NORTH AMERICAN NATURAL GAS DEMAND TO 2030

MAY 2021

INTRODUCTION

North American producers have the technical ability to bring Tcf's of natural gas to market very cheaply and quickly. This has resulted in growth of natural gas in all traditional sectors. Recent developments in LNG export sector is expect to continue and surpass Residential sector requirements before the end of the forecast period.

This analysis will review and forecast to 2030 demand for North American natural gas by sector:

- Core (Residential and Commercial)
- Gas-Fired Power
- Industrial (including Oil Sands and Pipeline)
- LNG Exports.

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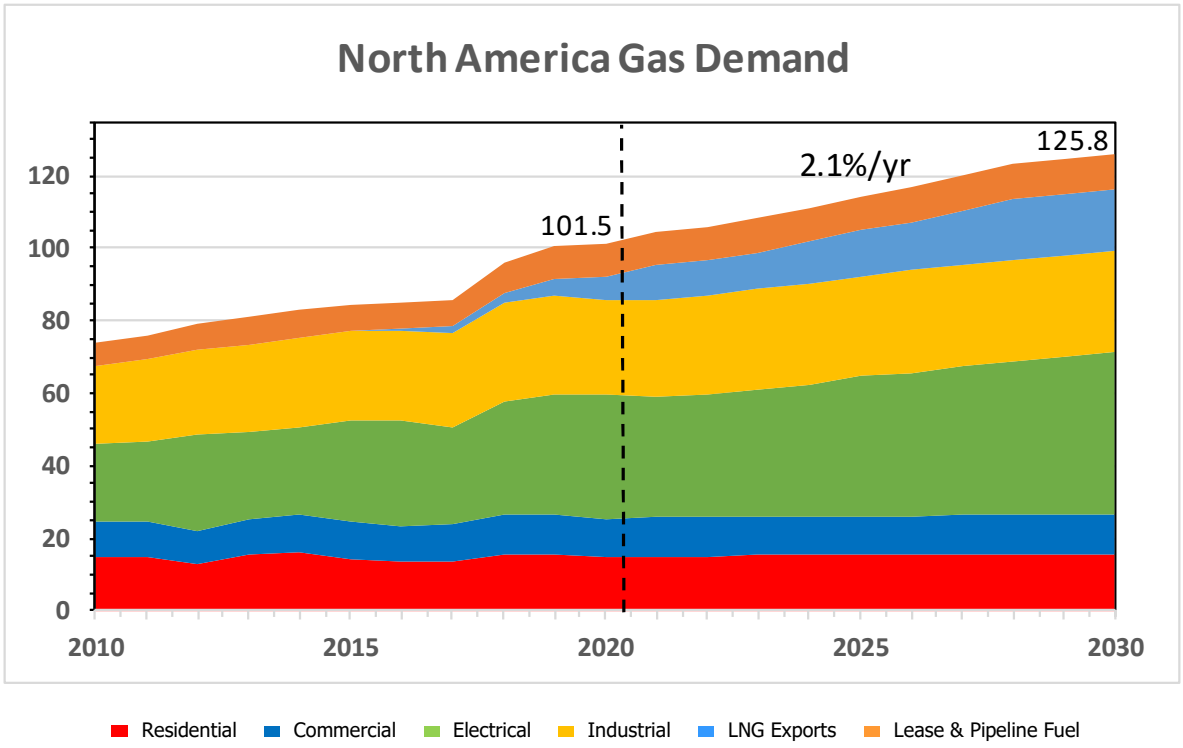
NORTH AMERICAN GAS DEMAND TO 2030



Natural Gas Demand Drivers

- LNG Exports are the largest growth driver for North American gas Demand. Build out continues in the Gulf Coast with an additional 5.3 Bcf/d of capacity by 2030 and completion of the LNG Canada four train 3.4 Bcf/d project moves exports to 16.2 Bcf/d by 2030
- Continued retirement/closing of Coal-fired power drives Gas-fired demand growth at 3.4%/year during the forecast and Renewable sources at 5.5%/year.
- US overall power emissions are reduced to 42% below 2005 levels.
- Electric Vehicles (33MM by 2030) are expected to drive overall power demand growth of 0.3%/year.

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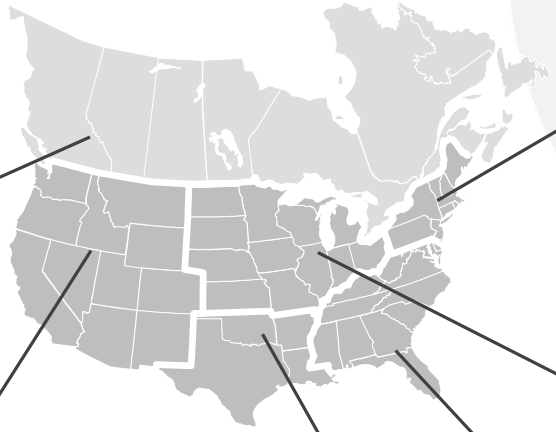
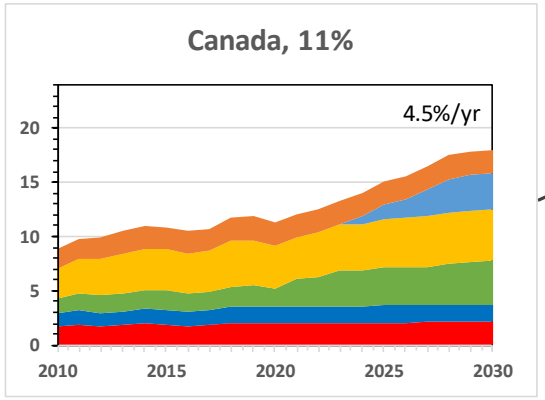
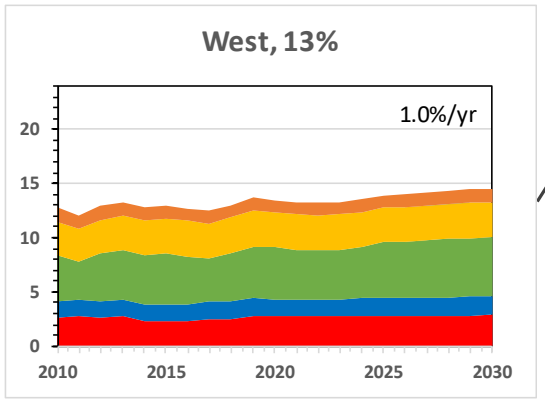
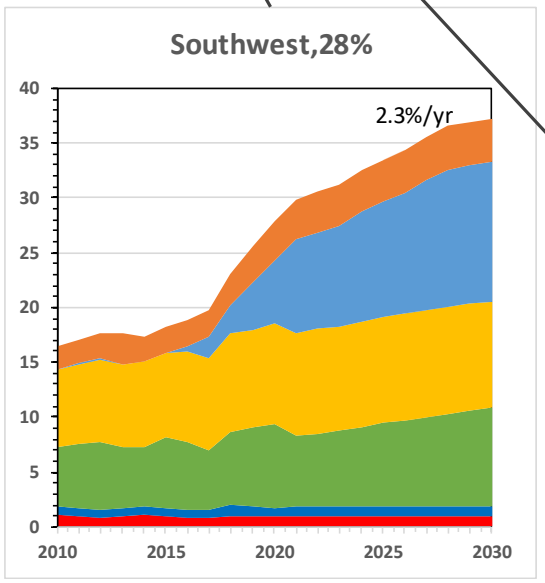
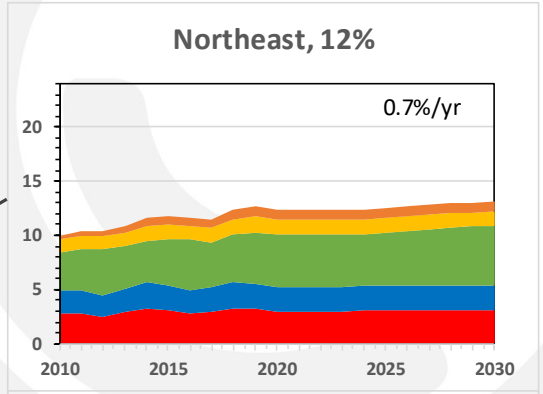
NORTH AMERICAN GAS DEMAND BY REGION, BCF/D

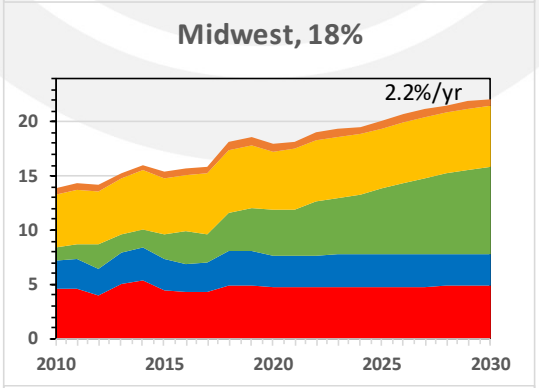


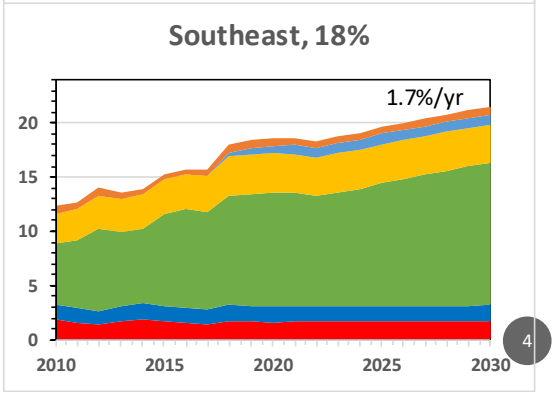












Residential
Commercial
Electric Generation
Industrial
Pipe & Lease
LNG
Region, % NA Market Share

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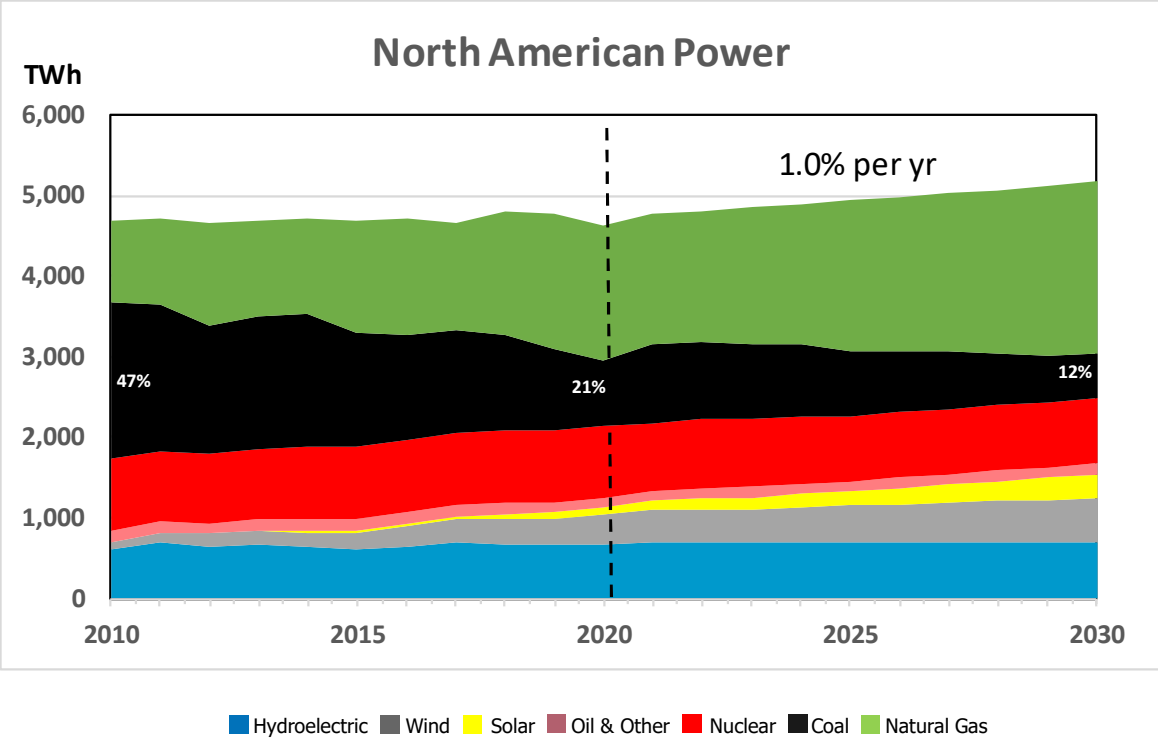
NORTH AMERICAN GAS DEMAND BY REGION, CONTINUED

- The chart shows a breakdown of North American gas demand by region to 2030.
- US Southwest is expected to lead regional natural gas growth.
  - Growth is driven by the recently completed and under-construction LNG liquefaction projects.
  - Industrial demand is expected to increase 0.5 Bcf/d by 2030 as investments in refining and petrochemical sectors come online.
- Declining coal-fired capacity drives growth in gas-fired generation, especially in the Midwest and Southeast regions. Strong electric vehicle adoption in the West region, drives slight increase in gas-fired generation.

NORTH AMERICAN POWER GENERATION TO 2030



Power Generation Drivers

- Coal-fired generation has lost market share over the last decade, accounting for just 21% in 2020 from 47% in 2010. This trend is expected to continue with market share eroding to 12% in 2030.
- Renewables (Wind and Solar) are expected to grow strongly at 5.5%/year over the next decade.
- Natural gas-fired generation is expected to grow 3.2%/year, requiring an additional 10 Bcf/d by 2030.
- Ageing Nuclear capacity coming offline will result in output declining 0.4%/year over the next decade.
- By 2030, Incorrys expects a 42% drop in overall CO2 emissions from 2005 levels.

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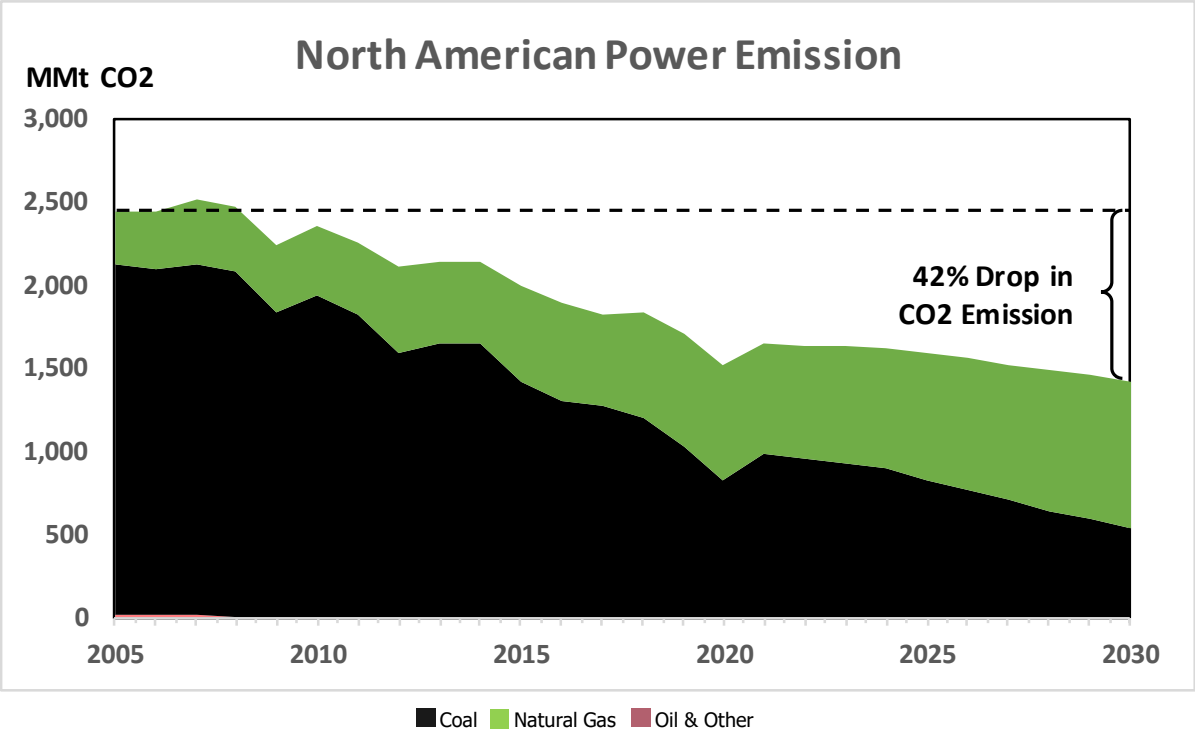
NORTH AMERICAN POWER EMISSIONS TO 2030



- Based on 2019 EIA data, coal fired electricity emits 1 Million Tonnes (MMt) of CO2 per TWh versus natural gas at 0.4 MMt of CO2 per TWh
- In 2005, Coal-fired generation of 330 GW of capacity operated at 73% load factor; by 2030, 125 GW of capacity will operate at just 50% load factor.
- From 2005-2030, coal fired generation will drop 1,575 TWh resulting in a 75% reduction in coal fired carbon emissions.
- From 2005-2030, natural gas fired generation will increase 1,355 TWh, replacing much of the lost coal fired declines. Natural gas emissions will grow 70%, however, overall emissions will drop 42%.

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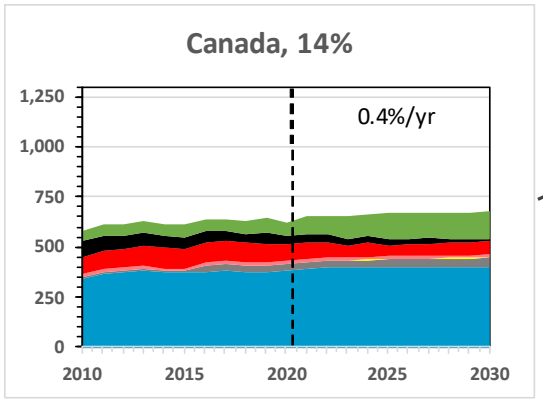
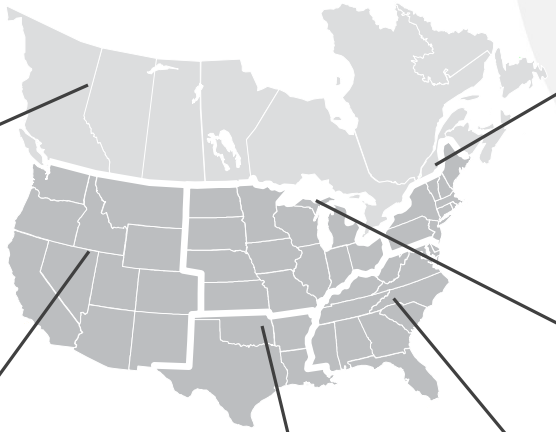
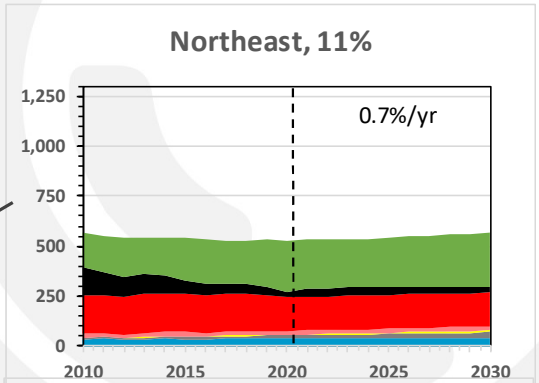
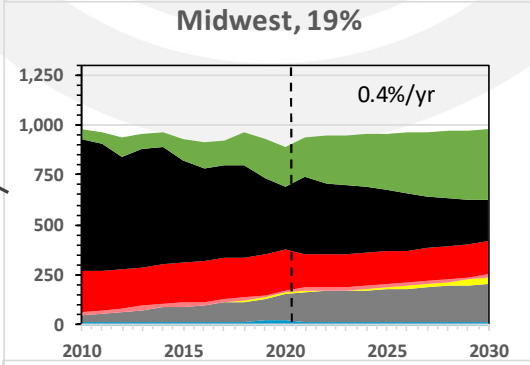
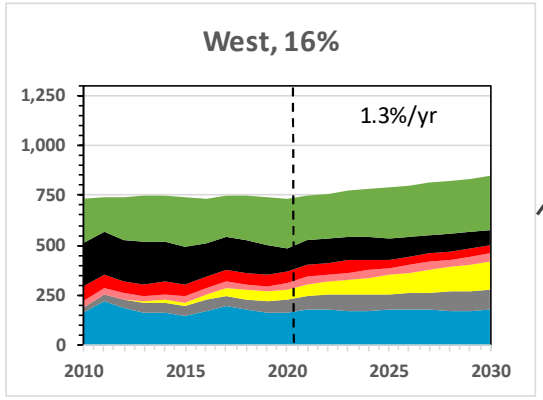
NORTH AMERICAN POWER DEMAND OUTLOOK BY REGION, TWH

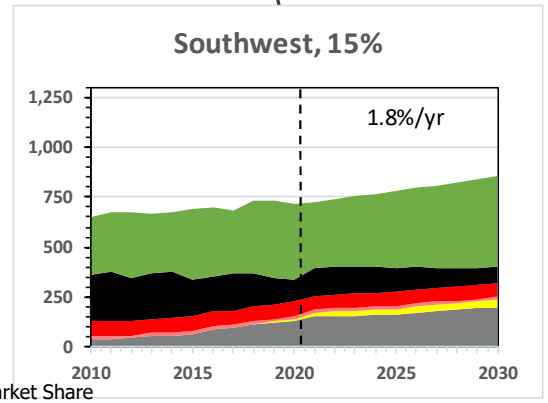


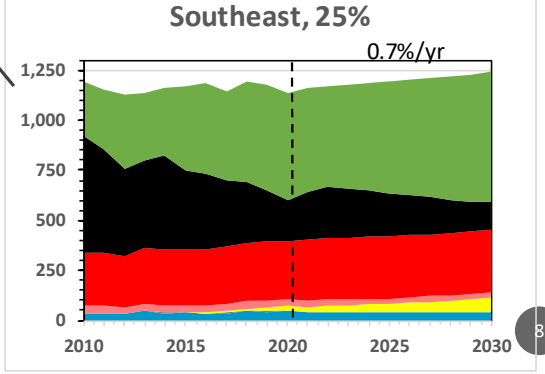












Hydroelectric
Nuclear
Wind
Coal
Solar
Natural Gas
Oil & Other

Region, % NA Market Share

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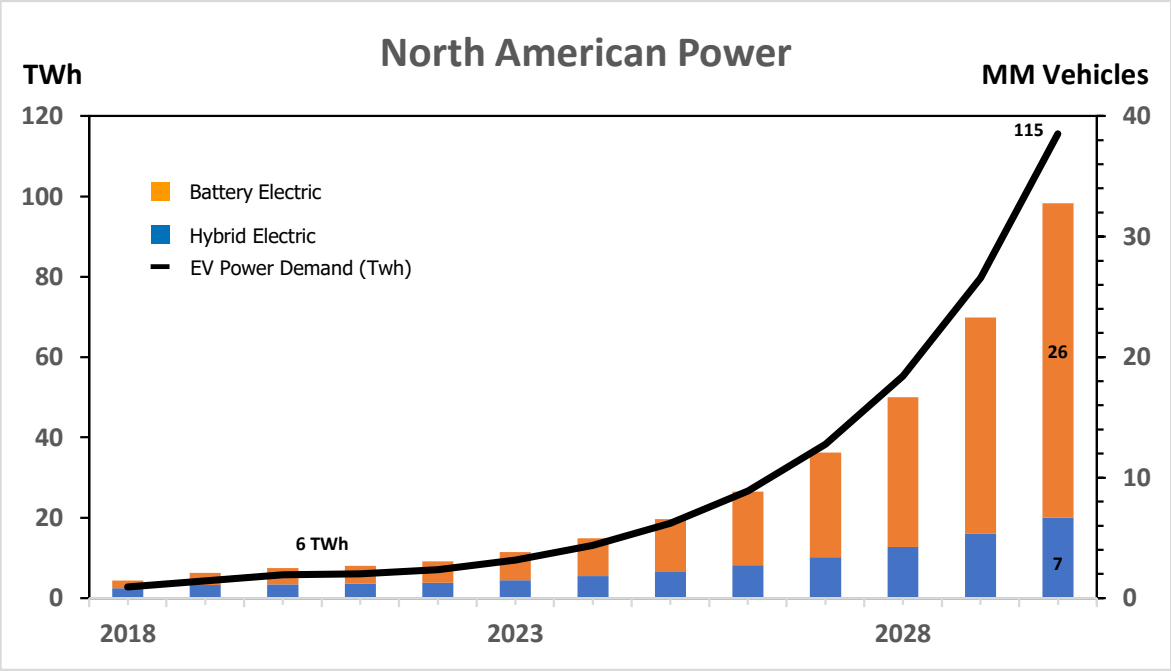
NORTH AMERICAN ELECTRIC VEHICLES FORECAST



Electric Vehicle Drivers

- Incorrys expects that electric cars will reach cost parity with gasoline cars towards 2025. As switching costs are reduced, significant growth in electric car production is expected.
- By 2030, power requirements for EV demand is expected to reach 115 TWh – approximately 30% of total power growth during this period
- The cost of battery packs has fallen to USD $140/kWh in 2020, from USD $1,100/kWh in 2010. Incorrys expects that cost will continue to drop and reach $100/kWh in 2023.
- EV range will close the gap with gasoline cars. Average range is expected to increase to almost 400 km, up from 310 km in 2020.

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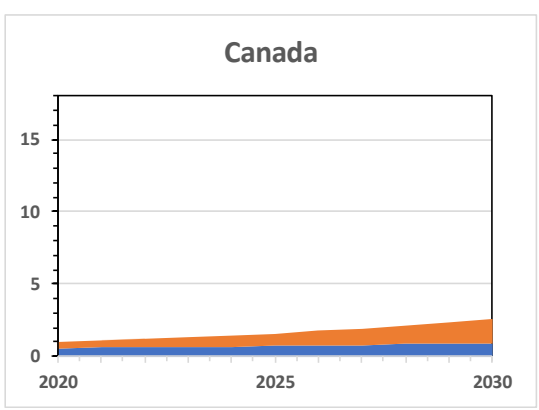
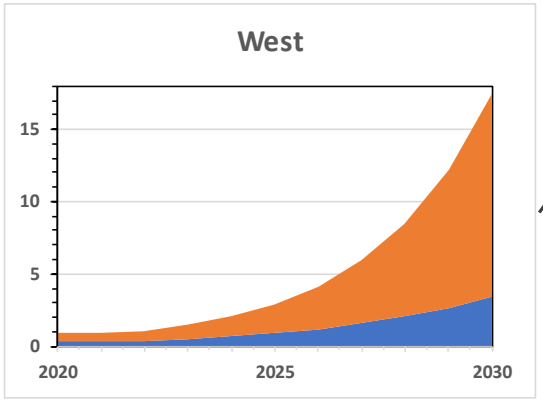
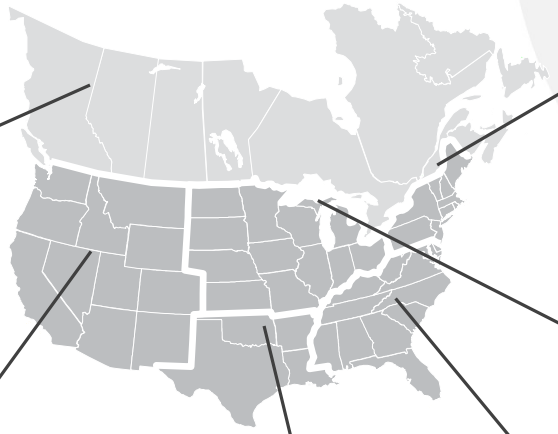
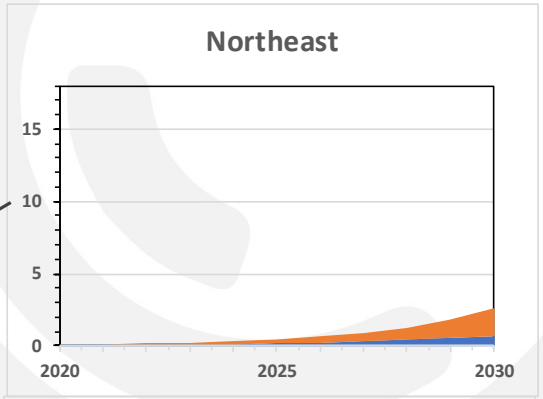
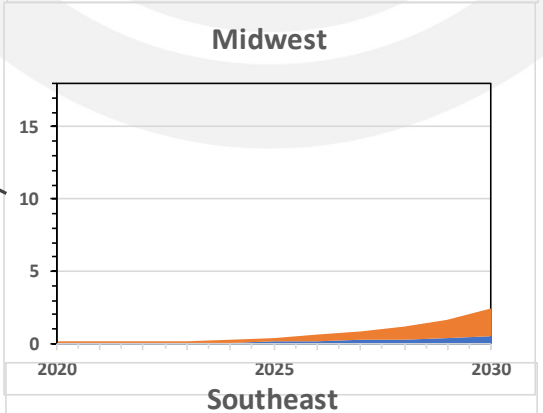
NORTH AMERICAN ELECTRIC VEHICLES OUTLOOK BY REGION, MM REGISTERED

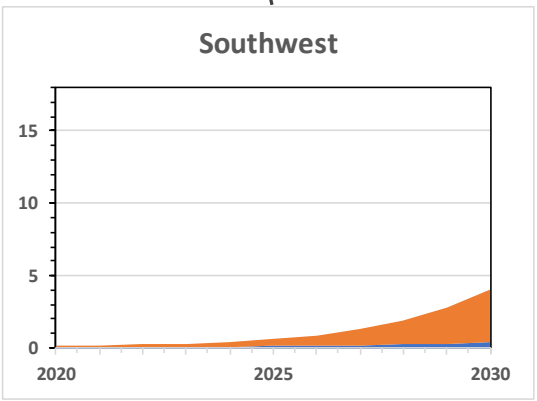


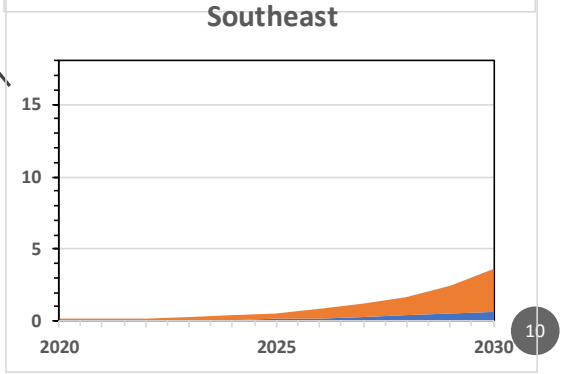








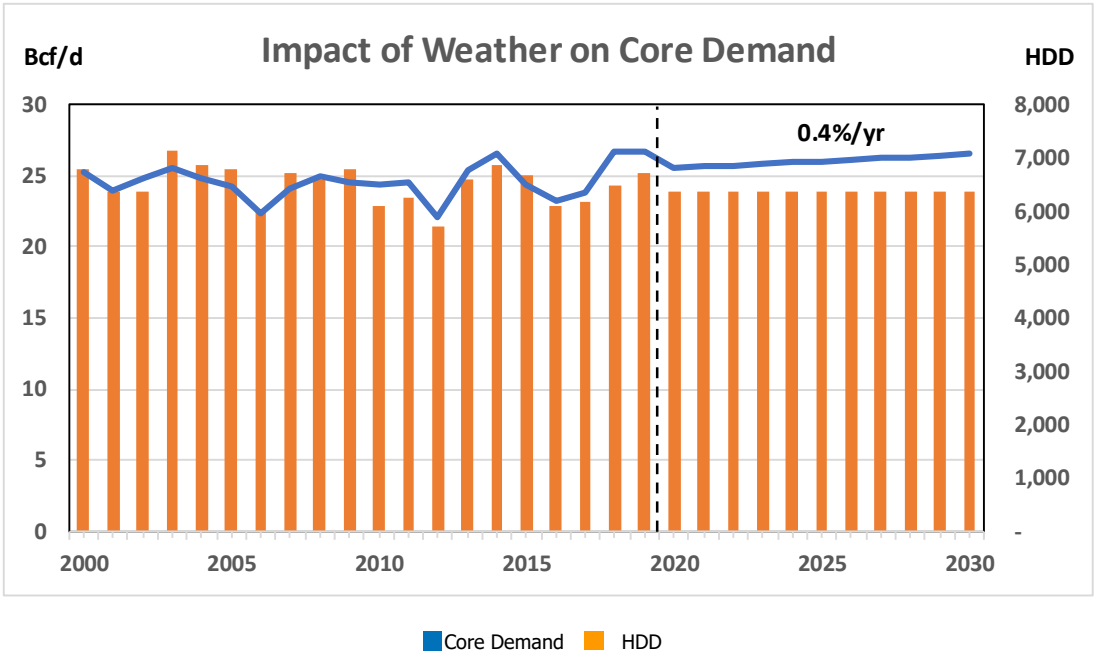




Battery Electric

Hybrid Electric

CORE DEMAND FOR NORTH AMERICAN NATURAL GAS



Core Natural Gas Demand Drivers

- Core Demand (residential and commercial sectors) mainly uses natural gas for winter heating loads.
- As illustrated in the chart, core demand correlates well to Heating Degree Days (HDD) with yearly swings resulting from warmer or cooler temperatures.
- Customer counts drive underlying Core demand growth of 0.4%/year. Efficiency factors on a normalized basis (Mcf/Customer/HDD) have steadied over the last decade, however, Incorrys is forecasting continued efficiencies of 0.1%/year.
- Efficiency factors include new building standards, opportunities to use modified technology applications such as adjustable smart digital thermomotors, and conservation measures in existing housing stock (insulation, new windows).

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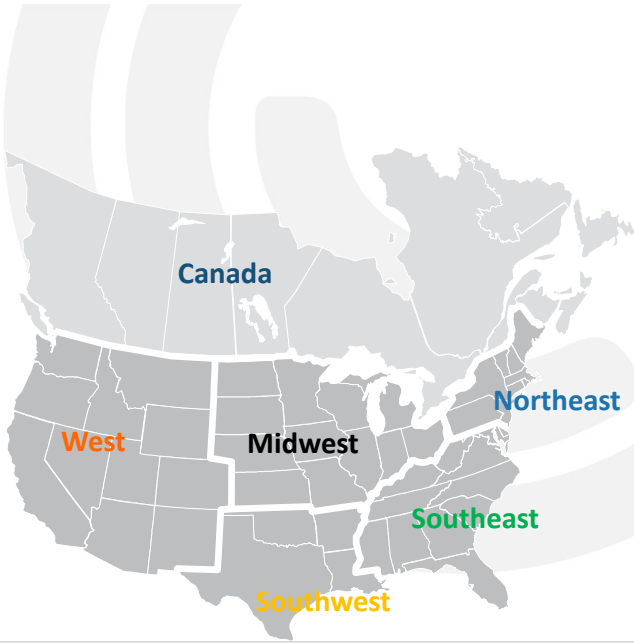
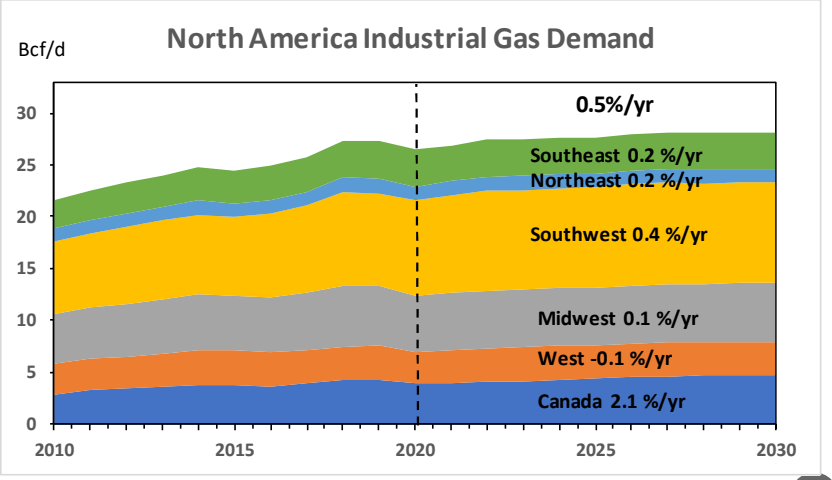
INDUSTRIAL DEMAND

Industrial Natural Gas Demand Drivers

- Industrial demand for natural gas is the most price sensitive sector. Chemical manufacturing (Fertilizer, Methanol), about 40% of market, tends to be the most natural gas intensive sector using the molecule as a feedstock in production.
- Petroleum and Plastics (10% market share) utilize natural gas as both a feedstock and process fuel.
- During the 2000s, price increases caused overall industrial demand to drop to 19.5 Bcf/d in 2009, down 5.1 Bcf/d from 2000.
- As shale gas supply increased the availability of low-cost natural gas, industrial demand that had been lost began to return to North America. Pre-Covid industrial demand in 2019 was 27.3 Bcf/d.
- Incorrys expects Industrial demand to grow 0.5%/year, reaching 28.2 Bcf/d by 2030. Evolving carbon policy could impact potential growth investments.





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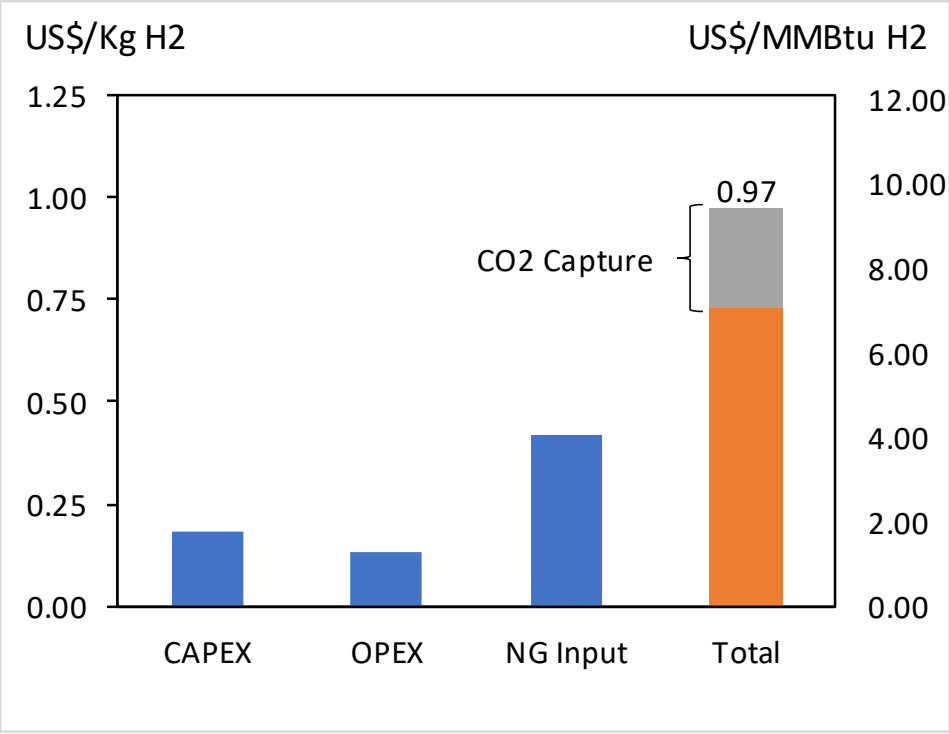
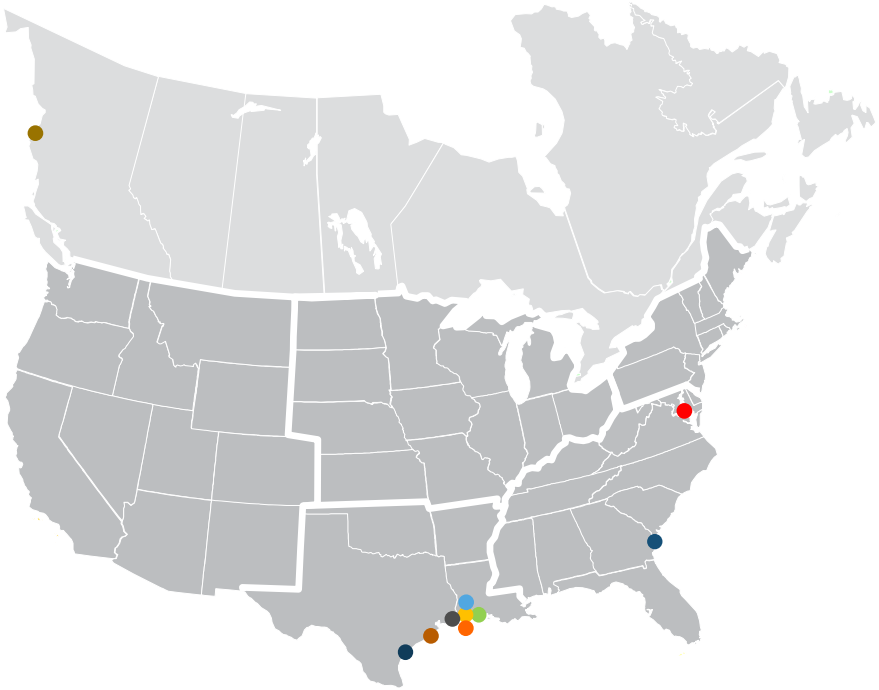
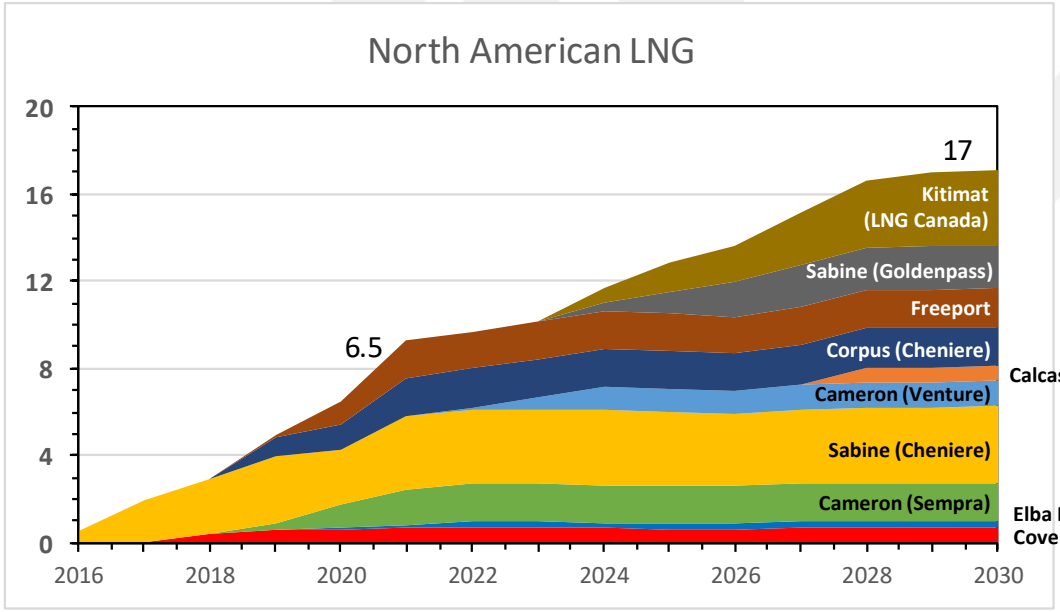
HYDROGEN STEAM METHANE REFORMING



- Although, not in Incorrys base forecast, hydrogen steam methane reforming could provide upside Industrial demand if adopted by heavy trucking industries.
- Potential to comingle with existing pipeline systems to reduce Scope 3 carbon emissions.
- 380 Tonnes H2/day plant output or 47.3 MMcf H2/d
  - Enough capacity for ~12,000 hydrogen semi-trucks
  - Hydrogen semi-truck will require ~11.5 Tonnes/year for 100,000 miles
- 62 MMcf/d natural gas input @ USD$2.30/Mcf
  - Hydrogen output cost highly dependent on natural gas input price, +USD$0.70/Mcf in natural gas price will increase total USD$0.15/Kg
- Assumptions:
  - CAPEX USD$170 MM
  - 90% load factor
  - 35:65 Equity to Debt
  - 15% Equity return
  - 7% Debt cost
  - USD$100/tonne CO_2 value

NORTH AMERICAN LNG EXPORTS TO 2030





- LNG Exports are expected to increase 10.5 Bcf/d over the next decade as Henry Hub pricing continues to offer worldwide buyers the ability to transact in a highly liquid and transparent market.
- Although there are many more projects proposed, Incorrys believes the ability of developers to source high quality credit for the next trench of worldwide demand growth will be limited by risks of emerging carbon uncertainties over the next decade.

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THANK YOU !

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