

Alberta Operating Scenarios Overview

Industry CEO Roundtable

May 28, 2021

- Context: The AESO's current 2019-23 strategic plan*, focused on the next 5-15 years, was informed by three plausible Alberta-focused operating scenarios which the AESO monitors (not the same as LTO scenarios but consistent)
 - Bitumen resource economy continues
 - Resource economy ends
 - Economic diversification
- The “Bitumen resource economy continues” scenario looks increasingly less likely to materialize
 - Energy sector is facing headwinds with prices, regulatory uncertainty, investor pressure, net-zero commitments, difficulty completing pipelines
 - Oilsands still expected to grow at moderate pace through low-cost activities (debottlenecking and expansions); yet greenfield development seems less likely
- Alberta is in a state of transition – which scenario is more likely to prevail remains unclear
 - Renewables and distributed energy resources are expected to continue expanding in Alberta
 - Market structure enables renewable development
 - Government is attempting to attract more petrochemicals (highly competitive), agri-food sectors (long-term potential), and hi-tech (also highly competitive)
 - These diversification efforts are slow to materialize and may not substitute the energy sector's weight in the economy and electricity market
 - Too early to tell - many paths to diversification
- The AESO continues to monitor sign-posts and strategic scenarios to prepare the AESO and industry for the transformation
 - Leveraging multiple insight tools such as the Long-term Outlook forecast scenarios, technology assessment and grid resilience studies

* <https://www.aeso.ca/aeso/about-the-aeso/strategic-priorities/strategic-plan/>

Economy on track for a slow recovery post-2020



- Alberta experienced the deepest recession of any province in 2020
 - Double impact: effects of COVID-19 and a plunge in oil and gas activity
- Consensus across 3rd party economic outlooks that recovery is under way across the country – including Alberta
 - Hinging on vaccination efforts and oil prices staying in the US\$45-50 per barrel or better
- However, Alberta recovery to pre-pandemic levels not expected until 2022
 - Alberta lags the rest of the provinces – except Newfoundland and Labrador

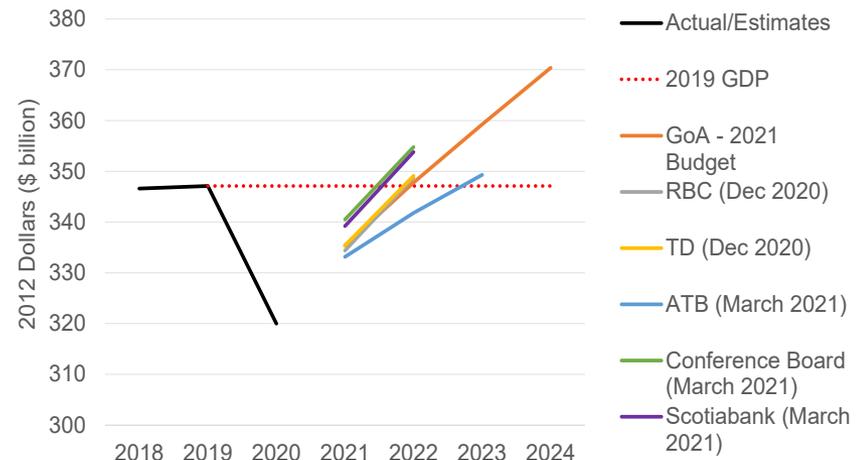
Real GDP by province, 2020
(percentage change*)



* based on market prices, 2012 \$
Sources: The Conference Board of Canada; Statistics Canada.

Chart source: Conference Board of Canada, Vaccines and a Recovery in Energy, Tourism, and Exports Boost Provincial Economic Activity: Provincial Outlook, (March 2021)

Alberta Real GDP Projections



Low-carbon energy transition kept up momentum thru the global pandemic

- 2020 marked a pivot point for the global energy transition
 - Fossil fuel demand dropped 7% in 2020, compared to 2019 – oil demand alone fell by 10% due to travel and business restrictions
 - Renewable energy increased by 9% - only net increase across the energy sectors
- Although 2020 trends occurred due to the pandemic and not policies, pro-climate change commitments did not slow down; instead, they accelerated
 - China, Japan and South Korea pledged carbon neutrality by 2050-2060;
 - EU is spending €550 billion of its recovery plan on green projects by 2027;
 - US re-joined Paris Agreement;
 - Canada’s carbon price set to rise to \$170/tonne by 2030
 - Increased adherence to “Building back better” principles
 - ESG (environmental, social and governance) initiatives increasingly becoming a focus
 - BlackRock’s effect on institutional investors – pushing for net-zero commitments
 - Alberta government’s new ESG office

“Given how central the energy transition will be to every company’s growth prospects, **we are asking companies to disclose a plan for how their business model will be compatible with a net zero economy...by 2050.** We are asking you to disclose how this plan is incorporated into your long-term strategy and reviewed by your board of directors.”

BlackRock’s 2020 Letter to CEOs

Alberta oilsands cost-competitiveness depends on sustained growth in oil demand and high prices...



- Alberta oilsands production is among the highest cost globally
 - Global crude break-evens steadily declining due to focus on operational efficiency – US shale is economic at sub-US\$45/bbl
 - Alberta’s existing oilsands and debottlenecking can be competitive with an equally capital-intensive U.S. shale sector – but both industries require sustained prices

2023 Global Liquids Supply Cost Curve

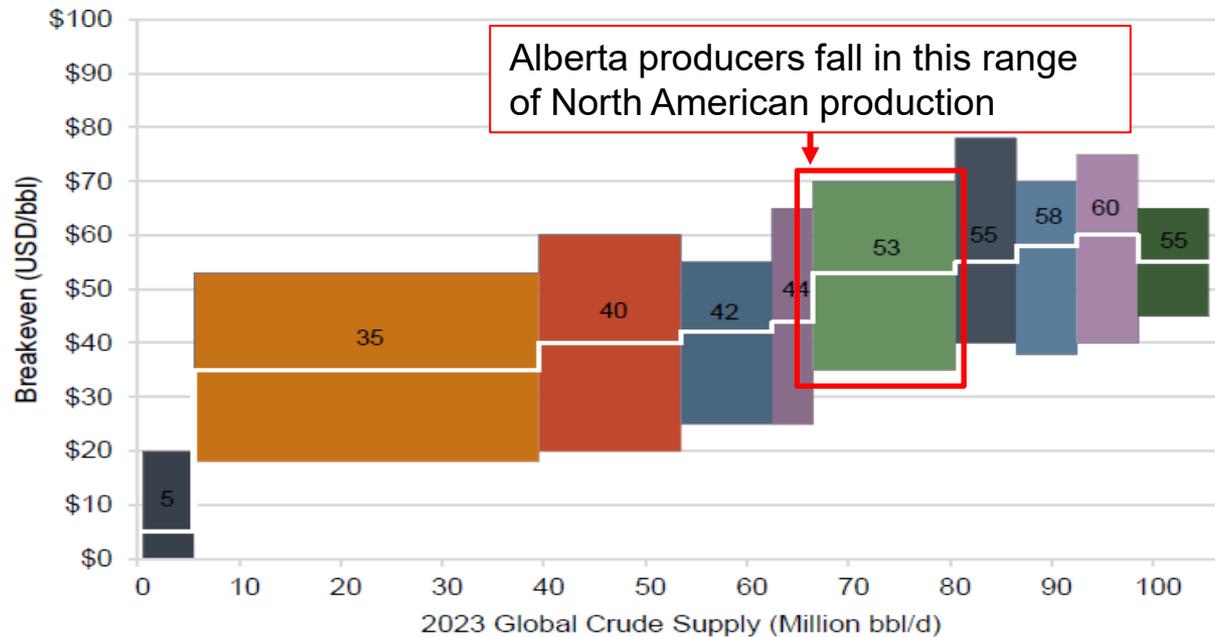


Chart source: Sproule, 2021 Global Oil and Gas Market Outlook (Jan 2021)

Biofuels, NGLs, Processing Gains
 Middle East
 Eurasia

North America Shale Top Tier
 Europe
 North America Exc Shale

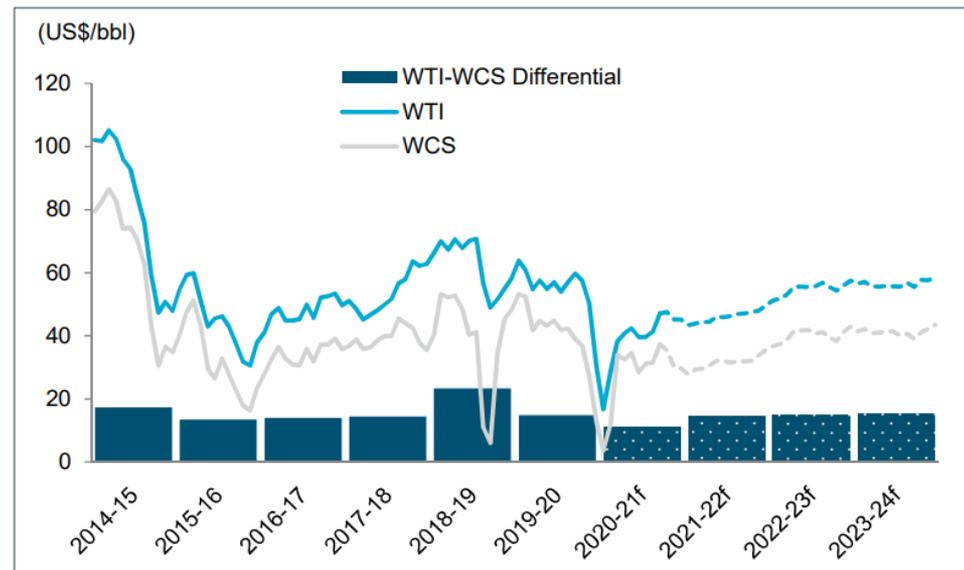
Asia
 Latin America
 Africa

North America Shale Marginal

... yet oil price outlooks are challenging for a return to high growth for the Alberta resource sector

- In the near-term, rising commodity prices reflect increased demand post-pandemic lows
 - WCS-WTI differential also improving – partly due to curtailment policy that expired at end of 2020
- Strong long-term price recovery is needed for:
 - Short-term economics – cover operating costs
 - New mine development (return on and of capital)

Chart 7: Light-heavy differential to reflect pipeline economics
Oil Prices



Sources: Alberta Energy and Alberta Treasury Board and Finance; e-estimate, f-forecast

Chart source: Government of Alberta, 2021 Budget Papers (March 2021)

Outside prices, the resource sector faces many headwinds

- Pipeline network can ease market access issues but carries its own risks
 - More export capacity once TMX and Line 3 pipelines are completed
 - Political risks are increasingly challenging projects – KXL and Line 5
- Crude by rail may mitigate some of the impact
 - CPR's expansion will connect Alberta directly to the Gulf of Mexico
- New Biden administration's energy and climate policies are not yet finalized but early announcements are ambitious
 - Expectations of US policy impact on long-term economics may freeze Alberta-based energy company decisions until more details are known/approved by US Congress

Western Canadian Crude Pipeline Export Capacity

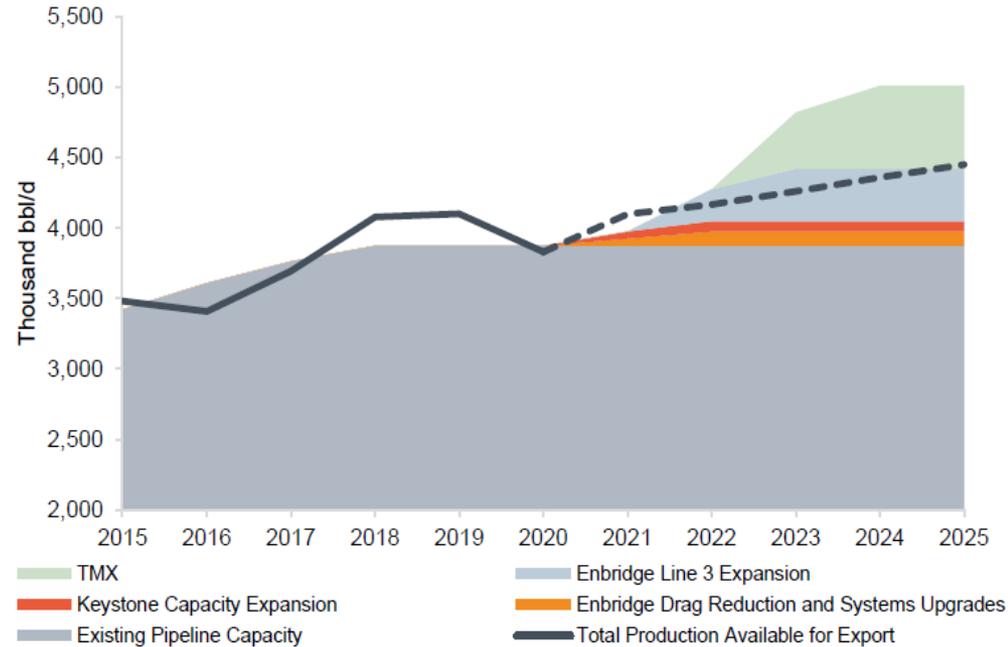


Chart source: Sproule, 2021 Global Oil and Gas Market Outlook (Jan 2021)

Oilsands production is expected to grow by tackling low-cost investments first

- The global pandemic and decline in oil prices led to production shut-ins in 2020
- Oilsands production is expected to resume production to pre-pandemic levels in 2021 and continue to grow thru 2030
- Low-cost investments such as de-bottlenecking and optimizations are expected to proceed before expansions or greenfield developments

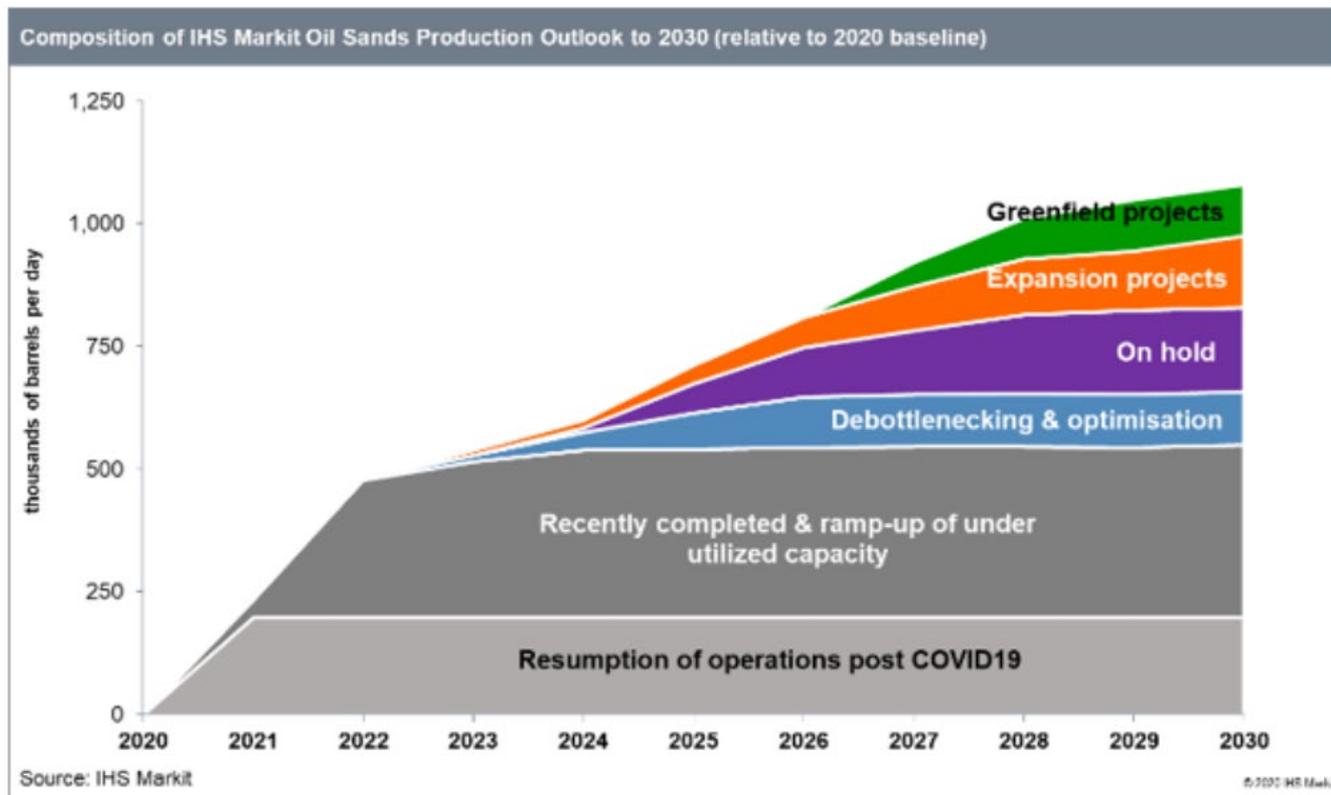
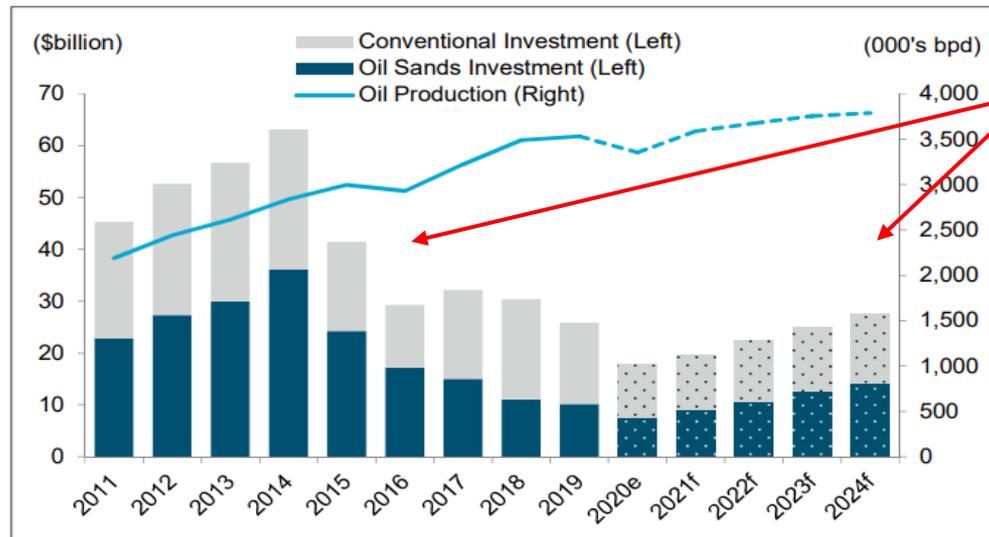


Chart source: IHS Markit, Longer-Term Outlook for Canadian Oil Sands Largely Intact Despite Largest Annual Production Decline in 2020 (July 2020)

Sector investment reflects a marked shift since 2015

- Economic downturn started with decline in commodity prices in 2014-15
 - Since then, economic and energy indicators haven't recovered – double impact of pandemic and oil production declines in 2020 extenuated the recovery

Alberta Nominal Oil and Gas Investment and Crude Oil Production



Sources: Statistics Canada and Alberta Treasury Board and Finance; e-estimate, f-forecast

Investments are markedly lower in the 2015-2024 period, compared to pre-2015

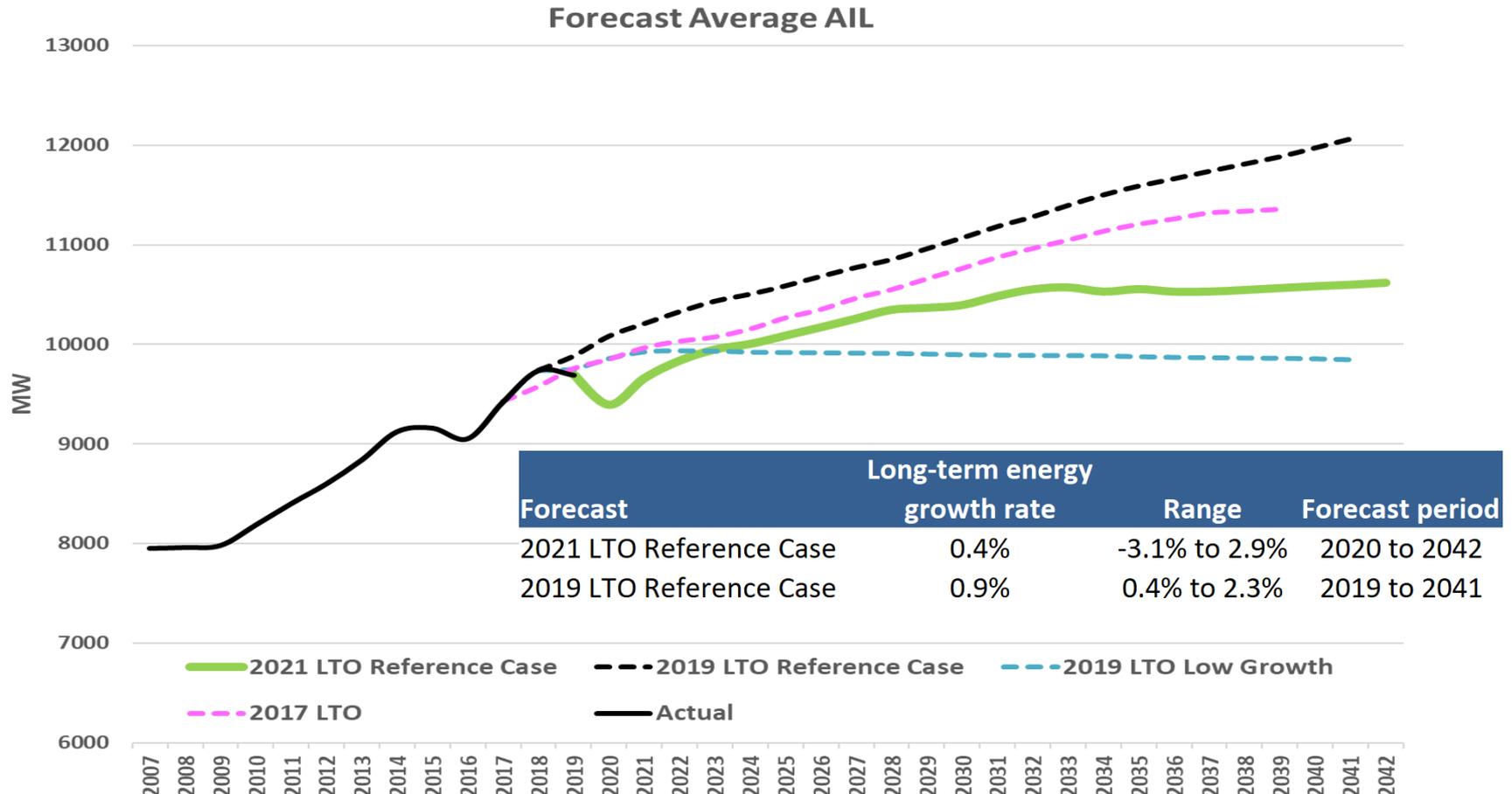
Chart source: Government of Alberta, 2021 Budget Papers (March 2021)

With no clear path to the levels of O&G investment observed pre-2015, questions about whether the bitumen resource economy will continue as an economic engine are increasingly dominating public discussions.

Deterioration in economic indicators and oilsands production translate into lower electricity demand



- 2021 Long-term Outlook* (LTO) represents a lower and flatter growth compared to previous LTOs



* Preliminary results. Final 2021 LTO anticipated to be released mid-2021. Also available at: <https://www.aeso.ca/assets/Uploads/Scenarios-Overview-for-Stakeholder-Insights-08Dec2021.pdf>

- In December 2020, the federal government proposed annual increases to the carbon price by \$15/tonne post 2022, to \$170/tonne by 2030
- March 2021 – The Supreme Court of Canada ruled the federal carbon pricing law is constitutional
 - Alberta provincial government incented to ensure Alberta carbon policies maintain equivalency with federal
- Higher carbon price raises the value of renewable generation in Alberta
 - Improving cost-competitiveness against thermal resources
 - Emitting companies likely to comply by participating in corporate power purchase agreements

Corporate power purchase agreements (PPAs) are expected to grow in Alberta



Corporate PPAs – Voluntary

Many US companies with Canadian load and Canadian-based companies may have an appetite for corporate PPAs in Canada. Alberta is currently the only viable province in Canada for corporate PPAs given its open market structure and transparent wholesale market.

Illustrative Companies that may have an appetite for Corporate PPAs in Alberta*

Retail	Telecom	Banks	Tech	Automotive	Food & Bev	Others
<ul style="list-style-type: none"> • IKEA** • Walmart • Kohls • Target 	<ul style="list-style-type: none"> • Telus** • Rogers • Bell Canada • Shaw 	<ul style="list-style-type: none"> • RBC** • CIBC • BMO • Scotia • TD 	<ul style="list-style-type: none"> • Facebook • Google • Microsoft • Amazon • Apple • Intel 	<ul style="list-style-type: none"> • General Motors • Ford • Honda 	<ul style="list-style-type: none"> • Starbucks • McDonald's • General Mills • Cargill • AB InBev 	<ul style="list-style-type: none"> • Johnson & Johnson • Kaiser Permanente

The companies listed above are a combination of:

- Companies that have procured corporate PPAs in the US and have load in Canada (and therefore might also procure corporate PPAs in Canada)
- Canadian companies that are the counterparts of US companies that have procured corporate PPAs in the US (e.g., telecom companies and banks)

* At most, these companies would be offsetting their Canadian load, not their US load. Some may elect to only offset their Alberta load.

** **Bolded companies** have already procured renewables in Alberta



Expected Offtake Market Size

The potential size of the offtake agreement market is likely to be driven primarily by either corporate PPAs (voluntary) or the compliance market (for offsets/credits) but it is unlikely both will see large uptake as they are competitors to a degree. The table also includes self-build generation which is expected to occur within all market segments.

- If the TIER maintains a high credit value and the offset protocol is continued the increase in carbon prices will likely drive large uptake from compliance purchasers over the next 3 to 5 years
 - In Power Advisory's view the High Case is most likely if offsets/credits remain attractive for compliance purchasers and carbon emissions from other sectors can be offset at relatively low cost in the electricity sector – the table reflects this scenario with roughly 7 MT of emissions offset via renewable generation (based on the current offset rate – as the rate falls more renewables are required for the same carbon)
 - The High Case could also be driven by the voluntary market if carbon offset/credit rates are reduced (this causes higher electricity prices and a more attractive voluntary market)

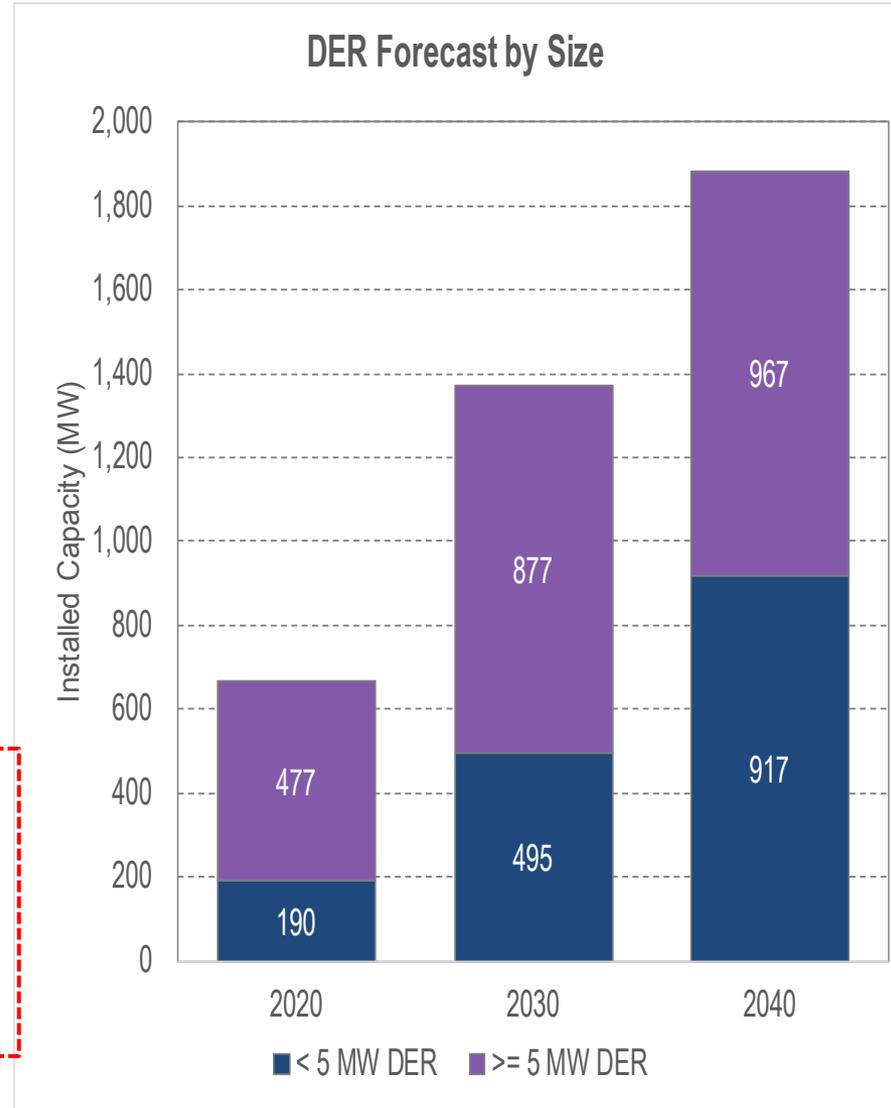
MWH/yr	Government	Voluntary	Compliance	Total	MW _{AC} - Wind	MW _{AC} - Solar
Low Case	850,025	1,545,599	3,504,000	5,899,624	1,497	3,061
Base Case	2,550,074	3,377,420	7,008,000	12,935,494	3,281	6,712
High Case	2,975,087	4,579,552	14,016,000	21,570,639	5,472	11,193

Consumer preferences, cost management and capital cost will drive to more distributed energy resources

- Preliminary* 2021 LTO forecast is that total distributed energy resources (DER) will triple in size by 2040
 - Drivers vary across technologies, but generally a combination of transmission tariff cost management, DC credits, and declines in capital costs
- Growth is expected across all technology types, notably:
 - Sub-5MW solar photovoltaic growth – from 79 MW to 712 MW by 2040
 - 5+ MW gas DCG – from 364 MW to 531 MW by 2040

Energy and technology diversification into renewables and DERs is not driven purely by opportunity to capitalize on energy market revenues but also external factors (carbon offset, cost red., etc.)

* Preliminary results. Final 2021 LTO anticipated to be released mid-2021



- Government efforts to diversify remain tilted to the resource sectors
 - Petrochemical industry is capital intensive and very competitive
 - Hydrogen is tied to CO2 capture economics – tied to carbon pricing
- Other sectors such as agriculture and agri-food also have long-term potential
 - Large federal-provincial investment in irrigation system upgrades
 - May expand due to the effects of climate change – takes decades to materialize
 - Could be central to food and national security goals – not entirely a priority now
- Many domestic companies are in consolidation mode, whereby net gains to Alberta remain unknown
 - Cenovus & Husky Energy; Shaw Communication & Rogers Communications; Canadian Pacific Railway & Kansas City Southern
- Hi-tech sector remains highly competitive and difficult to attract
 - Success thus far: Infosys is expected to expand into Calgary

Challenging for economic output or employment from new sectors to replace reductions in the energy sector – although COVID-19 could have also masked progress in short-term

Bitumen resource economy continued 	Resource economy ends/slow 	Economic diversification 
<p>Directional indicators:</p> <ul style="list-style-type: none"> Proposed oilsands projects Forecast capital expenditures Pipeline developments WTI, WCS outlooks North American and Global oil demand/supply Economic trends by sector 	<p>Directional indicators:</p> <ul style="list-style-type: none"> North American and Global oil demand/supply Cost of marginal unit in Alberta vs United States vs Globe Alternative energy cost trends (including distributed energy resource [DERs] trends) Government regulations (Carbon pricing, Clean fuel standard, OBPS, physical requirements, etc.) Economic trends by sector 	<p>Directional indicators;</p> <ul style="list-style-type: none"> Growth in green and technology industries Alternative energy costs (including DERs trends) Technological innovation Economic trends by sector Diversification of energy companies New industries

- “Bitumen resource economy” scenario is increasingly looking less likely to materialize as Alberta finds itself in a state of transition
- High degree of uncertainty and unknowns could translate into years or decades of transition/progress – likelihood of “Resource economy slows” or “Economic diversification” scenarios is increasing

- Market uncertainty is the new ‘normal’
 - The AESO tracks sign-posts and produces forecasting scenarios to assess the impact of temporary or permanent shifts on the energy market
 - Book-end scenarios yield insights of impacts on load, generation and/or grid reliability
- The upcoming 2021 LTO includes four 20-year scenarios, each with unique assumptions on the load and supply side that mirror Strategic Plan scenarios:
 - Reference Case – reflects current market trends and policy intentions
 - Clean-Tech Scenario – akin to the economic diversification scenario with economic diversification and de-carbonization policies
 - Stagnant O&G Demand – akin to the resource economy ends/slows scenario of prolonged economic decline
 - Robust O&G Demand – akin to the bitumen resource economy continued scenario of increasing oilsands growth
- Technology assessments provide a deeper look into emerging trends, viability within the Alberta market, and insights into how it can disrupt the electricity value chain
- Increasing focus on grid resilience and system operations assessments – flexibility, inertia, reliability of gas supply, etc. – to ensure the AESO facilitates the transformation in a safe and reliable manner

Thank you