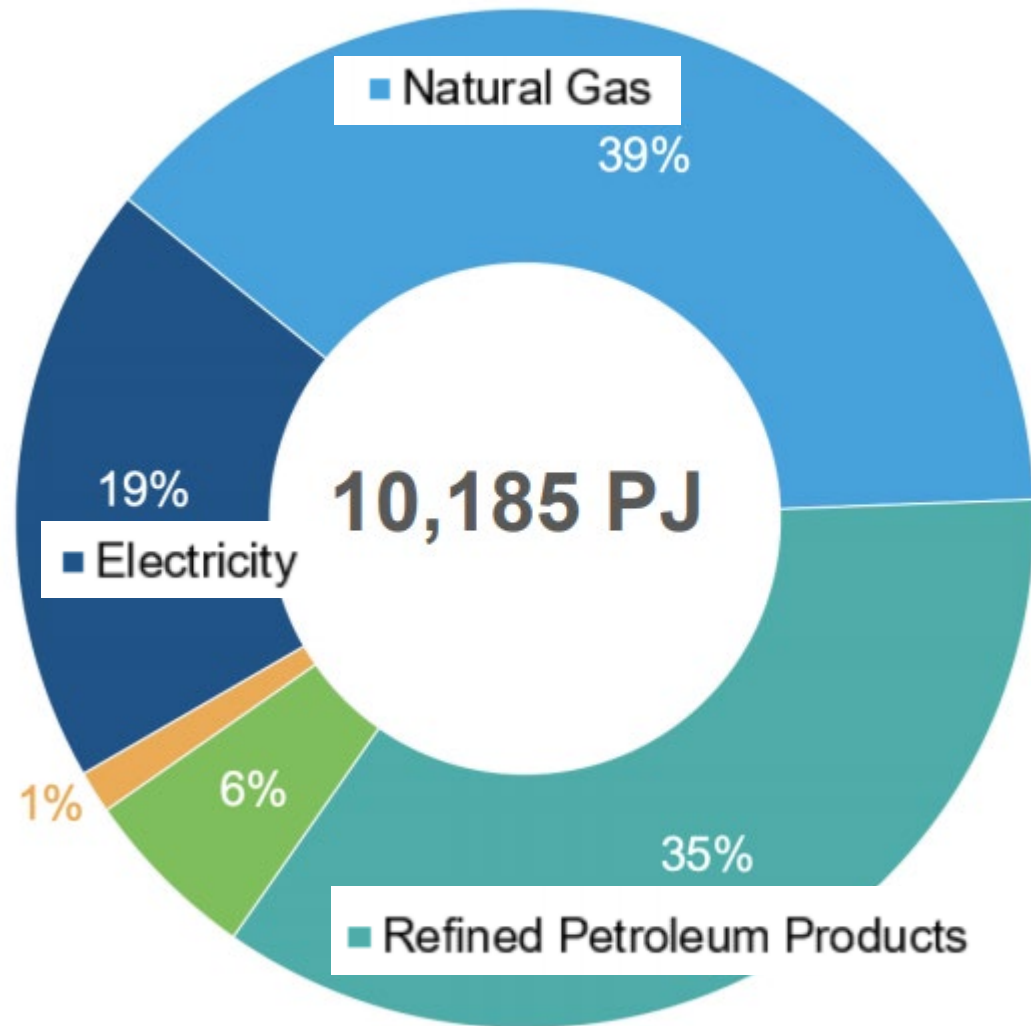
-3.5% tCO₂/yr

Total GHG emissions must reduce by 3.5%/yr over the next 9 years to meet the 2030 target

+17.5% \$/tCO₂/yr

Canada's price on GHG emissions will increase by 17.5% per year (on average) reaching \$170/tCO₂ by 2030

Canada's Energy Profile will need to Change Fast and Significantly to 2030 Meet Emissions Targets



Fuel use Varies by End User

30% Residential + Commercial – met by natural gas and electricity

45% Industrial – met by a mix of fuels but >50% natural gas

25% Transportation – met almost entirely by RPP

Fuel Emissions Profiles

Natural gas @ 50 tCO₂/TJ = 200 MtCO₂

RPP @ 70 tCO₂/TJ = 250 MtCO₂

Electricity @ 35 tCO₂/TJ = 70 MtCO₂ (varies from 0 to 200 tCO₂/TJ)

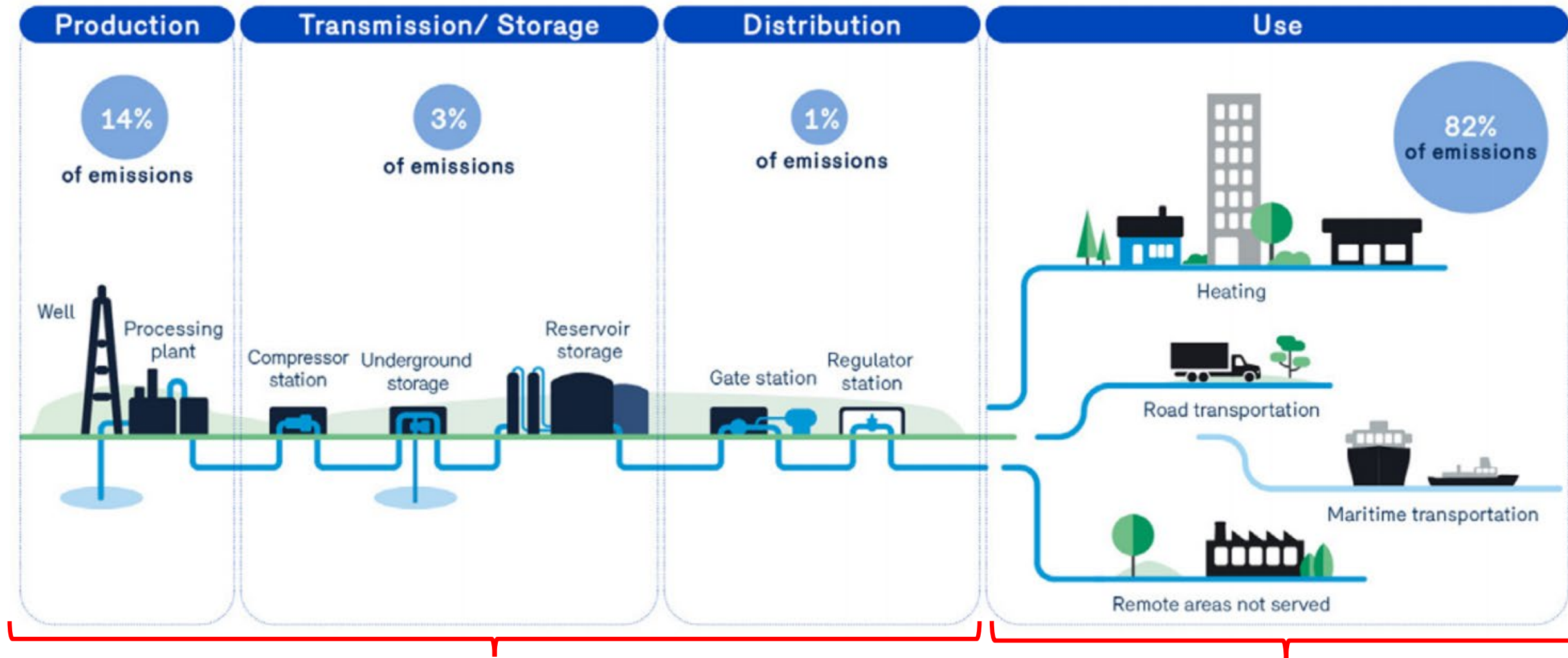
-210 tCO₂ by 2030

Reduce total demand by 2800 PJ (or 100% of Ontario's annual demand)

Or eliminate all transportation fuel use

Or eliminate all natural gas use

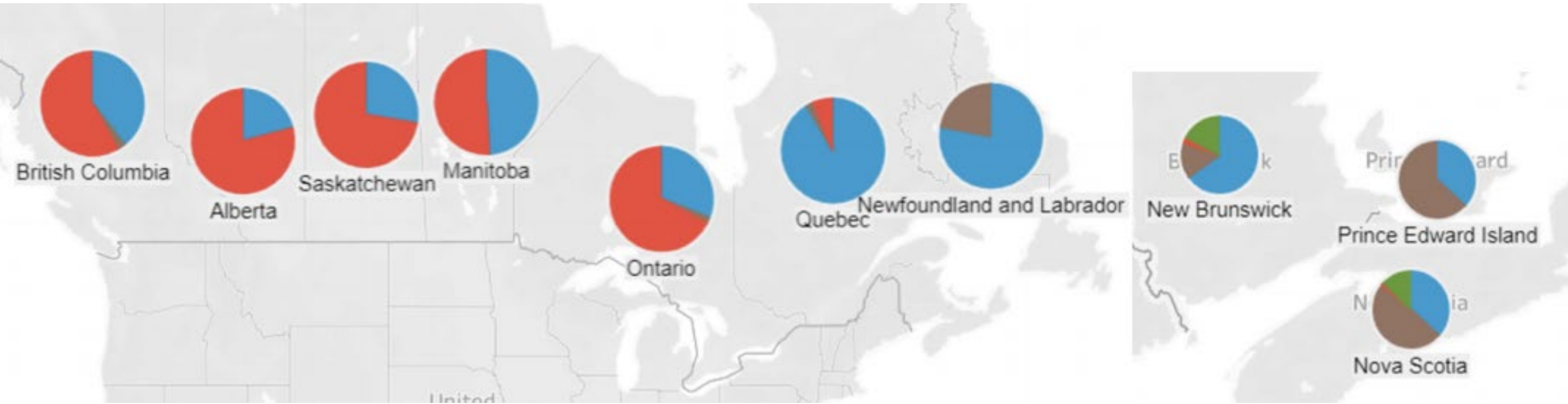
Natural Gas De-Carbonization Planning must Include Full Lifecycle, of Emission Sources



Reduce or Offset Venting, Fugitive, Combustion Emissions from Production, Processing, Transmission, and Distribution

Reduce End User Demand and Displace with Clean Fuels

Mix of Measures, Velocity, Cost and of De-Carbonization Pathway will Depend on the Province and Energy Profiles



Role of Natural Gas Varies by Province

Alberta natural gas meets 75% of energy demand for heating
Quebec natural gas meets 10%

Natural Gas Peak is Much Higher than Electric

Natural gas winter peak can be 5-6 times that of summer
Natural meets 2X the annual demand for energy
But 4-5X peak electric demand

Natural Gas is the Low GHG Energy in 50% of Provinces

Natural gas is lower GHG intensity than electric in Alberta, Saskatchewan, NB, NS, NWT and Nunavut

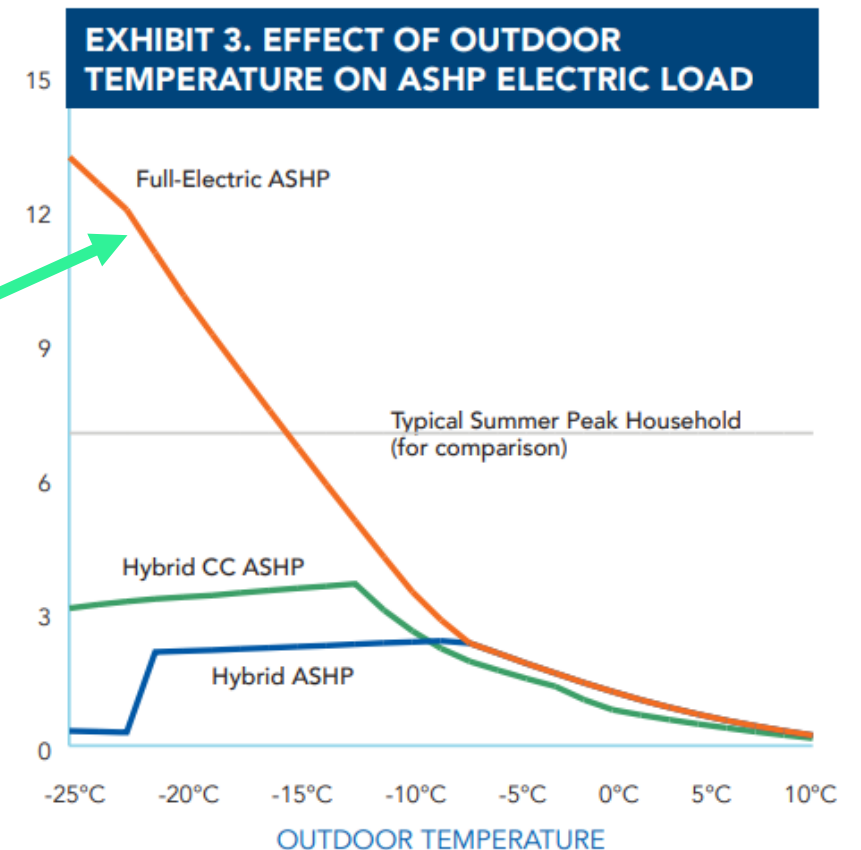
Gas Demand Reduction Options

- **Energy efficiency improvements**

- Utility programs have long track record driving a wide range of cost-effective energy efficiency improvements
- Reducing heating loads: updates to building insulation, air sealing, ventilation, and windows
- High efficiency appliances: options shift over time from condensing furnaces (95% - 98%) to emerging gas heat pump options (130% - 140%)

- **Hybrid-heating / targeted electrification**

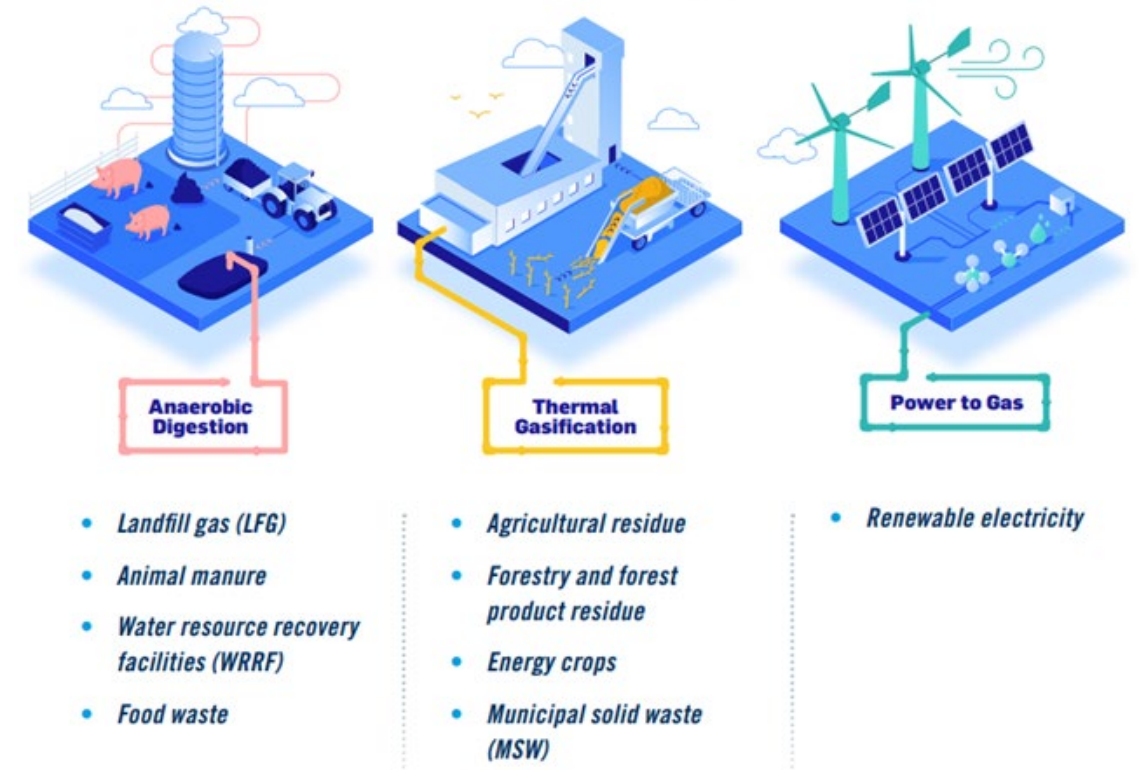
- Replacing central air-conditioner with electric air-source heat pump, which can also provide heat, but maintaining gas furnace instead of electric resistance back-up heating - still achieves major reduction in gas demand
- Avoid major spikes on the electric grid in colder periods, while adding flexibility, redundancy, and resiliency
- A/C failure (vs. furnace failure) is an easier time for customer conversion to ASHP
- Raises host of regulatory considerations



Low / No Carbon Gas Supply Options

- **Renewable Natural Gas (RNG):**
 - RNG is derived from biomass or other renewable resources and is a pipeline-quality gas that is fully interchangeable with conventional natural gas
 - As a biogenic resource, IPCC guidelines treat RNG combustion as carbon neutral
 - Today most RNG is produced through Anaerobic Digestion, while emerging Thermal Gasification processes can unlock larger supplies of RNG
- **Hydrogen (H2):**
 - H2 promises to be a low or no emission fuel source
 - Can drive decarbonization through different approaches, including:
 - Blending H2 into existing natural gas supply
 - Building dedicated H2 infrastructure
 - Methanation of H2 and/or adding H2 to thermal gasification to increase RNG yield

RNG Production Technologies



Source: <https://gasfoundation.org/2019/12/18/renewable-sources-of-natural-gas/>

NRCAN Hydrogen Strategy's Vision for 2050:
“>50% of energy supplied today by natural gas is supplied by hydrogen through blending in existing pipelines and new dedicated hydrogen pipelines”

Regulatory Enablement of Low Carbon Gas Utility Pathways

- The focus of utility commissions & regulators is to protect the public interest and ensure safe and reliable utility service at reasonable rates
 - Traditionally this has meant utilities are expected to demonstrate that the costs they seek to recover represent a 'least cost' approach that ensures criteria for safety, reliability, and other conditions are met
- By 2030 many provinces will have in place the federal carbon tax of \$170/tCO₂ – gas utilities should at a minimum be enabled to implement GHG emission reduction strategies for their customers that will cost less than the carbon price

—————→ **\$170/tCO₂e**
~\$9.23/GJ of natural gas
~\$0.34/m³ natural gas

Using 2020 Canadian NIR EF of 0.0543 tCO₂e/GJ, 0.0372 GJ/m³ (HHV) based on:

- National Inventory Report 1990–2018: Greenhouse Gas Source and Sinks in Canada, April 2020 (NIR 2020). Available at: <https://unfccc.int/documents/224829>
- NRCan Energy conversion tables. Available at: <https://apps.cer-rec.gc.ca/Conversion/conversion-tables.aspx?GoCTemplateCulture=en-CA#s1ss2>

British Columbia Enables LDCs to Take Action in Support of Customer Emissions Reductions

- Significant expansion of energy efficiency budgets for natural gas utilities in support of emission reduction objectives
- Legislation provides mandate, process, and criteria for gas utilities to procure RNG to reduce customer emissions
- 'Clean Growth Innovation Fund' enabling FortisBC to accelerate GHG emission reductions, with \$4.9 million in annual funding (\$0.40 monthly charge to all FortisBC natural gas customers)
 - First project looking at compatibility of distribution system for hydrogen injection

	2017	2018	2019	2020	2021*	2022*
FortisBC DSM Portfolio, Total Utility Expenditures (\$ millions)	34.0	35.5	64.5	75.8	88.8	96.8

*Planned

Source: <https://www.fortisbc.com/about-us/corporate-information/regulatory-affairs/our-gas-utility/gas-bcuc-submissions/fortisbc-energy-inc.-gas-submissions/C-EM/annual-dsm-reports>

Three-part test for RNG projects:

- The public utility must be acquiring renewable natural gas (as opposed to some other form of commodity);
- The utility must pay no more than \$30 per GJ for that renewable natural gas; and
- Subject to certain exceptions, the annual volume of renewable natural gas acquired must not exceed 5% of the total volume of natural gas the utility provided to its non-bypass customers in 2015.

Dual Energy Programs in Québec Recognize the Importance of Gas Distribution Systems in Meeting Peak Space Heating Loads

- Hydro-Québec already has a 'dual energy' program, to reduce peak electric space heating loads in cold periods by having customers automatically switch to other fuels, (mostly heating oil / electric, some natural gas / electric)
- To unlock further emission reductions without overwhelming the electric grid, Hydro-Québec and Énergir are trying to expand the use of dual-energy systems
 - They are hoping to propose to the Régie de l'Énergie 'common rates' (gas and electric) for customers who switch to dual energy heating ¹



Hydro-Québec's Existing Dual Energy Program

Rate DT	Rate D*
4,427 ¢/kWh for the energy consumed during most of the year	6,159 ¢/kWh for the energy consumed in the <u>first tier</u>
25,882 ¢/kWh for the energy consumed during a cold spell, which only happens a few days a year	9,502 ¢/kWh for the rest of the energy consumed (2nd tier)

*Given that most contracts at Rate DT are eligible for Rate D, for simplicity, the only comparison shown here is with Rate D. Contracts that are eligible for domestic rates DP or DM are also eligible for Rate DT if the customer uses a dual-energy system that qualifies for Rate DT.

In effect as of April 1, 2021. In either case, the system access charge will apply.

Who benefits from dual energy?

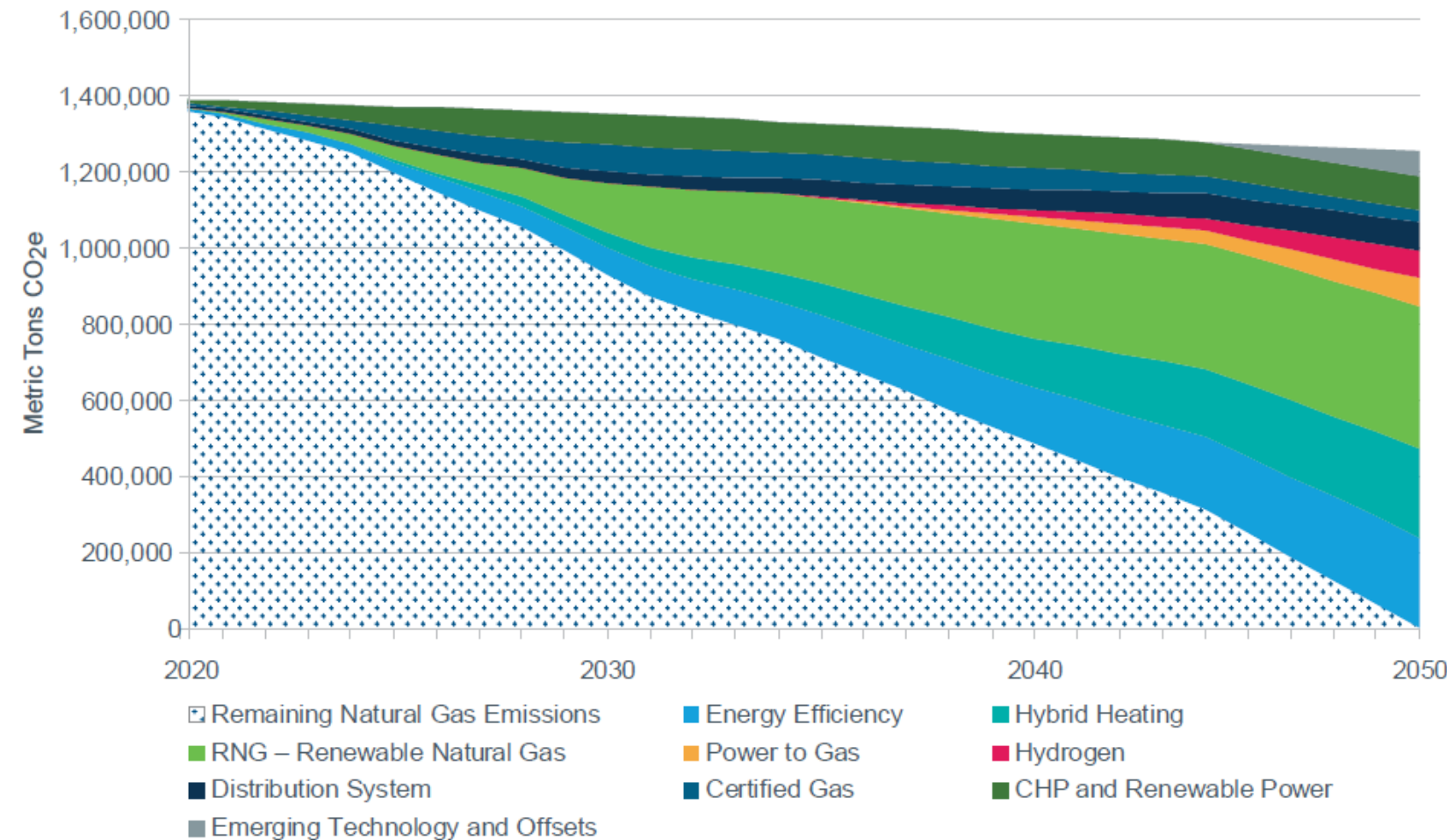
Dual energy is advantageous for Rate DT customers, Hydro-Québec and Hydro-Québec customers as a whole! Take a closer look:

Who ?	Advantages
Rate DT customers	Savings on the vast majority of kWh consumed during the year to make up for the high price applied to electricity consumption during cold spells
Hydro-Québec	Better management of demand for electricity during cold spells
Other Hydro-Québec customers	Lower electricity rates overall due to lower supply costs during winter peaks

Gas Utilities Starting to Demonstrate How They Can Contribute to Net Zero Emissions Pathways

- Washington Gas (WG) built plan to reduce natural gas emissions in support of Washington D.C.'s Climate Goals – 50% by 2032 and carbon neutral by 2050
- WG's Climate Business Plan demonstrates:
 - Pathway leveraging natural gas infrastructure found to be less costly approach to carbon neutrality
 - WG's business will need to evolve and innovate, including decarbonizing the mix of gases delivered and an expanded focus on high-efficiency equipment, among other components
 - Gas utilities can play a significant role in local and regional decarbonization efforts, combined with support from policymakers and regulators to develop low carbon gas solutions

Washington Gas Emission Reductions Over Time by Measure (MTCO₂e)



Source: <https://washingtongasdcclimatebusinessplan.com/wp-content/uploads/2020/04/Climate-Business-Plan-March-16-2020-FOR-WEB.pdf>

Parting Thoughts

- Progress on Environmental Policy requires understanding of and coordination with Energy Policy
- There are pathways to leverage gas distribution infrastructure to support net zero targets
- Gas distribution companies cannot act on their own – many or most of the actions that could be taken by gas distribution companies to reduce carbon emissions will require approval from regulators and policy makers
- Regulators should be ready to be asked to consider new, more complicated, proposals – and ideally regulators would signal their readiness to accept proposals in emerging areas



Get in touch with us:
Peter Narbaitz

Senior Manager, Energy Markets – Gas
1.613.520.1845
Peter.Narbaitz@icf.com

icf.com

 [linkedin.com/company/icf-international/](https://www.linkedin.com/company/icf-international/)

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