

2019 Long-term Outlook Information Session

October 3, 2019

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Introduction

Nicole LeBlanc
Director, Market & Tariff Design

- Introductions
- Context
- Key Results
- Load Forecast
- Generation Forecast
- Q&A



Name	Title
Nicole LeBlanc	Director, Market & Tariff Design
David Johnson	Manager, Forecasting & Market Simulation
Chad Ayers	Senior Market Simulation Analyst
Noeline Kanagalingam	Senior Generation Forecast Analyst
Lars Renborg	Load Forecast Analyst

Context and Key Results

David Johnson
Manager, Forecasting and Analytics

- The 2019 Long-term Outlook (2019 LTO) is AESO's view of Alberta's load and generation development for next 20 years
 - Used for transmission planning and market assessments to ensure a reliable supply of power now and in the future
- Considers Alberta's economy, provincial and federal policy, technology, and expected electricity consumption patterns
 - We continually monitor changes that could affect the forecast
- While Alberta's competitive electricity market determines future generation investment, the LTO provides a view of the expected type and location of generation
- A scenario-based approach tests a range of future outcomes

Reference Case

AESO's main corporate forecast

High Cogeneration Sensitivity

tests increased cogeneration adoption at existing and future oilsands sites

Alternate Renewable Policy

tests higher renewable target or policy

High Growth Scenario

tests higher economic and generation growth due to strong oilsands growth

Diversification Scenario

tests greater penetration of new technologies in an economy not driven by oilsands

Low Growth Scenario

tests lower economic and generation growth due to limited oilsands growth

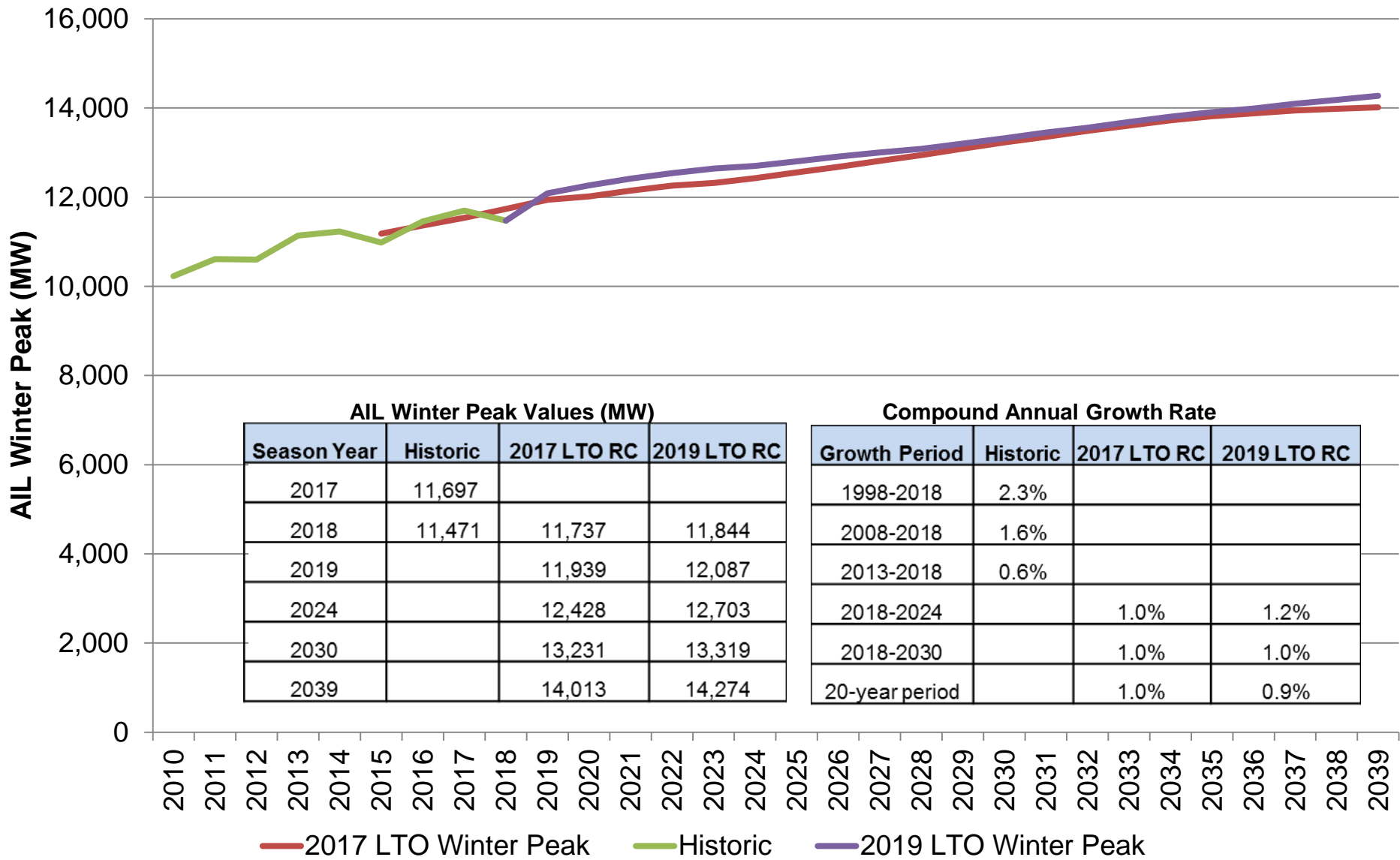
- Alberta load is forecast to grow at a compound annual growth rate of 0.9% until 2039
 - Half the rate of growth experienced in the past 20 years
- Expected generation development in next 20 years:
 - 13 GW of new generation capacity totalling ~ 23 GW by 2039
 - Natural gas becomes dominant generation source
 - 5,275 MW of coal-fired capacity will co-fire or convert to natural gas beginning in 2021
 - Renewables will develop from recent government support programs in the near term and through market mechanisms and corporate PPAs in the longer term
 - Additional 1,050 MW of wind, 100 MW of solar by 2030
 - Incremental 550 MW of wind and 250 MW of solar by 2039

2019 LTO Load Forecast

Lars Renborg
Load Forecast Analyst

- 2019 LTO Reference Case
 - Relies on Conference Board of Canada's 20-year GDP forecast of 1.9% annual real GDP growth
 - Results in 0.9% load growth over the next 20 years
 - Similar load outlook to the 2017 LTO Reference Case
- The 2019 LTO load scenarios consider a broad set of outcomes to account for economic uncertainty in Alberta
 - Low Growth Scenario: Alberta's oilsands industry stops expanding and load growth flattens out as a result
 - High Growth Scenario: Oilsands production continues at the pace seen historically between 2010 and 2014, and new load drivers such as electric vehicles further increase load
 - Diversification Scenario: Alberta successfully diversifies away from oil and gas and new industries increase load in urban areas

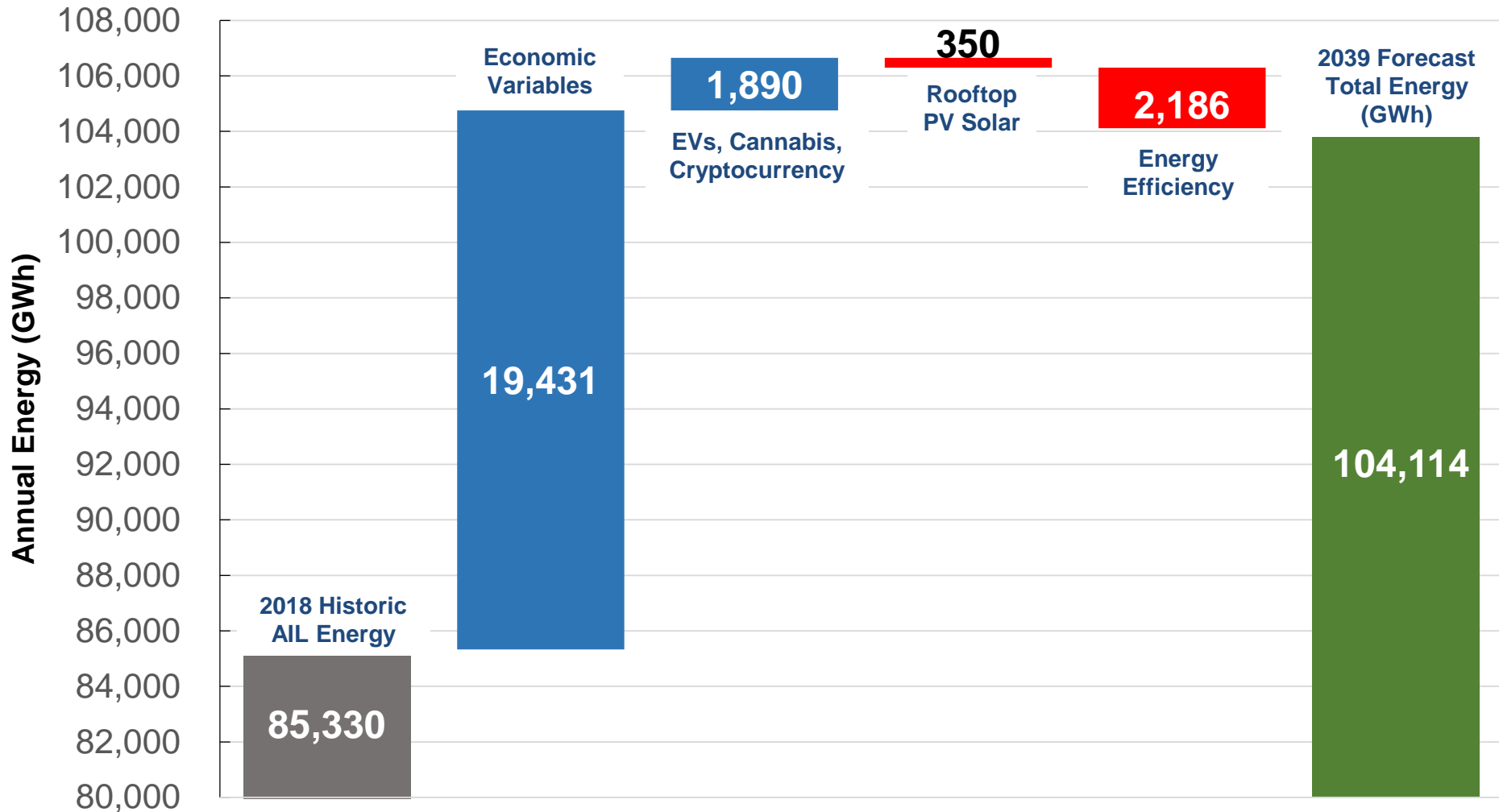
Load: Reference Case



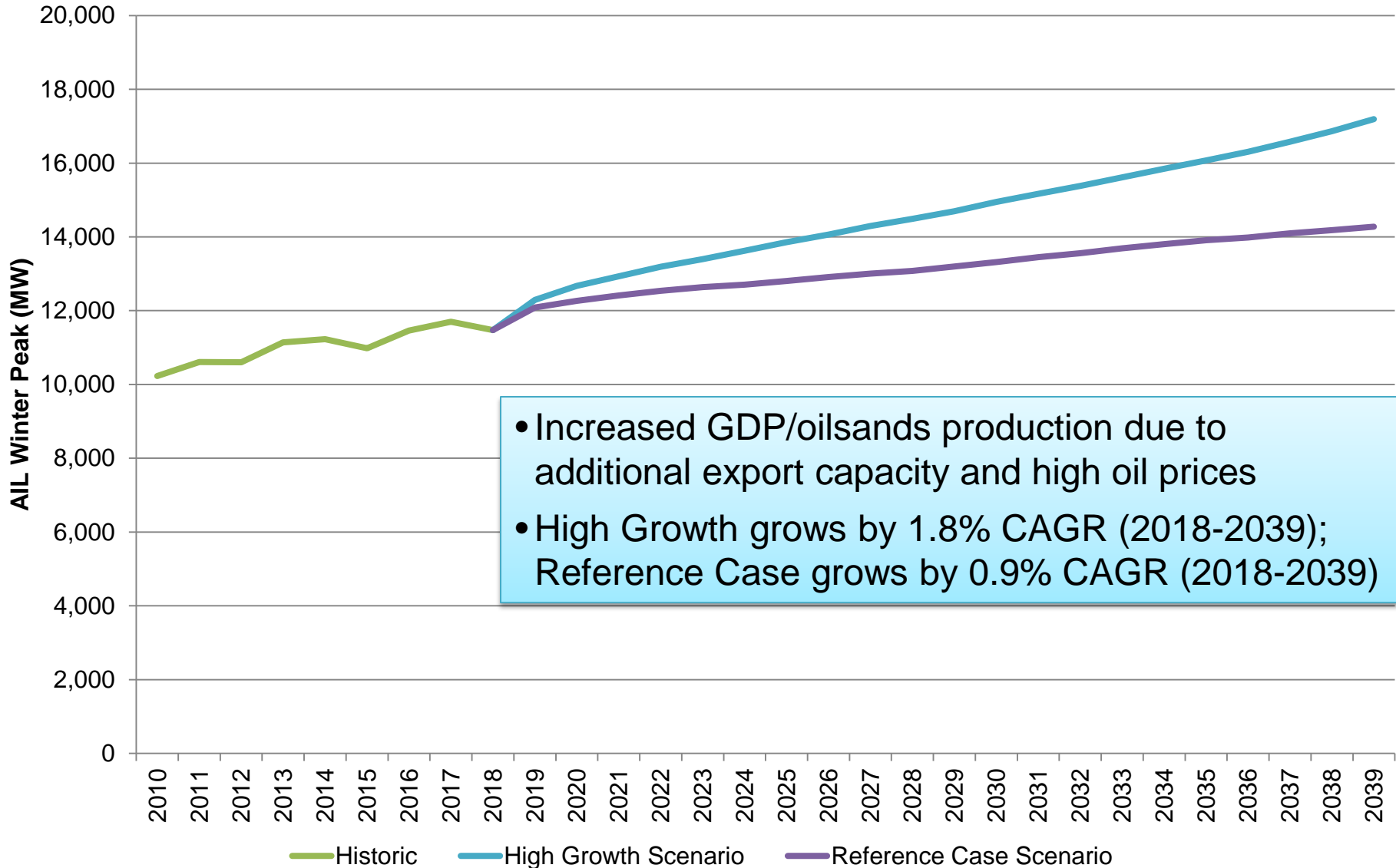
- 2019 LTO uses SAS LTLF tool
 - Linear regression used to forecast point of delivery (POD), area, region and AIL
 - Variables empirically shown to drive load are used as inputs for POD, area, region, and AIL
 - Examples of variables used for AIL model:
 - Real GDP, population, employment, oilsands production, time of day, week and year

Forecasting Technique Used	2019 LTO	2017 LTO
POD level econometric models?	Yes	No
Area and regional econometric models?	Yes	No
Econometric model for AIL?	Yes	Yes
DFO forecast used as a direct input?	No (consulted)	Partially

Reference Case Load Growth Breakout



High Growth Scenario Comparison

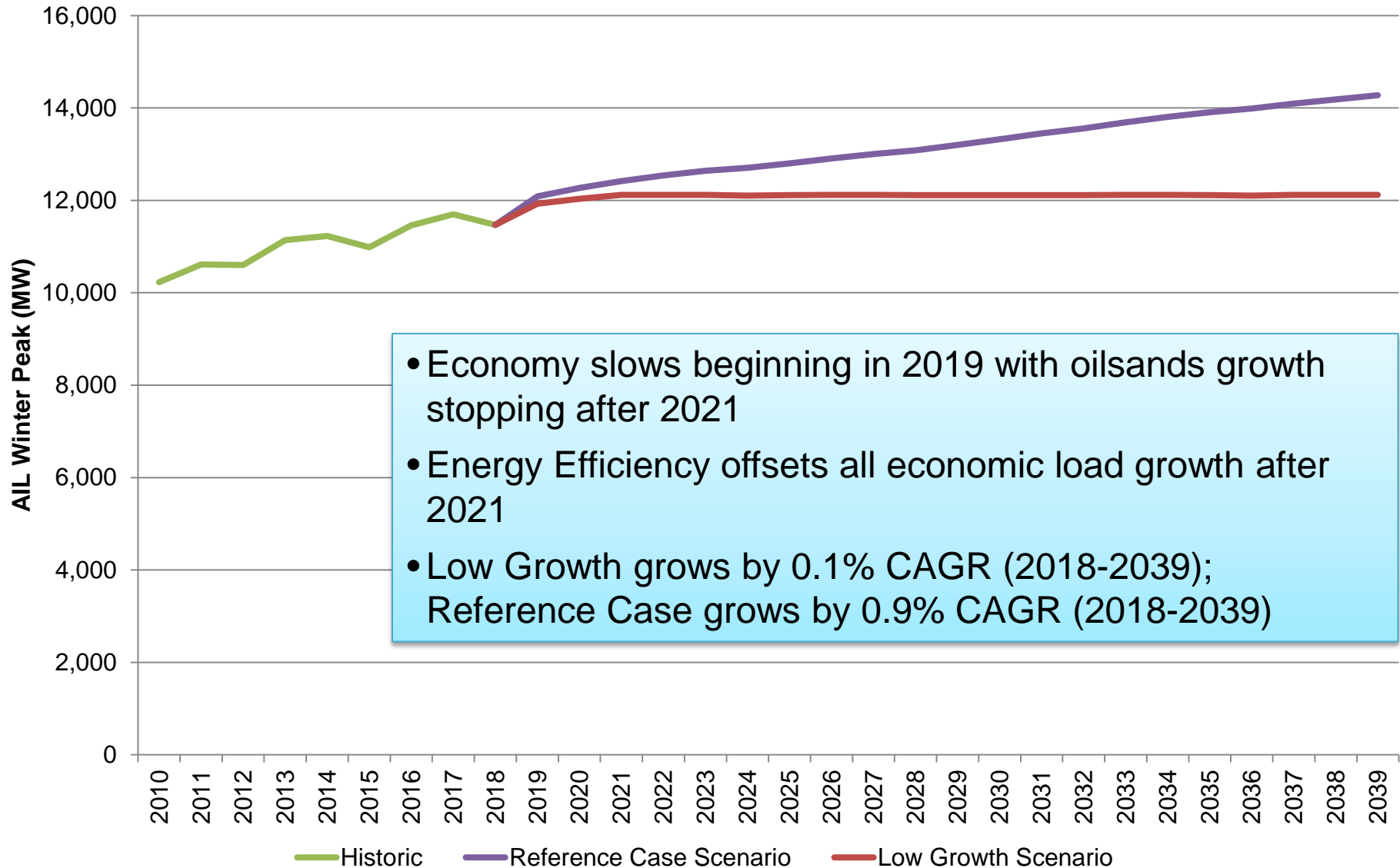


High Growth Scenario Assumptions

- Significant oilsands development driven by strong North American oil prices and increased pipeline export capacity
- Commensurate condensate demand and value of other NGLs results in increased drilling and completion activity in northwest Alberta

Scenario	Reference Case	High Growth
Forecast GDP growth (CAGR from 2018 to 2039)	1.9%	3.3%
Energy Efficiency Assumption – Winter Peak demand savings by 2039 (MW)	251	302
Maximum Rooftop Solar Output by 2039 (MW)	241	241
Oilsands Production – Growth from 2018 to 2039 (kbbbl/day)	1,297	3,272
Load Forecast Growth Rate (CAGR from 2018 to 2039)	0.9%	1.8%

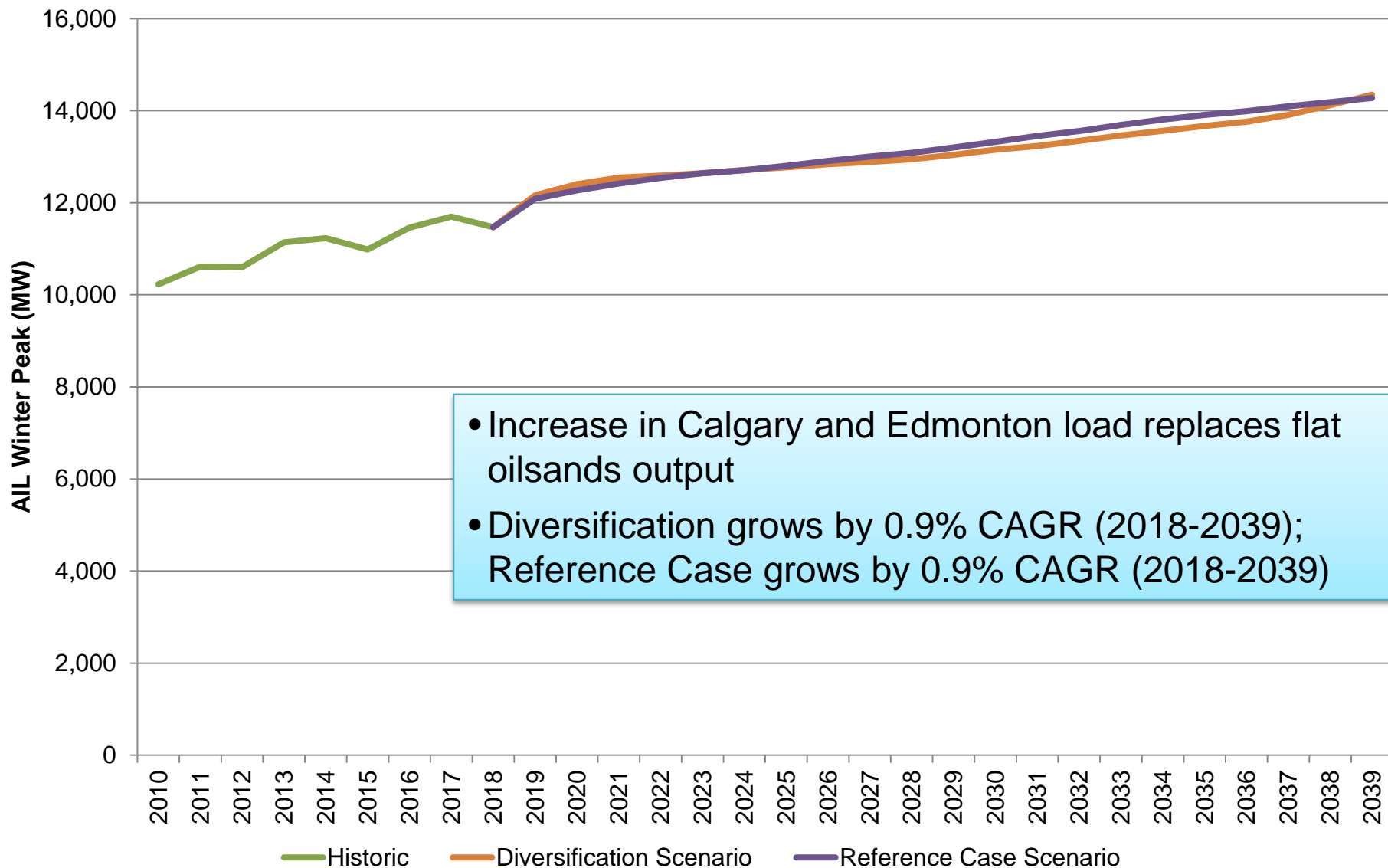
Low Growth Scenario Comparison



- Low Growth Scenario tests what the impact on load growth would be from four factors:
 - Reduced GDP growth in Alberta
 - Flat oilsands growth after 2021
 - Higher energy efficiency
 - Higher rooftop solar adoption in Alberta

Scenario	Reference Case	Low Growth
Forecast GDP growth (CAGR from 2018 to 2039)	1.9%	1.1%
Energy Efficiency Assumption – Winter Peak demand savings by 2039 (MW)	251	936
Maximum Rooftop Solar Output by 2039 (MW)	241	728
Oilsands Production – Growth from 2018 to 2039 (kbbbl/day)	1,297	329
Load Forecast Growth Rate (CAGR from 2018 to 2039)	0.9%	0.1%

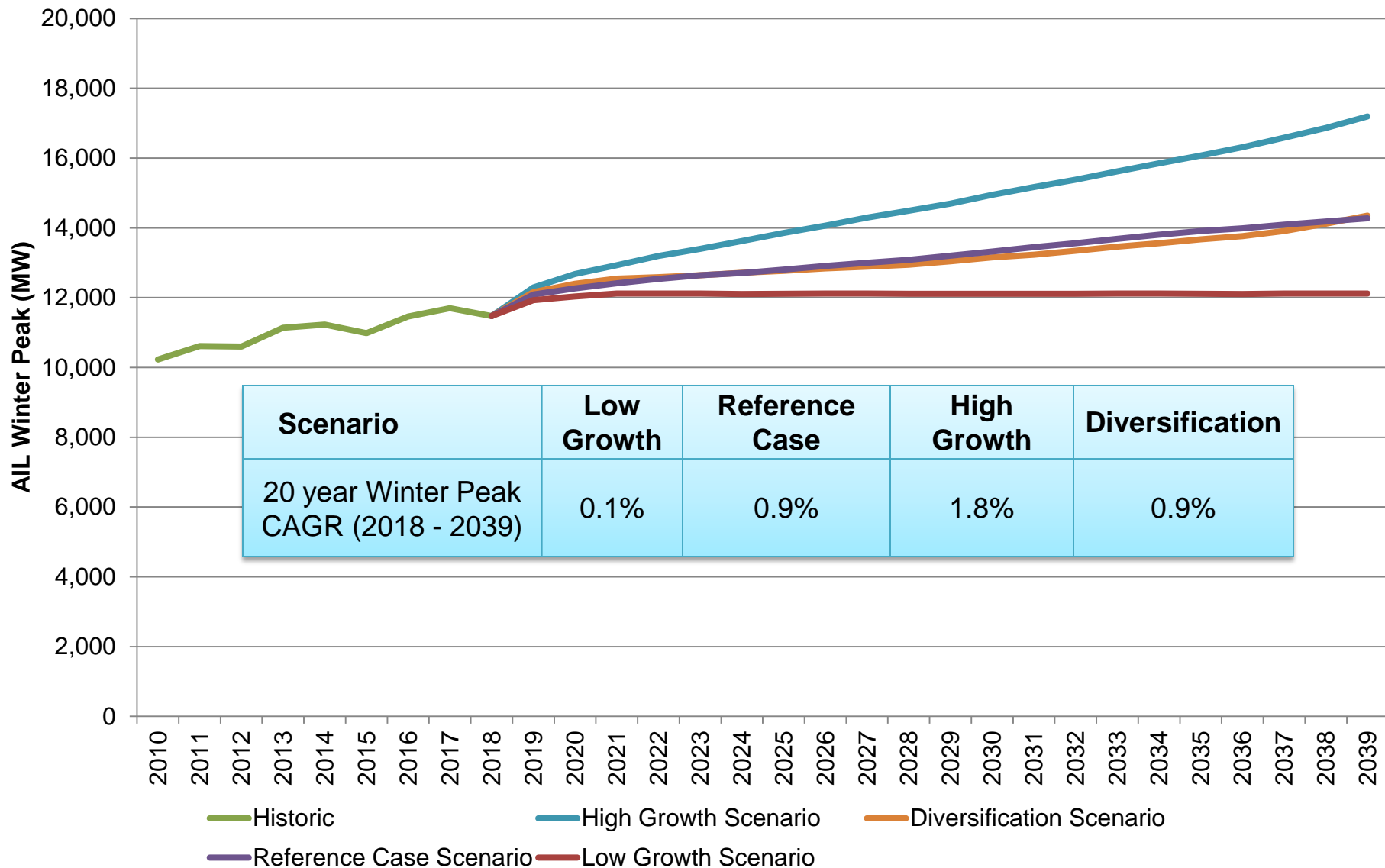
Diversification Scenario Comparison



- Alberta’s oil industry slows however Alberta successfully diversifies to other industries and continues to grow
- Diversification scenario’s economic outlook for Alberta is based on Manitoba’s economic outlook
- Manitoba was used because it currently has a highly diversified economy

Scenario	Reference Case	Diversification
Forecast GDP growth (CAGR from 2018 to 2039)	1.9%	1.7%
Energy Efficiency Assumption – Winter Peak demand savings by 2039 (MW)	251	474
Maximum Rooftop Solar Output by 2039 (MW)	241	241
Oilsands Production – Growth from 2018 to 2039 (kbbbl/day)	1,297	329
Load Forecast Growth Rate (CAGR from 2018 to 2039)	0.9%	0.9%

Load: Scenario Comparison



2019 LTO Generation Forecast

Noeline Kanagalingam

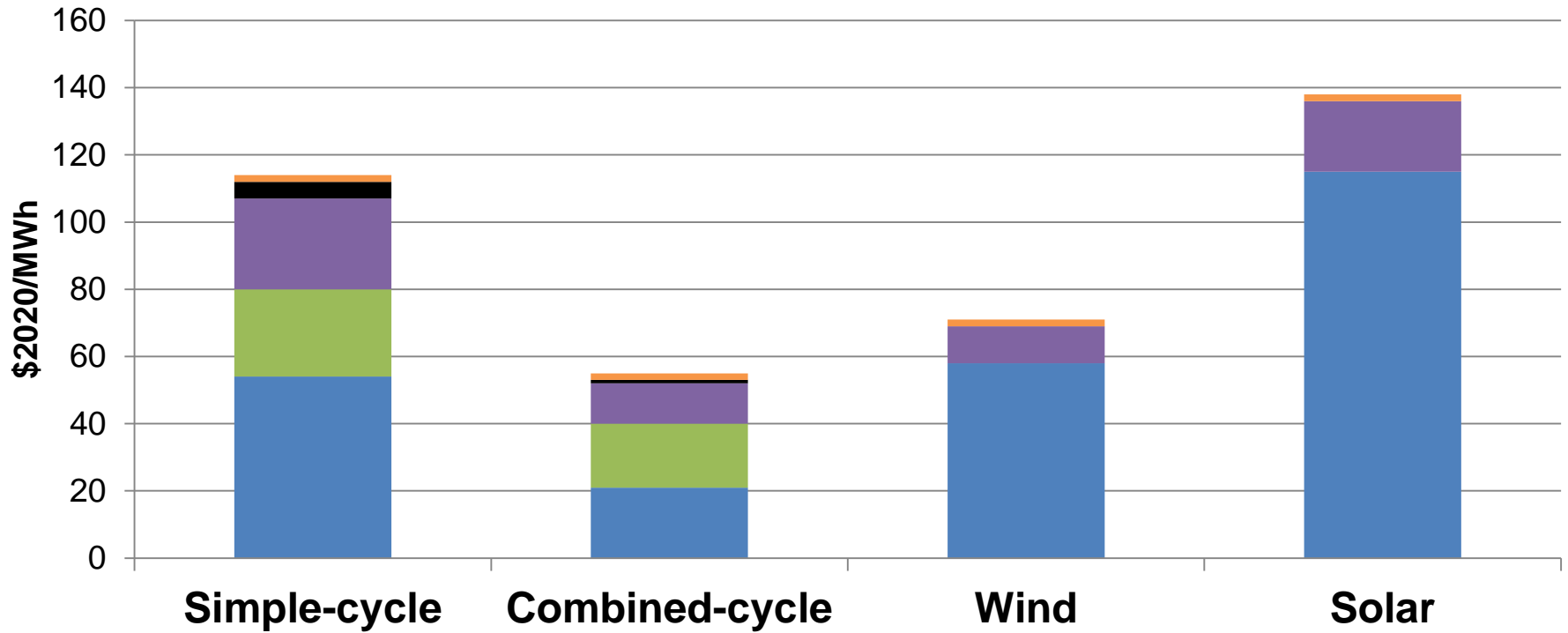
Senior Generation Forecast Analyst

- Generation forecast is based on:
 - Forecast load growth and assumed retirements
 - Known and assumed policies
 - Alberta generation resource availability
 - Economics of various generation technologies

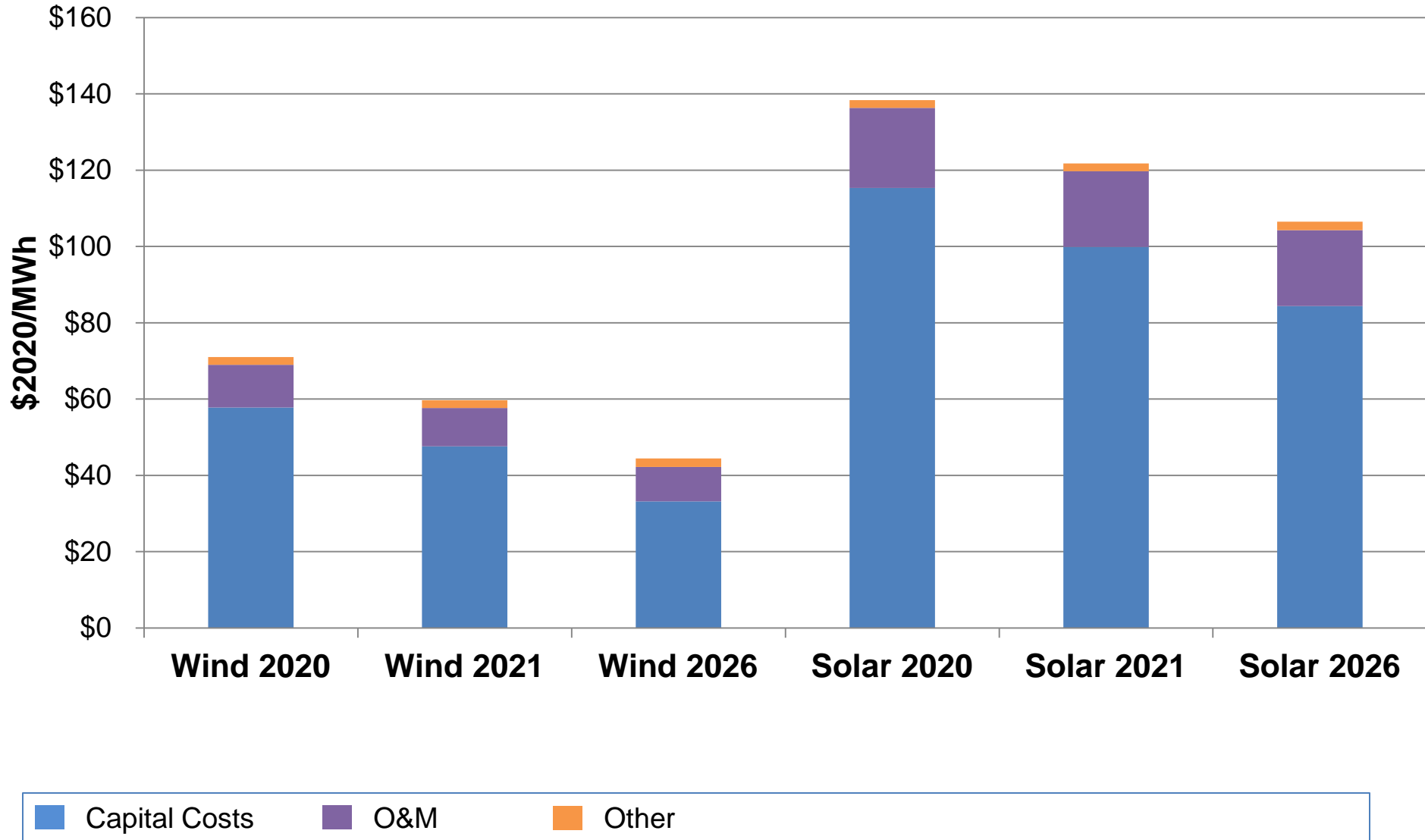


- Key Assumptions:
 - REP 1, 2 and 3 and Alberta Infrastructure projects are included
 - Majority of coal units are assumed to co-fire or convert to gas
 - \$20/tonne carbon price in 2020 with assumed TIER
 - 675 MW of new cogeneration development
 - 50 MW of storage development
 - Reference Case load forecast
 - Gas prices \$1.58 – 3.54/GJ

Levelized Cost of Energy Results for Projects in Service in 2020



Levelized Cost of Energy for Wind and Solar at Different Time Intervals



- Generation forecast includes 5 scenarios and 1 sensitivity
- Common in all scenarios and sensitivity:
 - Natural gas is dominant fuel source
 - Renewables continue to develop after REP projects through competitive market forces
 - Coal-to-gas contributes to near-term supply mix



Generation: Reference Case

- ~13 GW of generation additions (excluding coal-to-gas conversions)
- Natural gas accounts for 75% of generation capacity in 2039
- Renewables account for ~19% of energy demand in 2030
- Net additions by 2039: ~2.5 GW wind and ~0.5 GW solar

Installed Generation Capacity Mix

2018

Generation: 16,106 MW



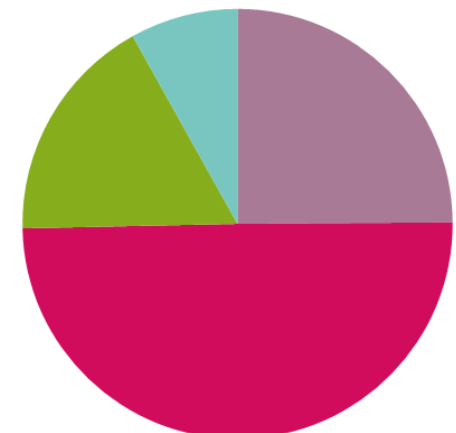
2030

Generation: 19,853 MW



2039

Generation: 22,815 MW



■ Cogeneration ■ Gas-fired (CC, SC, CtG) ■ Wind ■ Renewables (Non-Wind) ■ Coal-fired

Generation: High Cogeneration Sensitivity

- Coke boiler replacements and increased cogeneration at existing and future sites
- ~2.3 GW of cogeneration additions (~1.6 GW higher than Reference Case)
- Wind additions post-REP are lower compared to the Reference Case
- Cogeneration defers and displaces gas-fired capacity

Installed Generation Capacity Mix

2018

Generation: 16,106 MW



2030

Generation: 19,437 MW



2039

Generation: 22,217 MW



■ Cogeneration ■ Gas-fired (CC, SC, CtG) ■ Wind ■ Renewables (Non-Wind) ■ Coal-fired

Generation: Alternate Renewable Policy

- Driven by a renewable energy target or policy to support greater renewable development
- Net additions by 2039: ~6 GW wind and ~1 GW solar
- Large amount of renewable generation compared to the Reference Case

Installed Generation Capacity Mix

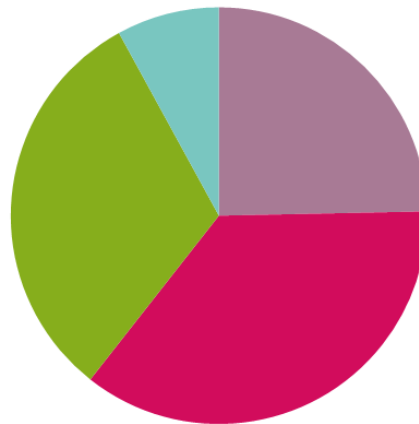
2018

Generation: 16,106 MW



2030

Generation: 22,289 MW



2039

Generation: 26,216 MW



■ Cogeneration ■ Gas-fired (CC, SC, CtG) ■ Wind ■ Renewables (Non-Wind) ■ Coal-fired

Generation: Low Growth

- Uses Low Growth load scenario
- ~9 GW of generation additions (excluding coal-to-gas)
- Firm gas additions replace coal and coal-to-gas retirements
- Net additions by 2039: ~1.7 GW wind (~0.8 GW lower than Reference Case)

Installed Generation Capacity Mix

2018

Generation: 16,106 MW



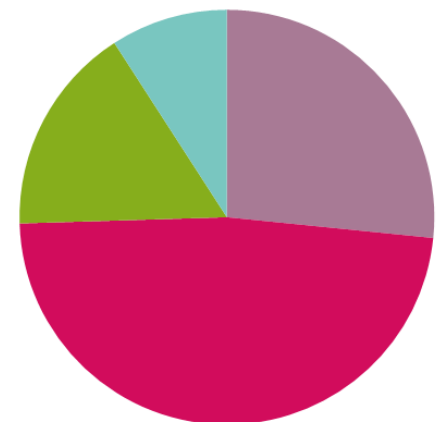
2030

Generation: 17,472 MW



2039

Generation: 19,149 MW



■ Cogeneration ■ Gas-fired (CC, SC, CtG) ■ Wind ■ Renewables (Non-Wind) ■ Coal-fired

Generation: High Growth

- Uses High Growth load scenario
- ~2.3 GW cogeneration develops (~1.6 GW higher than Reference Case)
- ~17 GW of generation additions (excluding coal-to-gas)
- Increased firm gas-fired generation additions

Installed Generation Capacity Mix

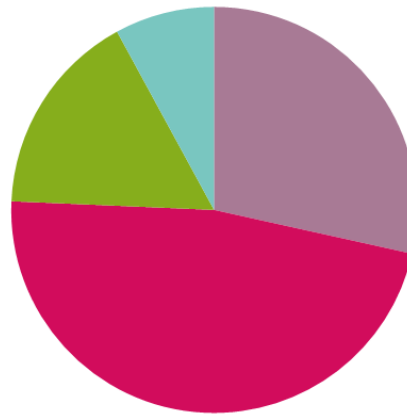
2018

Generation: 16,106 MW



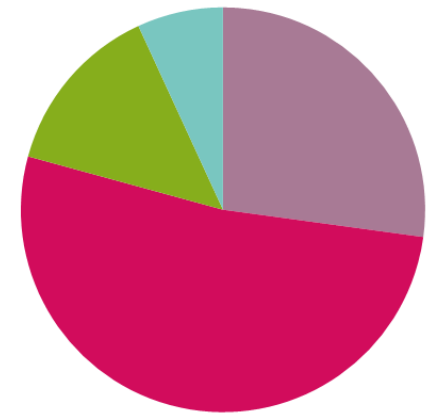
2030

Generation: 22,005 MW



2039

Generation: 26,881 MW



■ Cogeneration ■ Gas-fired (CC, SC, CtG) ■ Wind ■ Renewables (Non-Wind) ■ Coal-fired

Generation: Diversification

- Tests the impact of a more diversified generation capacity mix
- Cost reduction for solar and support for other renewables and storage
- Net additions by 2039: 350 MW hydro, 500 MW storage, ~3.2 GW solar, ~3.2 GW wind
- ~40% of fleet capacity is renewables in 2039
- More flexible gas-fired fleet than Reference Case

Installed Generation Capacity Mix

2018

Generation: 16,106 MW



2030

Generation: 21,606 MW



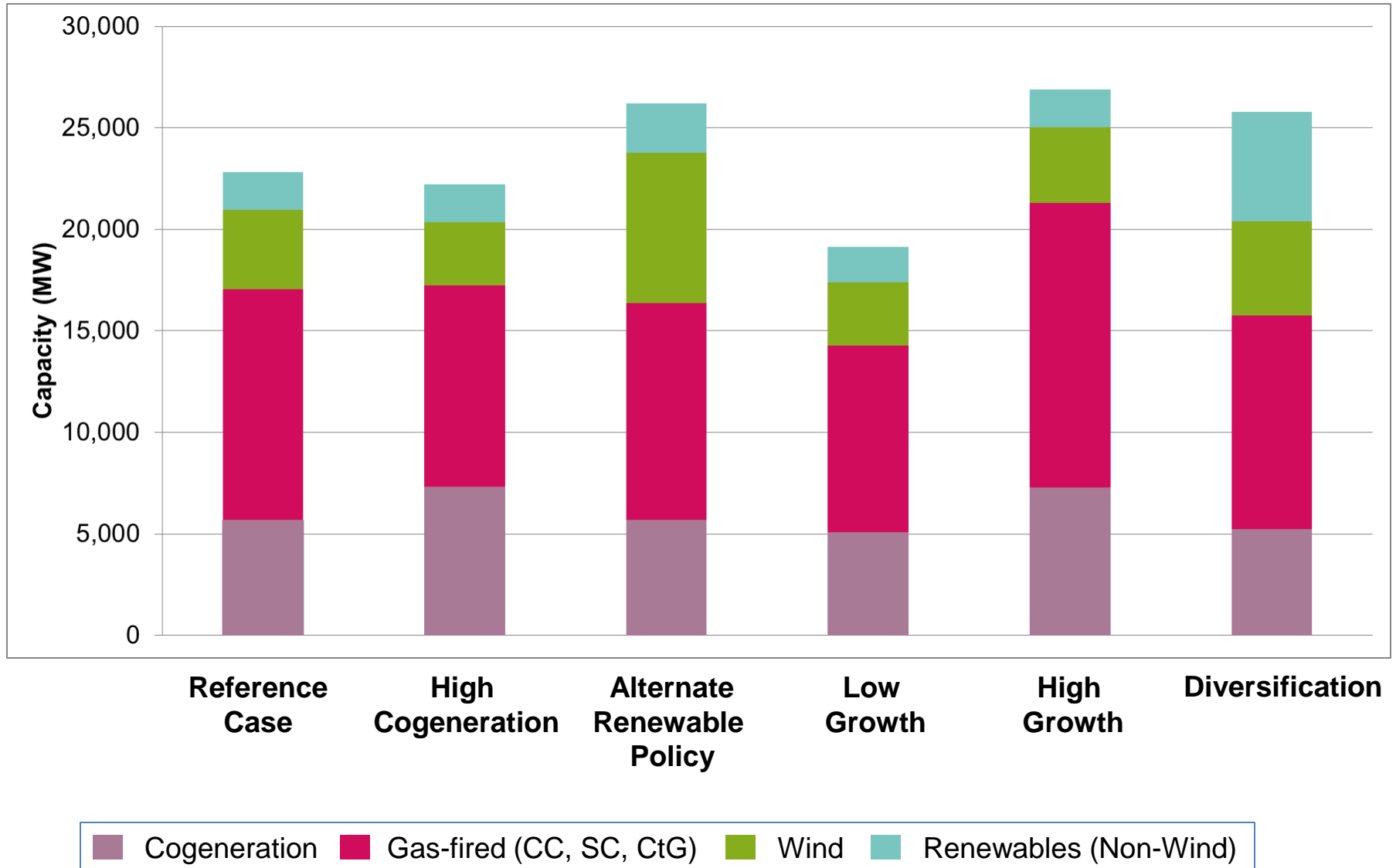
2039

Generation: 25,773 MW

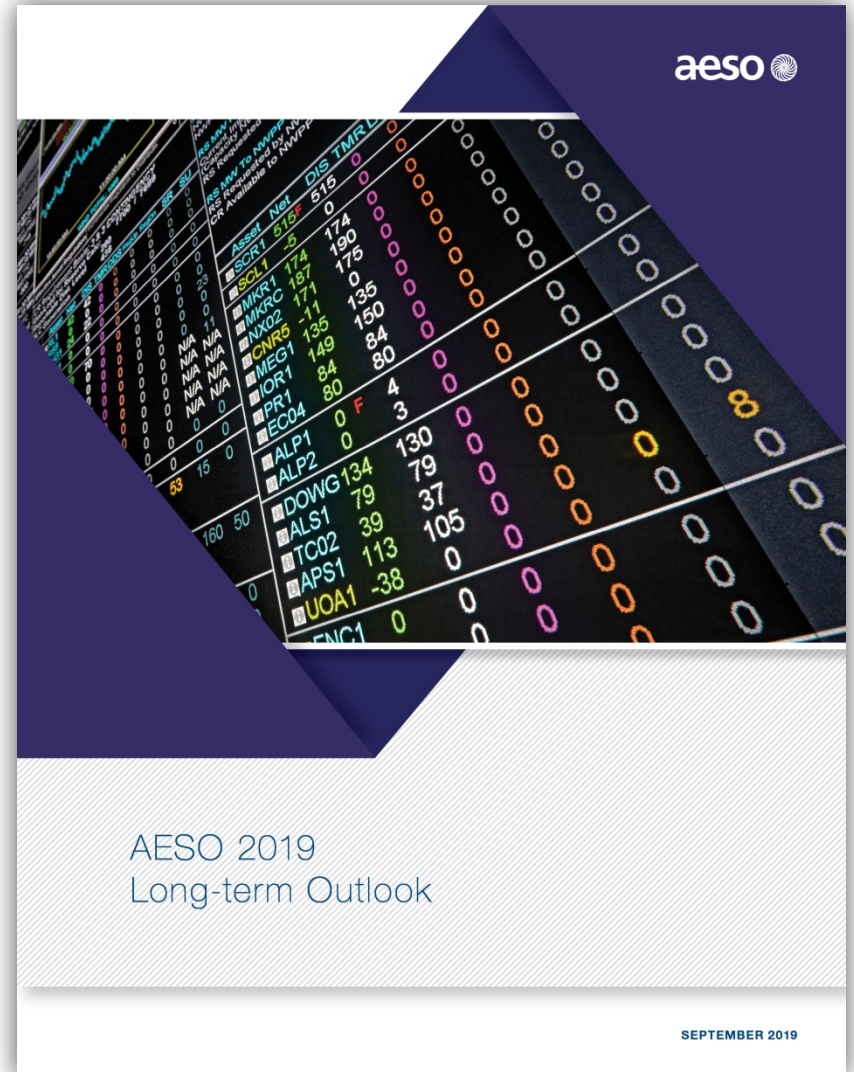


■ Cogeneration ■ Gas-fired (CC, SC, CtG) ■ Wind ■ Renewables (Non-Wind) ■ Coal-fired

Generation Capacity – 2039



- Visit our website at aeso.ca/grid/forecasting for:
 - 2019 LTO
 - 2019 LTO data file
 - AWS TruePower Wind and Solar Assessment
 - Webinar recording
- Questions? Email us at: forecast@aeso.ca



Q&A Period



- **Twitter:** @theAESO
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Thank you