

**2021 Long-term Outlook
Scenarios: Stakeholder
Engagement & Feedback**
December 2020

- The AESO's *2021 Long-term Outlook* (LTO) is a 20 year forecast of expected electricity supply and demand in the province
- This presentation summarizes the **preliminary results** from the reference case so the scenarios can be understood in context
 - Over the next six months the AESO will complete a detailed forecast of the reference case and run the scenarios
- Due to the wide range of unknown outcomes within this timeframe, the AESO will publish a Reference Case as well as three scenarios
 - Scenarios are intended to reflect a range of possible future economic and policy outcomes that could change our energy landscape vis-à-vis the Reference Case which allows the AESO to pivot should the world change faster than expected before the next LTO
 - Key information regarding the Reference Case is being provided to stakeholders as it relates to the Scenarios
- The AESO would like to solicit feedback from stakeholders that are interested in the *2021 Long-term Outlook* to understand their perspectives and insights related to the proposed scenario narratives

2021 Long-term Outlook Preliminary Reference Case Overview

- The AESO forecasts demand and supply over the next 20 years based on a reference set of assumptions
- The next few slides will summarize the assumptions and preliminary Reference Case results
 - Reference Case developed with consideration of stakeholder feedback received in summer 2020

Key drivers of AIL growth: economic indicators, oilsands, COVID-19

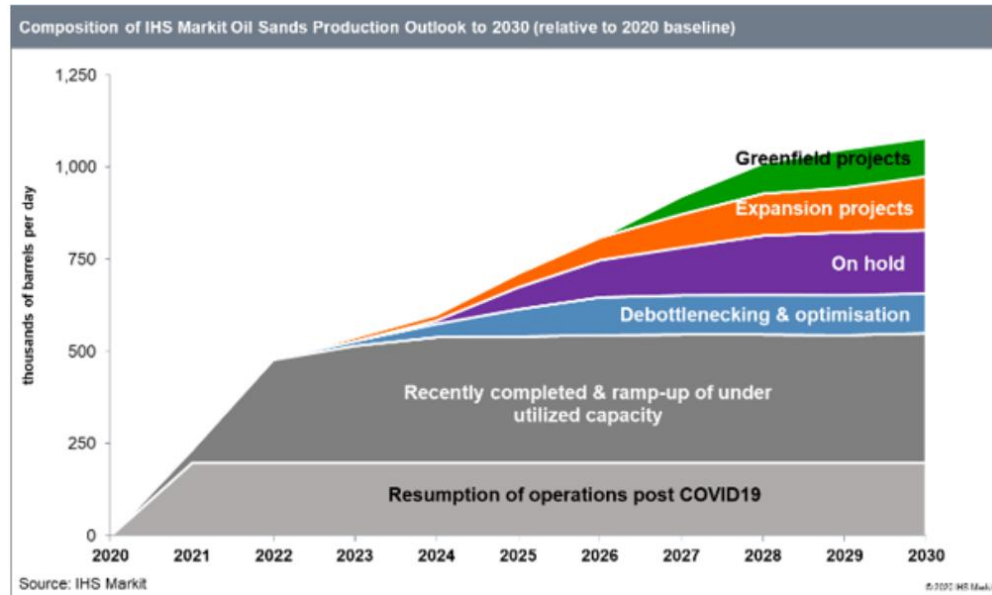


- The AESO relies on third party forecasting experts for macroeconomic inputs to the LTO such as GDP growth data, employment data, and population growth data
- Economic indicators from Conference Board of Canada's outlook for Alberta reflect a significant short-term economic shock, with a rebound, and then a return to long-term growth by 2025
- Oilsands outlook from IHS Q3 2020 reflects Alberta production recovering to 2019 levels by 2022
 - Projects oilsands growth thereafter of an additional 500,000+ barrels per day by 2030
- COVID-19 assumptions incorporate effects on load from subsequent waves until the end of 2022
- Out of these inputs, oilsands production is the leading driver of load growth – economic indicators are becoming less influential due to a decreasing electricity intensity factor of the economy (improvements in energy efficiency, technology)

CBoC Alberta Economic Outlook				
Year	2020	2021	2022-2024	2025+
Real GDP Growth, %	-11.3%	6.9%	4.5%	2.2%
Employment Rate, %	-6.9%	4.4%	2.2%	1.5%
Population Rate, %	1.3%	1.6%	1.8%	1.7-1.2%

Source: Conference Board of Canada, 5 year Provincial outlook E-Data, Aug 24th 2020 and Conference Board of Canada, Long Term Provincial Outlook E-Data, Dec 4th 2019

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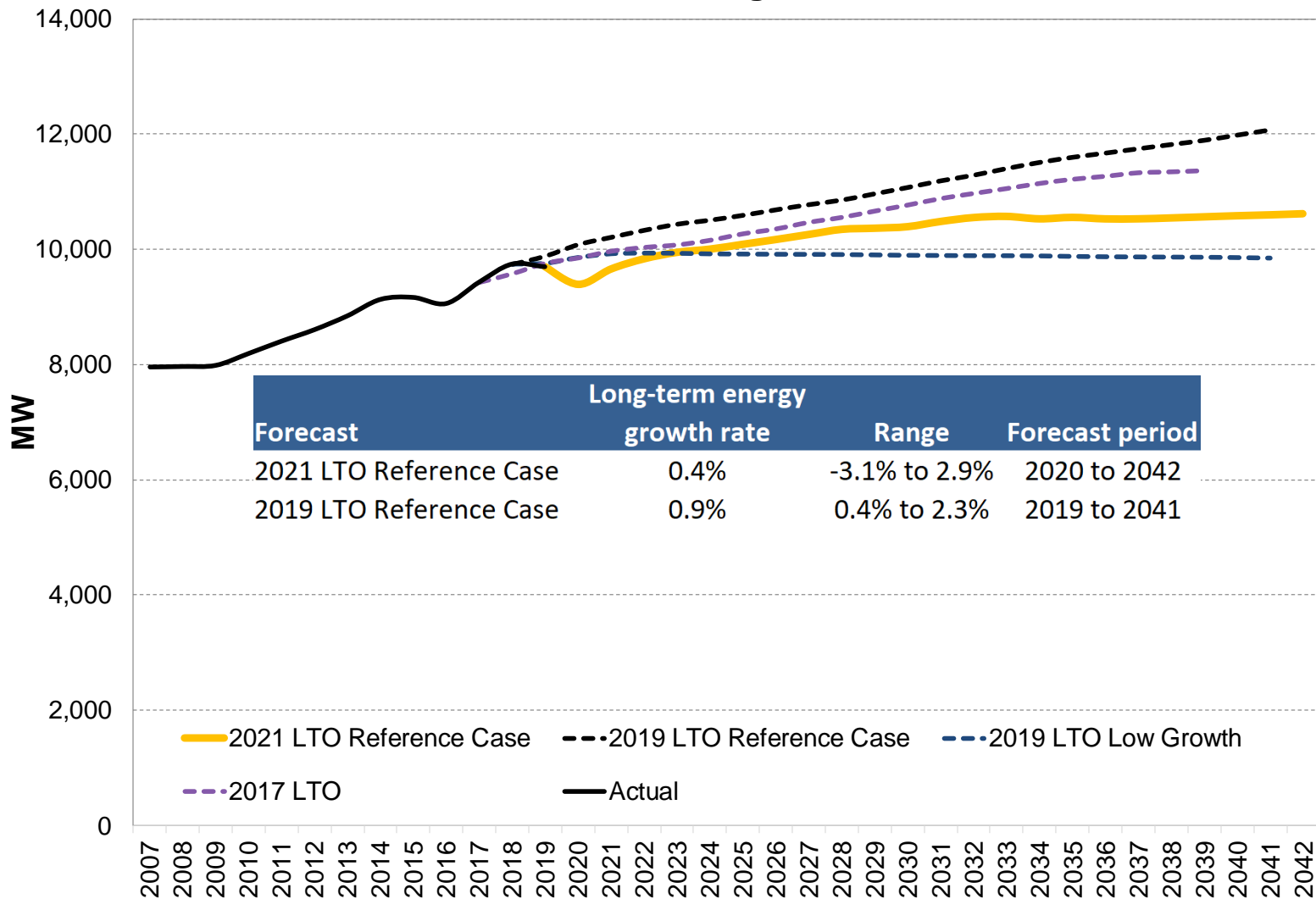
Source: IHS Markit, "Longer-Term Outlook for Canadian Oil Sands Largely Intact Despite Largest Annual Production Decline in 2020", 28 July 2020

Preliminary forecast results: Average AIL



- 2021 LTO is lower than the 2019 LTO

Forecast Average AIL

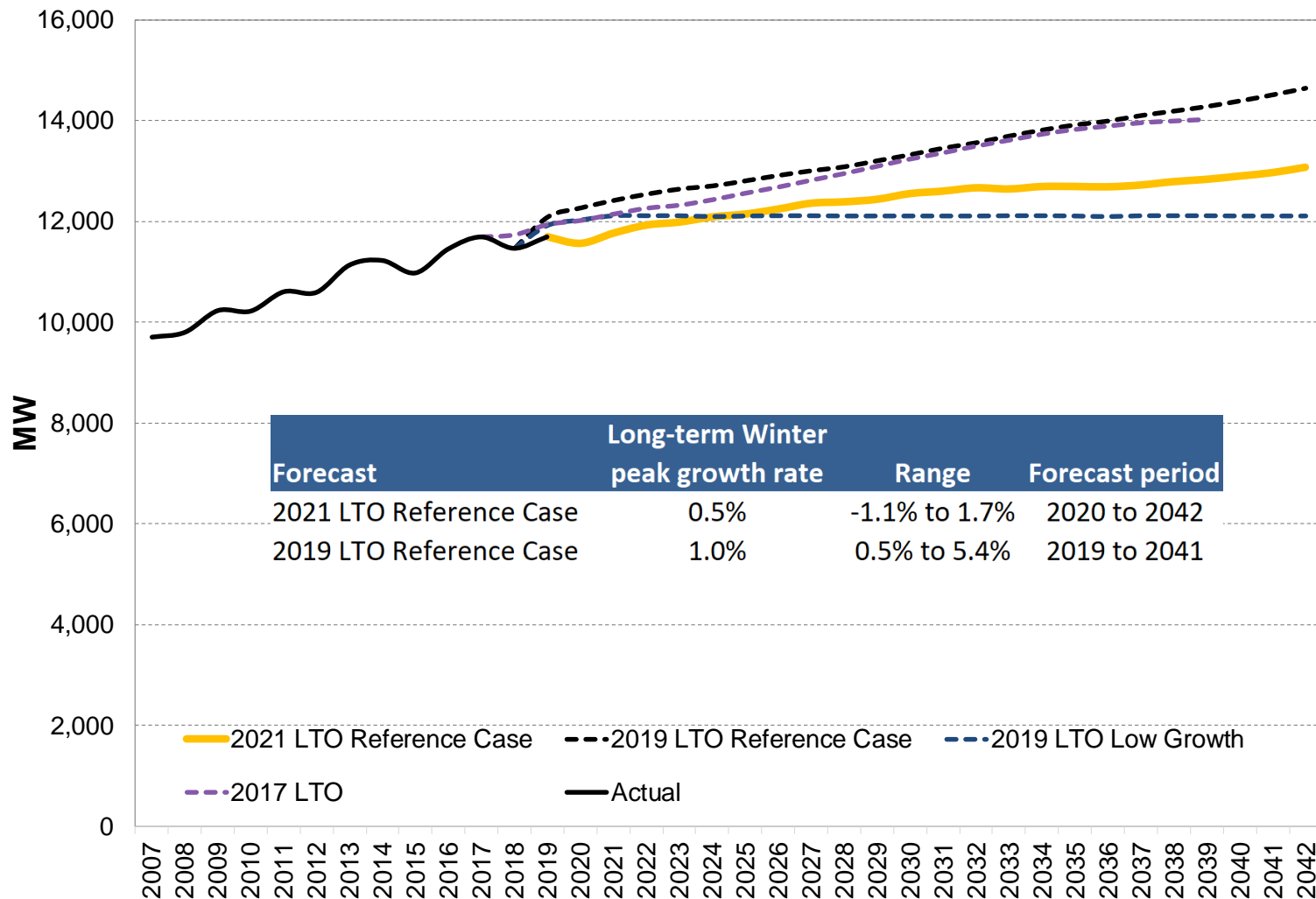


Preliminary forecast results: Winter peak



- Alberta is expected to remain a winter peaking jurisdiction – electric vehicle charging is expected to add to winter peak load over time

Forecast Winter Peak



Key generation assumptions

Assumption	Details
Carbon Price	<ul style="list-style-type: none"> • \$30/tonne (nominal) for 2020 • escalating to \$50/tonne (nominal) for 2022, • escalating at 2% onward with a good-as-best-gas performance standard (0.37t/MWh)*
Coal-to-Gas Conversion	<ul style="list-style-type: none"> • All coal units fully convert to gas except BR4, SD4 and KH1 (4,106 MW of coal-to-gas generation by 2030) • SD4 and KH1 run at lower capacity, running on natural gas, in the 2020's and retire in the late 2020s
Generation Forecast Method	<ul style="list-style-type: none"> • Relies on economic generation additions, not reserve margin capacity targets
Corporate PPA	<ul style="list-style-type: none"> • Added 750 MWs between wind and solar
Projects Included	<p>Meets sufficient certainty criteria</p> <ul style="list-style-type: none"> • Kinetikor Cascade project (900 MW) comes online March 2023 • Fengate (Inter-Pipelines) Petrochemical Facility (103 MW) scheduled to go into service in 2021 • Medicine Hat's new Unit 17 comes online June 2021 (43 MW) <p>2021 LTO Reference Case does not include:</p> <ul style="list-style-type: none"> • Suncor Boiler Replacement • Genesee 1 & 2 Repowering • Sundance 5 Repowering
Gas Price	<ul style="list-style-type: none"> • \$1.87-\$2.24 per GJ (real) from 2020 to 2030 – based on EDC Q3 2020

*Does not consider Clean Fuel Standard (CFS). CFS will be further assessed via a separate scenario

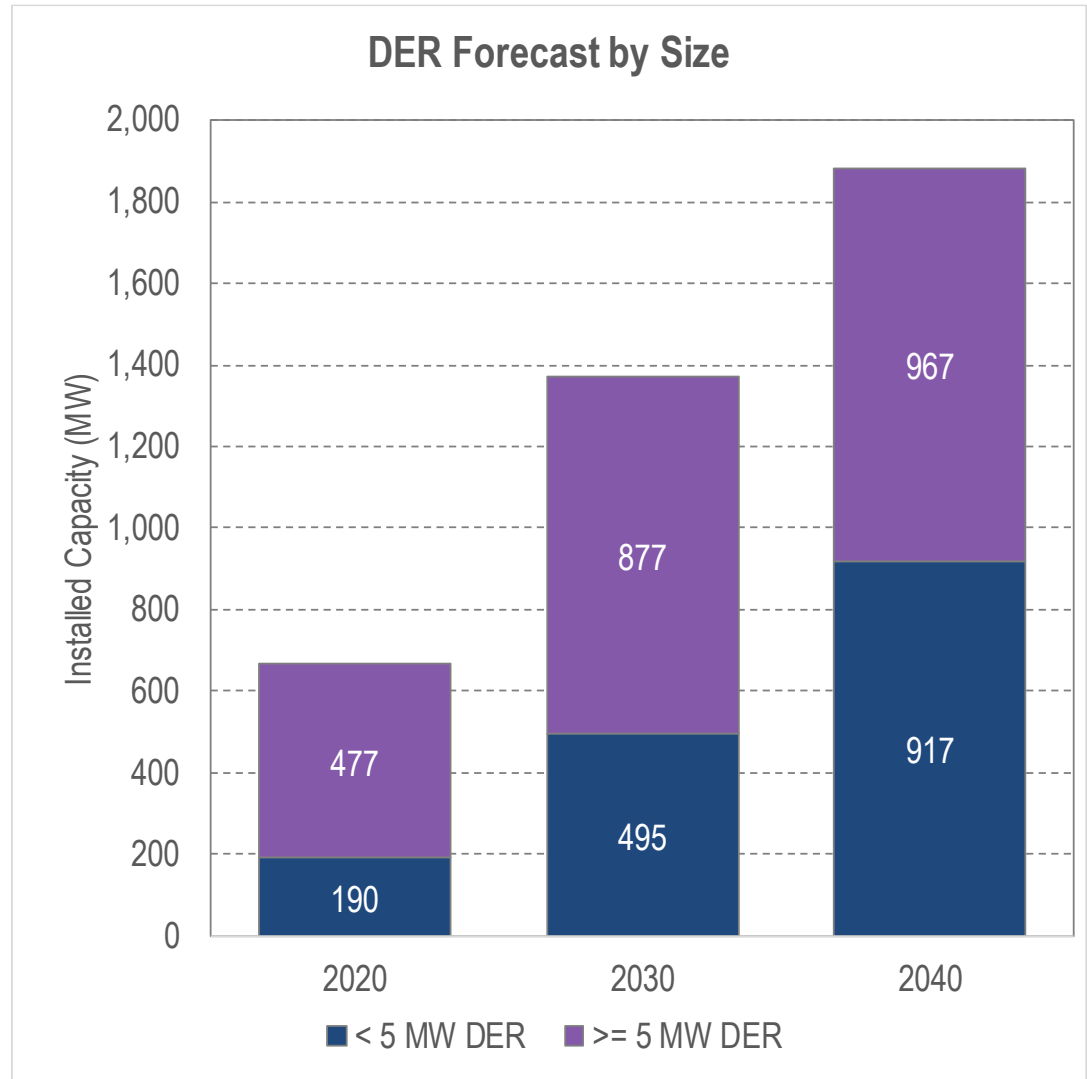
LTO forecast comparison: 2021 vs 2019

Generation Capacity, MW	2021 LTO		Change from 2019 LTO		
	Year	2030	2030	2040	
Average Load Forecast		10,393	-677	10,585	
Solar		990	+759	1,330	
Wind		4,117	+263	4,367	
Simple Cycle		1,337	-498	1,654	
Combined Cycle		2,648	+421	4,012	
Coal to Gas Conversion		4,106	-784	-	
Coal		-	-	-	
Cogeneration		5,684	+185	5,864	
Other		423	-	423	
Hydro		894	-	894	
Energy Storage		65	+65	145	
Total Generation		20,264	+411	18,689	
Rooftop PV Capacity*		336	+216	712	
Less than 5 MW DER Gas Capacity*		119	+119	158	
	Year	2024	2030	2034	2039
Renewable Generation Percentage (2019 LTO)		16%	19%	20%	18%
Renewable Generation Percentage (2021 LTO)		19%	22%	22%	24%

* Rooftop solar and less than 5 MW gas offsets load and is subtracted from the Average Load forecast
Renewables under 5MW have been excluded from the Renewable Generation Percentage calculations

Distributed Energy Resources penetration levels

- Total distributed generation* capacity is expected to triple by 2040: from 666 MW to 1,884 MW
 - Split between sub-5MW and over-5MW distributed energy resources (DER) will even out by end of forecast period
- Growth is expected across all DER technology types, notably:
 - Sub-5MW rooftop solar growth – from 79 MW to 712 MW by 2040
 - 5+ MW gas DCG – from 364 MW to 531 MW by 2040



* Excluding biomass, gas cogen, hydro, other DCG types

Scenario Development

- The AESO's *2021 Long-term Outlook* is a 20 year forecast of expected electricity supply and demand in the province
- Due to the wide range of unknown outcomes within this timeframe, the AESO will publish a Reference Case as well as three scenarios
 - Scenarios are intended to reflect a wide range of possible future economic and policy outcomes that could change our energy landscape vis-à-vis the Reference Case
 - Three scenarios may not exhaust all potential alternatives, but will present a broad spectrum of supply and demand forecast results that could be applicable to alternative scenarios
- The AESO would like to solicit feedback from stakeholders that are interested in the *2021 Long-term Outlook* to understand their perspectives and insights related to the proposed scenario narratives

Proposed scenario narratives

Scenario	Narrative	Load	Supply	Purpose
Reference Case	Based on most recent intelligence; changes are incremental and aligned with current understanding of policy, economic expectations, technology landscape	Drivers: economic recovery by 2022 and IHS outlook for energy sector (recovery in 2021)	Based on current policies, technology costs, industry trends (corp. PPAs, gas entries). Near term additions based on certainty criteria, long term additions based on economics.	Update the AESO's long term forecast with the most recent information and form a base forecast for long-term market and system planning
Clean-Tech (Energy Transformation)	Policies towards decarbonization and cost reductions in renewables accelerate grid changes toward low-emissions and DER technologies	Different load profile than Ref Case – higher EVs, higher DER, potential changes to industrial mix due to diversification; yet oilsands outlook is same as Ref Case	Shift towards more renewables (Tx and Dx connected), fewer carbon intensive technologies; also higher cogeneration due to boiler replacements	Test radical grid transformation – more DG, renewables and cogen leads to changes in flow; insightful for NIDs, NDV/flexibility, tariff and market design studies
Robust Global Oil & Gas Demand (High Growth)	Align with the most optimistic scenario for AB's energy sector (add projects to fill major pipelines plus crude by rail)	Higher than Ref Case due to O&G (incl. condensates in NW) growth and more market access (pipelines) while maintaining 100 MT emissions cap	Higher cogeneration, and clean natural-gas generation	Test robust load growth; insightful for regional impacts
Stagnating Global Oil & Gas Demand (Economic Headwinds)	Economic stagnation and no further investment in the O&G sector changes AB economic future	Oilsands production remains flat post 2021 recovery; economic inputs reflect lower energy sector, including permanent loss of load	Clean natural-gas generation is built to replace retired facilities, but growth is muted	Test a scenario of prolonged economic deterioration; insightful for assessing low/negative growth outcomes

Scenario assumptions:

Assumption	Reference Case	Clean-Tech	Robust Global Oil & Gas Demand	Stagnant Global Oil & Gas Demand
Economic Drivers				
Economic outlook – GDP, labour drivers	Recovery by 2022	Same as RC	↑ High-growth; bullish long-term	↓ Lower long-term growth than reference case
Oilsands outlook – proxy for O&G growth	IHS outlook recovery by 2021	Same as RC	↑ Additional pipelines/ SAGD/ condensates in LT	↓ Flat/no growth post recovery in 2021
BTF Oilsands generation – incl. boiler replacements	IHS outlook for oilsands production, with generic incremental additions through 2040	↑ Higher than RC: Existing SAGD boilers convert to cogeneration	↑ Higher than RC: Existing SAGD boilers convert to cogeneration and incremental new facilities	Same as RC
Carbon/CFS* policies – adders to emissions	\$50/t by 2022 (no CFS adder)	↑ Higher than RC: \$100/t by 2030 (TBD) + CFS	Same as RC	Same as RC
Renewable & Energy Storage Assumptions				
Renewable capital cost – wind/solar	Aligned with 2021-2030 estimates; AWS Truepower	↓ Reduced from RC	Same as RC	Same as RC
Renewable corporate PPAs	Projected to grow by 250 MW by 2030 and 750 MW by 2040	↑ Higher than RC	Same as RC	Same as RC
Energy storage – utility-scale	Some growth in 2020s and 2030s	↑ Higher than RC	Same as RC	Same as RC
Emerging Trend Assumptions				
DER < 5MW – solar, wind and gas	Based on economics and historical trends	↑ Higher than RC: higher adoption rates	Same as RC	Same as RC
DCGs > 5MW – solar, gas	Based on economics and historical trends	↑ Higher than RC: higher adoption rates	Same as RC	Same as RC
Electric vehicle – only residential profiles	Based on economics and historical trends	↑ Higher than RC: higher adoption rates	Same as RC	Same as RC

- Do the proposed LTO scenarios cover a reasonable range of plausible future outcomes? Which scenario do you think is more likely? Which one is less likely?
- Does the “Clean Tech” scenario focus on the appropriate technologies and policies?
- Are there different scenarios that warrant inclusion?
- What long-term hydrocarbon demand projections do you think are reasonable for the Robust and Stagnant Global Oil & Gas Demand scenarios?
- Are there additional generation technologies that warrant inclusion in the 2021 Long-term Outlook Scenarios?
- Do you disagree with any of the Scenario Assumptions? If so, what alternatives would you propose?
- The AESO has not yet determined the quantum of change in the scenario variables. Do you agree directionally with the scenario assumptions? Do you have insights regarding the magnitude of scenario changes?