Stakeholder Comment Matrix – June, 2020

2021 Long-term Outlook Stakeholder Feedback

Period of Comment:	June 4, 2020	through July 6, 2020	**Contact:** [redacted]
Comments From:	TransAlta Corporation		**Phone:** [redacted]
Date:	2020/07/06		**Email:** [redacted]

Instructions:

1. Please fill out the section above as indicated.
2. Please respond to the questions below and provide your specific comments.
   Email your completed comment matrix to forecast@aeso.ca by **July 6, 2020**

The AESO is seeking comments from Stakeholders with regard to the following matters:

	Questions	Stakeholder Comments
1.	**Long-term Outlook** a. What information do you find most useful within the Long-term Outlook? Is there additional information you would like to see? b. Do you use the Long-term Outlook data file? Which information within the Long-term Outlook data file is most useful to you? What additional data would you like to see within the data file? c. What delivery format of the data file would you find most useful? (Excel file, web query and download, interactive web based data visualization tool, other)	***The LTO is helpful and provides insight and transparency about the AESO's views and planning considerations*** TransAlta appreciates the publication of the Long-Term Outlook (LTO). The information that is most useful in the long-term outlook are the details of the AESO's methodology for forecasting, its key assumptions about economic and policy drivers and how those are translated into the various scenarios, and the details of load and generation changes. ***Provide the year-to-year changes for each scenario*** The Long-Term Outlook data file is very helpful We would appreciate details on a year-to-year basis for the different scenarios rather than snapshots with only 5 data points. ***Additions to the delivery format would be useful*** We support the continuation of the existing delivery format: the LTO report and the data file. We would also support further

		augmentation of the delivery format to include a interactive web based data visualization tool. We could also support a web query and download function but do not support the implementation of a tool like the historic market data format – that format is not user friendly and does not accommodate the download of large files in an efficient manner. We would not support a cut-off implementation of any new delivery format i.e. the elimination of the existing delivery format without sufficient time and testing of the new format (in other words, new delivery formats should be done in parallel with trials).
2.	**Macroeconomic variables** a. The economic outlook could range from a V-shape recovery by Q2 2021 to a longer-term recovery by 2023, with some permanent load loss in the commercial and industrial sectors going forward. What is your view on the Alberta GDP over the medium- (next 5 years) and long-term (5+ years)? b. Oil sector production capacity is expected to increase in 2023 with the completion of pipeline projects (e.g., Keystone XL, etc.). I. The 2019 CAPP Crude Oil Forecast released in June 2019[1] had oilsands forecast growth from 3.2MM bbls/d in 2020 to 3.6MM bbls/d in 2025 and then 3.9MM bbls/d in 2030. a. What is your view on oil production in Alberta over these time periods given the market changes over the last year? What is your view post 2030? b. Do you expect new oil production developments to be in situ or mining, or a combination of both? c. Do you expect domestic condensate growth, required for transport, to meet the	Even prior the pandemic, Alberta and Canada were grappling with an oil recovery and trade tensions. With the pandemic and the dispute between OPEC and Russia, the economic turmoil was significant. Even now, whether the oil market remains on a recovery path is uncertain and hampered with the propect of a slow global recovery, continuation of the OPEC+ agreement, and a second wave of the pandemic. We are in the very early stages of the recovery so whether or not we can expect to see a V-shape recovery by Q2 2021 or by 2023 is still a significant question that requires close attention and more data. While the expected negative GDP growth in 2020 is likely to reverse in 2021 if the pandemic can be controlled. It may take until 2022 to achieve the level in 2019. We are hopeful that the recovery will meet or surpass expectation but there are too many unknowns to project even 2-years out. In the medium or long-term, we are also hopeful that we are back to normal (pre-pandemic and without oil trade disputes). However, we do see some directional alignment in views but potentially significant differences in outcomes. For points of reference: • The Conference Board of Canada estimates that the effects of travel bans and social distancing could result in "a much deeper and longer-lasting hit to Canadian economic activity" and result in real GDP falling by 1.1% in 2020 instead of growing at 0.3%. They estimated that Canadian real exports of goods and service will decline

[1] Canadian Association of Petroleum Producers https://www.capp.ca/resources/crude-oil-forecast/

	incremental oilsands growth? Will domestic condensate displace imported condensate? II. What is your view on further oil sector investments over the same timeframe? III. What kind of oil price or other environment would allow for further cogeneration development in the oilsands and/or petrochemical sectors? d. Current forward gas prices are in the $2.25/GJ range. Post 5 years, do you see gas prices remaining at this level, decreasing, or increasing beyond inflation?	2.1% in 2020 as a result of a consumer-led recession in the US decreasing its real GDP by 1%. Their projection of real GDP growth of 3.3% in 2021 is predicated on a view that there will be pent-up consumer demand and household speding will rebound in 4Q2020 and 2021. • The OECD's Economic Outlook dated June 2020 provides views of a single and double wave of economic impacts. In the single hit scenario, annual output for Canada (GDP at market price) shrinks by -8% in 2020 and recovers to 3.9% in 2021. In the double hit scenario, annual output shrinks by -9.4% in 2020 and recovers only to 1.5% in 2021. • The World Bank's Global Outlook titled "Pandemic, Recession: The Global Economy in Crisis" dated June 2020 provides an projection of Real GDP for advanced economies of -7.0% and 3.9% for 2020 and 2021, respectively. Their estimate for US Real GDP is -6.1% and 4.0% for 2020 and 2021, respectively. • The International Monetary Fund released its World Economic Outlook Update on June 2020 that projects that the pandemic had a more severe impact on the global economy that their April 2020 forecast. They predict global growth to shrink -4.9% in 2020 and expect a more gradual recovery to 5.4% in 2021. Their forecast for Canadian GDP growth is -7.5% and 4.6% in 2020 and 2021, respectively. • The US Federal Reserve released its economic projection on June 10, 2020 showing median estimates of -6.5%, 5.0% and 3.5% for US real GDP in 2020, 2021 and 2022, respectively. The range of their estimates are -10% to -4.2% in 2020, -1% to 7.0% in 2021 and 2 to 6% in 2022. The real GDP estimate for the US Federal Reserve shows a more negative view than the Conference Board of Canada's view of US GDP in 2020 and potentially in 2021. The medium and long-term impacts largely depend on the strength of the global economy. More dire economic predictions

		of US unemployment see it taking up to a decade to fall back to the percentage pre-pandemic. The Bank of Canada Governor also expects a 'prolongued and bumpy' recovery and a likelihood that there could be lasting damage to demand and supply. If these are reflective of the path that Alberta and the global economy might take, it is possible that we may experience a prolonged period of lower GDP growth potentially extending to the medium and long-term. While we agree that the questions the AESO has posed about oilsands and natural gas are important, we find it difficult to answer given the lack of certainty in the near-term and the potential impacts into the medium and long-term. For reference, the IEA noted its Oil Market Report dated April 2020 that global oil demand was expected to fall by 93 million bbl/d in 2020. While they predicted that there would be a gradual recovery from 2Q 2020 they expected demand in December 2020 would still be down by 2.7 million bbl/d year-over-year. Alberta oil production dropped to 3.1 million bbl/d in April 2020 according to Alberta Energy Regulator (AER) statistics mostly in bitumen production. Canadian oil producers could face longer shut-ins or curtailment if global demand or trade tensions within OPEC+ reemerge. We note that while OPEC+ extended its June cuts by an additional month, the agreement is expected to slowly increase production over time and that will play into pricing and the response to that price signal from non-OPEC producers. The questions that remain are how quickly global demand will pick back up and if the pandemic and the government and industry response has fundamentally altered the course over the longer time frame. The AER forecasts a reduction in both in-situ and mining in 2020 under a low price scenario and steadily increasing production from in-situ. Under the base scenario, AER projected high production from in-situ than the low price scenario out until 2029. In contrast, mining production was the same under the base and low price scenarios from 2021 to 2029. What we do know now is that capital investment has already

		been postponed and cancelled and these conditions will continue until greater certainty about global demand and its path to recovery become clear. This will have an impact on forecasted production. How Alberta oil and gas (convention, in-situ and mining) will stack up in the global market after we reset back to "normal" will also play a significant role in the growth we can expect and the types of investments that will be made. Furthermore, whether additional investment will be made into cogeneration is about the cost savings that will be achieved, the use of scarce corporate capital and the impact to the competitiveness of Alberta oil in the global market; it is not necessarily a trigger point based upon the oil price. We fully support revisiting the LTO and its assumptions but there is not enough information at present to provide predictions about what will unfold. We recommend that the AESO conduct stakeholder sessions over the course of the year to further discuss and share the information as it comes in.

3.	**Policy** a. What are your expectations of carbon prices in the future? Do you expect any change from a $30/t rising to $50/t, inflated by 2% thereafter? b. Other than policy on carbon pricing, what coming policies or policy scenarios do you see impacting load growth and generation development?	***Carbon prices should follow the trajectory set by the federal and provincial governments but adjustments may be necessary*** The federal government indicated it intends to move ahead with its set carbon prices from $30 to $50/t$CO_2$e in 2022. At which time there will be a review of the federal program. Our current assumption is the $50/t$CO_2$e cost will remain flat going forward from 2022. However, following the review in 2020, it is possible the carbon price will be escalated going forward. The Alberta government has only agreed to a $30/t$CO_2$e. If the province does not increase its carbon price in line with the Greenhouse Gas Pollution Pricing Act (GGPPA) requirements, the federal indicated it will act to add incremental carbon costs based on the difference between the imposed provincial and federal tax. Our expectation is the province will be required to increase the carbon cost. Currently, some provinces are challenging the federal government's jurisdiction to impose a carbon cost on provinces. The Supreme Court is currently hearing this challenge and expected to rule in the Fall of 2020. This ruling will either maintain the status quo of the GGPPA or lead to significant changes to carbon pricing in Alberta. ***Pandemic recovery federal and provincial spending may have a significant impact on load growth and generation development*** We expect that the federal and provincial government will develop and implement pandemic recovery plans and programs to restimulate Alberta's provincial economy. These plans are necessary to reduce and mitigate the worst case economic outcomes that could arise due to the significant and adverse impacts of the pandemic. However, the overall global recovery and coordination of global economic recovery plans will also play a significant impact on the efficacy of the federal and provincial programs and the economic path to recovery. For example, without a significant improvement in economic and investment conditions in Alberta unemployment could remain

		high and weaken expected load growth. Government support of businesses is also seen as critical to ensure the survival and recovery of business near and potentially mid-term to ensure a robust recovery to pre-pandemic levels and the ensuing revival. The prospect of a second wave of the pandemic could extend the the adverse economic impacts further into 2020 and potentially forestall recovery measures and prolong the recovery. We expect that the design of the recovery programs could incent specific forms of generation and alter the normal course and supply mix for generation development. In the near-term, we anticipate that the transition from coal-to-gas will remain on course or hasten. The introduction of new federal or provincial programs to subsidize renewable development would result in accelerated changes in the supply mix; however, there is no certainty if these will be implemented and to what extent these could change trajectory of generation investment.
4.	**Impact of the COVID-19 pandemic** a. What is your expectation on behaviour changes (e.g., work-from-home practices, online shopping, etc.) and the way Albertans consume electricity going forward? b. How are near-term costs and future generation projects being impacted by covid-19? Do you anticipate long term impacts to generation development?	The AESO's analysis, "Impacts of the COVID-19 Pandemic and Low Oil Prices on Alberta's Power System", provides historical observations of the initial impact of the pandemic lock-down and low oil supply on electricity demand. We anticipate that the observed reduction in electricity consumption during business hours and evenings and shift of peak consumption to 6 pm will likely change as the pandemic-related measures are relaxed and removed. This will likely result in a return to the historical pattern of electricity consumption. The change in industrial consumption may also change as shut-in oil production could come back on line as the oil market recovers. That said, the recovery will be dependent on the global oil market recovery and is subject to risk of trade tensions and reduced demand. With respect to generation, we have seen limited impacts to supply chains for parts and equipment but we anticipate those will be relieved as the lock-downs globally ease. There are near-term cost impacts due to the implementation of preventative workplace safety and hygiene measures (segregation of spaces to maintain physical distance, protocols of building entry,

		temperature testing, cleaning supplies and enhanced hygiene protocols), requirements for Personal Protective Equipment (PPE), and enabling greater work-from-home capabilities. Generation investment will likely be impacted due to lower prices from demand softening. We also expect that the potential for government programs to stimulate investment could impact generation development. We expect that both types of impacts will have near, mid and potentially long-term impacts.
5.	**Load growth and modifiers** a. Where do you think load growth will be concentrated –at the System Load (all metered demand) level, or at the Alberta Internal Load (system load plus load served by on-site generating units) level? b. Under what conditions could Alberta see sustained negative system load growth? c. In the 2019 Long-term Outlook, the AESO had a number of economic and technological advances that are expected to impact the load growth in the province (see section 4 of the 2019 LTO and "New Load Modifiers" tab of the 2019 LTO data file). What is your view on load growth and the impact of the following modifiers within the next 5 years, from 5 to 10 years, and after 10 years for: i. Distributed energy resources: 1. Rooftop solar PV 2. Electric vehicles and charging stations 3. Gas generation 4. Wind generation 5. Energy storage 6. Energy efficiency d. What is your view on load growth and the impact of other emerging industries, sectors or technologies (e.g., bitcoin and cryptocurrency mining, cannabis facilities, petrochemical facilities, data centers, others)?	***Alberta Internal Load will outstrip System Load*** Factors related to economic and population growth in Alberta will negatively impact AIL and system load growth. However, the price signal sent from significant transmission development and an increasing burden of transmission cost driving the delivered cost of electricity has resulted in strong signal to shift to self-supply. This signal is already strong and further system expansion will serve to strengthen this signal. This has resulted in a trend of greater Alberta Internal Load (AIL) growth and lower system load growth. The introduction of tariff design structures such as load retention rates could stimulate greater parity between AIL and system load growth. <u>Load modifiers</u> The load modifiers capture rooftop PV and electric vehicles as well as the relatively nascent cannabis, cryptocurrency and data services industries in Alberta. We expect the impacts will be modest in the near and early mid-term but has potential for accelerating late mid-term and long-term. The trend for growth in rooftop PV and electric vehicles will likely be shaped by the availability of subsidies; at this point, we believe it is fair to assume that the growth is coming from early adopters rather than being more mainstream users. However, this trend and the transition of these to the mainstream could be significantly changed with the availability of subsidy programs or changes to government regulation that require the adoption of electric vehicles. Additionally, the cost competitiveness of electric vehicles will likely improve as car companies focus on transitions to fully electric vehicle fleets that have already been

		targeted by 2030. This could significantly push forward and steepen the curve of electric vehicle adoption. Cannabis, cryptocurrency and data centre customers are price sensitive and highly mobile loads; we expect that these types of load customers will seek out jurisdictions that offer the lowest delivered cost of electricity. While it is possible that Alberta could attract such customers, we anticipate that Alberta is mainly competitive if these operations could be served at a similar cost as self-supply customers. As such, we expect the system load growth contributions from these industries to remain fairly low without a change to tariff that can attract these customers. <u>Distributed energy resources</u> The only load driver listed is electric vehicles adoption and charging stations could stimulate new load growth. We do not see solar, gas, wind generation and energy storage altering load growth but rather being a choice for these technologies being developed on the transmission system. The availability of transmission credits on the distribution system likely incentivizes these resources to connect on the distribution system and potentially displaces these resources being developed on the transmission system. To the extent that this drives higher wires costs, we expect that this could drive a feedback loop for loads to consider more self-supply as well as pursuing energy efficiency.

6.	**Generation Technologies** a. What renewable technologies are likely to be developed by PPA's? b. What is the potential size of the corporate PPA market for renewables, being funded fully or in part, in Alberta? c. What challenges do you foresee in implementing PPA's for renewable development in Alberta? d. Recent public announcements indicate all existing coal-fired units will utilize natural gas in the near term. How do you see the operation of the converted units changing compared to operations as a coal-fired unit? e. Outside of existing generation technology in Alberta, what technology will show up in Alberta next? f. What are the challenges surrounding generation development in Alberta and what are the major factors that will determine what gets built?	***Wind technology will dominate the PPA market*** We expect that the most competitive renewable technologies for PPAs will remain wind generation. However, large solar development projects like Travers show that the continued development of wind generation is likely pushing the wind discount to a point where that the potential captured price for solar generation in the peak hours is overcoming its relative higher cost. Significant increases in solar generation in Alberta's supply mix could reduce these opportunities. The continuation of a decreasing cost trend could however allow solar to be more cost competitive relative to other more dominant technologies over time. We also foresee solar being developed for self-supply and to capture self-supply like benefits through the availability of distribution system transmission credits. ***Corporate PPA market*** The corporate PPA market is growing but at present is around the 250-500 MW per year range and is likely to expand out as big as 1,000 MW per year depending on corporate interest and load growth. A key challenge for implementing PPAs in Alberta is the electricity markets relatively small size and the predictability of its drivers (competitiveness of Alberta versus other markets, corporate spending on renewable development, and changes in environmental regulation). While the general trend and driver has been corporate environment and sustainability objectives, the interested from parties fluctuates from year to year. ***Coal-to-gas conversion*** The operations of converted coal units will vary from dual-fuel, full coal-to-gas, and repowered alternatives. Dual-fuel and coal-to-gas conversions will operate more as peaking generation. These units could have shorter cycle times and be more responsive to prices than they were as purely coal-fired units. Coal units that are repowered with gas turbines and converted to combined cycle gas generation will largely operate as baseload generation but could also have the flexibility to operate in various modes.

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New technology

We anticipate that there will be growing interest and development in hydrogen fuel in the generation space in the mid to long-term in Alberta. In the near, mid and long-term, we anticipate energy storage to be a focal area for new and transformative technology. We expect a wide variety of energy storage technologies including pumped storage and various battery technologies to increase as a share of the overall generation supply mix.

Development Challenges

Regulatory processes including interconnections and facilities permitting remain administratively burdensome and long. Additionally, the potential for regulatory changes including greenhouse gas policy and regulation and market and tariff design pose uncertainty that challenges generation development.
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Future technologies

The following table contains generation technologies and specifications on potential future generation development. Do you believe that these are representative of potential future Alberta generation projects? Would you like to share views on additional technologies and specifications that are not included within the table?
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We note that the AESO's estimates in the table for gas technologies are different than those presented in the Brattle Group/Sargent & Lundy Cost of New Entry (CONE) study that was filed with the AESO capacity market application. For reference, see the table below that compares the AESO's table and costs of estimated for combined cycle and aeroderivative presented in the capacity market proceeding:

<table>
<tr><th></th><th colspan="2">Combined Cycle</th><th colspan="2">Aeroderivative</th></tr>
<tr><th></th><th>2021 LTO</th><th>CONE Study</th><th>2021 LTO</th><th>CONE Study</th></tr>
<tr><td>Generator Capacity (MW)</td><td>479</td><td>479</td><td>46.5</td><td>93</td></tr>
<tr><td>Heat Rate (GJ/MWh)</td><td>7.03</td><td>6.81</td><td>9.68</td><td>9.68</td></tr>
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Facility Type	Overnight Capital Cost ($/kW)	Fixed O&M ($ / kW-year)	Variable O&M ($/MWh)	Generator Capacity (MW)	Heat Rate (GJ/MWh)
Combined-Cycle Natural Gas	1,667	$49.71	$2.49	479	7.03
Simple-Cycle Natural Gas – Aeroderivative	1,159	$52.83	$4.24	46.5	9.68
Solar Photovoltaic – 2021-2025	1,643	$31.85	Credit: grid intensity x carbon price	50	N/A
Solar Photovoltaic – 2026-2030	1,388	$31.85	Credit: grid intensity x carbon price	50	N/A
Wind Generation - 2021-2025	1,586	$32.50	Credit: grid intensity x carbon price	50	N/A
Wind Generation - 2026-2030	1,105	$29.25	Credit: grid intensity x carbon price	50	N/A

Overnight Capital Cost ($/kW)	1,667	1,371	1,159	1,479
Fixed O&M ($/kW-year)	49.71	53.90	52.83	57.30
Variable O&M ($/MWh)	2.49	2.70	4.24	4.60

We note that the simple cycle and combined cycle generator capacities and heat rate values appear to be optimistic. The generator capacities reflect maximum winter ratings and the heat rate are generally lower than what may be expected for a new unit in real operation. With respect to the simple cycle, we also note that the size of the unit in 2021 LTO is half the size that was assumed for the CONE study and yet the costs for the 2021 LTO appear to be significantly lower despite a single unit project having limited economies of scale benefits.

Further, global economic trends could weigh in on how these costs evolve. It may be useful to conduct a long-term cost of generation study after we are further into the pandemic recovery to see if there are observable impacts to these costs.

Additionally, the costs for solar and wind generation appear very aggressive. While wind generation may have cost as low as shown on a kW and kW-year basis, we disagree that a 50 MW project would approach costs this low. We also believe that the unsubsidized cost of solar is significantly understated. Moreover, we view the projections for 2026-2030 of solar and wind costs to be optimistically assuming significant cost reductions - we are not aware of the technological driver(s) that would reduce small scale project costs so low in the mid-term.

8.	**Other** a. Is there any information that you would like to share, which would contribute to the Long-term Outlook development (ie. Developing trends)? b. What do you think is likely to disrupt Alberta's electricity industry in the next 20 years and in what way?	The AESO's 2019 Long Term Outlook is the basis for its transmission plan and needs to be reviewed to account for the impacts of the pandemic. The key economic forecasts that the forecasts were based upon are being drastically revised. Furthermore, the generation planning scenarios were/are even more unrealistic given the fundamental shift in Alberta's economy and impacts to capital spending. The impact to transmission cost as a result of lower load growth needs to be updated – this may increase concerns about the affordability and competitiveness of delivered cost of electricity in Alberta. While potential disruption in the 20-year horizon from the introduction of new technologies, changes to Alberta's economy, or changes in consumption are possible, we are most concerned about the significant disruption to business-as-usual due to pandemic which threatens to have longer term impacts. We expect that the future response in the form of government support and corporate business plans for the recovery to shape developing trends but these are evolving. It is important for the AESO to consider how to effectively gather information and stakeholder views, weigh those considerations, and adjust the forecast for these rapidly changing conditions. This should not be done as a single opportunity for stakeholder written comments at the beginning of recovery but rather as a series of sessions over the course of the recovery on each specific topic raised in this questionnaire.