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To: Clients and Colleagues

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RE: Alberta Climate Change Strategy, Implications for Alberta's Electricity Market, and Renewable Generation Development Opportunities

Summary of Key Points for Alberta's Climate Change Strategy, Implications for Alberta's Electricity Market, and Renewable Generation Development Opportunities

The Alberta Government has declared policy direction to: 1) establish a price on carbon; 2) phase out coal-fired generation by 2030; and 3) accelerate renewable generation developments. These are the key policies that will impact Alberta's wholesale energy market within the Alberta Government's broader Climate Leadership Plan.

This bold policy direction will have many other implications by creating opportunities and posing challenges for Alberta's wholesale energy market and the development of renewable generation, as summarized by the high-level points below.

- Phasing out coal-fired generation by 2030 will pose challenges to Alberta's wholesale energy market and potentially for the reliability of Alberta's power system. However, these challenges can be managed by the pace to which renewable generation projects are developed in response to the forthcoming clean power call coupled with retirements of coal-fired generation.
- The clean power call which will contractually facilitate development of renewable generation must be soundly designed to ensure development of renewable generation in order to meet climate change policy objectives along with successfully integrating renewable generation into Alberta's wholesale energy market.
- New renewable generation will require revenue adequacy from Alberta's wholesale energy market in addition to contract revenues. Therefore, forward energy prices and their projected energy market revenues will be extremely important for renewable energy developers, etc. (e.g., lenders, etc.).
- There will be complicated and dynamic interdependencies regarding Alberta's energy supply in the wake of retiring coal-fired generation while renewable generation is being developed.

These interdependencies will also be impacted by revenue adequacy from Alberta's wholesale energy market and the contract revenues for renewable generation.

- Overall, existing Alberta wholesale market participants and prospective renewable energy developers looking to participate in the forthcoming clean power call should be very diligent regarding the design of the forthcoming clean power call and contract, future energy market revenues, and potential need to evolve Alberta's wholesale market design and market rules.

Alberta Climate Change Policy Direction and Implications for Alberta's Electricity Market

On November 30, 2015, the Alberta Government announced that energy from renewable generation will supply up to 30% of Alberta's energy demand by 2030. As part of Alberta's Climate Leadership Plan, the Alberta Government has committed to:

- Phase out emissions from coal-fired generated electricity by 2030;
- Diversify Alberta's supply mix by replacing retired coal-fired generation with at least two-thirds renewable generation;
- Appoint an independent facilitator and negotiator to help develop and implement this plan, where the work of this facilitator will be to transition Alberta away from coal-fired generation without endangering the reliability of Alberta's power system;
- Keep the costs of renewable energy as low as possible by using market mechanisms, such as auctions (i.e., the clean power call);
- Support workers employed in the coal electricity sector with opportunities to retrain for new jobs in a greener energy economy; and
- Reduce greenhouse gas emissions from coal-fired generation to zero by 2030, from current emissions of 40 mega tonnes annually.

The objectives listed above from the Alberta Government's Climate Leadership Plan were in part concluded based upon the November 20, 2015 Alberta Climate Change Advisory Panel's report and recommendations to the Alberta Government regarding the development of a comprehensive climate change strategy¹. The report was based on extensive consultation with industries, environmental groups, municipalities, general public, and Aboriginal communities, and summarizes advice to the Alberta Government on climate change strategy and the rationale for the recommendations.

The purpose of this note is to summarize the Panel's recommendations, particularly those that apply to Alberta's electricity market, and to provide Power Advisory's high-level insights regarding potential opportunities and risks that may arise from the proposed approach and stated objectives of

¹ The report is available here: <http://alberta.ca/documents/climate/climate-leadership-report-to-minister.pdf>

the Alberta Government. These insights will provide considerations for future implications for renewable generation development in Alberta along with implications for the existing Alberta wholesale energy market.

Alberta Climate Change Advisory Panel

The Alberta Climate Change Advisory Panel (the “Panel”) was formed in August 2015 to comprehensively review the province’s climate change policy, consult stakeholders, and provide advice to the Alberta Government on a permanent set of measures to advance Alberta’s climate change policy.

Throughout August and September, the Panel was responsible for guiding the stakeholder engagement process by facilitating discussions regarding key issues relating to an Alberta climate change plan. As part of this process, the Panel invited stakeholders to provide submissions containing ideas, feedback, reports, and data. Resulting from this stakeholder engagement and submissions process, the advice from the Panel consisted of policy options and recommendations that were used by the Alberta Government to help shape and determine their Climate Leadership Plan.

Carbon Competitiveness Regulation

The Panel’s core policy recommendation establishes a price on carbon that is broadly applied across Alberta’s emitters. The Panel concluded that carbon pricing provides the greatest flexibility towards achieving a least-cost approach that reduces emissions through whatever process or action best suits individuals and their abilities at a given time. Specifically, the Panel provided the following recommendations.

- For large industrial facilities, the existing Specified Gas Emitters Regulation should be replaced in 2018 with a Carbon Competitiveness Regulation (CCR), where a carbon price on emissions is applied to facilities with emissions over 100,000 tonnes/year. Sector specific and output based allocations of emissions rights should be used to mitigate competitiveness and employment impacts in trade exposed sectors and to protect electricity consumers from significant and avoidable rate increases.
- For end-use emissions, a broad-based carbon price (i.e., economy-wide pricing) should be applied under the CCR, requiring distributors of transportation and heating fuels to acquire emissions permits in recognition of the emissions their products will create when combusted.
- The carbon price will have a ceiling, set by a price at which emissions permits can be acquired from the Alberta Government through the payment of a levy.
- Revenues from the carbon price should be used for defined purposes (discussed further in applicable sections below).

The proposed CCR is intended to:

- Broaden the carbon pricing signal in Alberta to cover approximately 90% of the province's emissions, up from less than 50% today;
- Provide a consumer rebate to mitigate the impacts of carbon pricing on low- and middle-income Albertans, fund complementary emissions abatement programs, and where applicable, support a sound and just transition for labour and communities and strategies to protect small- and medium-sized businesses;
- Improve the mechanism by which trade-exposed industries are protected to ensure their competitiveness while encouraging and rewarding top performance in carbon emission reductions;
- Increase stringency at the same pace as peer and competing jurisdictions; and
- Avoid the transfer of wealth outside of Alberta.

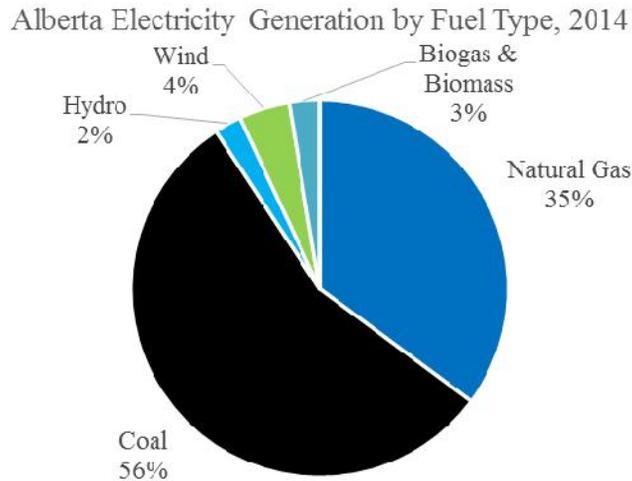
To complement the carbon pricing system, the Panel recommended four other policy initiatives related to the following areas.

1. Electricity – Phasing Out Coal-Fired Generation and Phasing in Renewable Generation
2. Oil and Gas – Pricing Carbon and Reducing Emissions from Methane
3. Energy Efficiency and Energy – Resilient Communities
4. Technology and Innovation

Since this note focusses on policy initiatives related to the electricity sector, clients and colleagues are encouraged to review all other policy initiatives to thoroughly understand the broader impacts that Alberta's climate change strategy could have on Alberta's economy.

Phasing Out Coal-Fired Generation and Phasing In Renewable Generation

As illustrated in the following figure, Alberta's electricity supply is primarily composed of fossil fuel generation. In 2014, coal-fired generation accounted for over 50% of generation, followed by 35% from gas-fired generation and a relatively small contribution from renewable generation.



Source: Alberta Utilities Commission

The Panel's recommendations outline a strategy to reduce emissions from fossil fuel generation within Alberta's electricity market and increase the contribution of energy from renewable generation through an integrated solution that is compatible with Alberta's electricity market design and structure. The policy recommendations are summarized below along with Power Advisory's high-level commentary.

1. Establish a carbon price that includes electricity sector emitters

Building on the broader recommendation of establishing a price on carbon for the Alberta economy, the Panel recommended that a carbon price for large emitters should include electricity generators. A carbon price should discourage the dispatch of carbon-intensive generation and rewards low- or zero-carbon generation by dispatching this generation ahead of carbon-intensive generation. The Panel recommends establishing a carbon price with output based allocation similar to the allocation of emission credits in California.

Power Advisory Commentary: On balance, a carbon price is expected to increase the marginal operating costs of coal- and gas-fired generation within Alberta's wholesale energy market. This will have an impact on the shape of the supply curve and in some instances on the order to which generation is dispatched by the Alberta Electric System Operator (AESO). Increasing the operating costs for coal- and gas-fired generation will increase energy offers from these resources which could result in higher real-time wholesale energy prices. However, as more renewable generation from sources of relatively low operating costs (e.g., wind, solar, etc.) come on-line, this will change the supply curve further and will likely tend to dampen real-time wholesale energy prices. Therefore, understanding the wholesale pricing dynamics

and potential energy market revenue impacts of the ramp down of coal-fired generation along with the phase in of renewable generation will be extremely important regarding any renewable generation investment decisions in Alberta.

2. Pursue a regulated and accelerated phase out of coal-fired generation

The Panel expects that a predictable coal-fired generation shutdown schedule will provide clear signals to the market regarding opportunities for the development of new alternative generation (e.g., renewable generation). By setting a target of 2030 for the retirement of coal-fired generation, the Panel hopes to avoid too rapid a retirement schedule that might create power system reliability issues. This recommendation also recognizes that Alberta has access to relatively cheap natural gas that can be used by new gas-fired generation to help maintain power system reliability.

Power Advisory Commentary: As coal-fired generation units are retired, wholesale energy price volatility may become a growing issue within Alberta’s electricity market especially if future supply cannot adequately meet future demand.

Therefore, even though the Panel hopes that the Alberta Government does not need to specify a regulatory shutdown schedule for coal-fired generation, such a schedule may need to be defined in the future if it is determined that some of the coal-fired generating units are needed to stay on-line longer than otherwise planned in order to meet Alberta’s power system reliability needs. There is a risk that the carbon pricing policy alone will not be enough to achieve timely coal-fired generation retirements by 2030 and that further policies may be required. Much will depend on how the coal-fired generation retirements are managed and the AESO’s assessment of future power system reliability. With a current installed capacity of over 6,200 MW of coal-fired generation representing approximately 39% of Alberta’s total installed capacity², coal-fired generation is a significant part of Alberta’s supply mix.

3. Accelerate renewable generation

To facilitate renewable generation development, the Panel recommends that the Alberta Government pursue a clean power call (i.e., Request for Proposal (RFP)). The clean power call is to be an open competitive procurement process to purchase renewable energy attributes from the owners of new renewable generation. In effect, the clean power call will procure Renewable Energy Credits (RECs) through contracts.

The Panel recommended that the clean power call encourage partnerships with rural and Aboriginal communities by their inclusion as part of the procurement evaluation criteria. The clean power call is recommended to have an annual financial commitment from the

² AESO Annual Market Statistics Report 2014: <http://www.aeso.ca/market/8856.html>

Alberta Government for renewable generation projects that execute contracts, and to include a pre-qualification procedure to ensure that procurement participants (i.e., renewable generation developers) are in a position to develop their projects or provide security to the Alberta Government if they fail to do so.

As part of the integrated solution to the climate change strategy for Alberta's electricity sector, the Panel recommended, and the Alberta Government has accepted, that two-thirds of the phased out coal-fired generation be replaced by renewable generation with the goal of achieving 30% of the annual generation output from renewable generation by 2030.

The Panel focused on policy initiatives that will be compatible with Alberta's electricity market design and structure. The policy initiatives are therefore expected to work within Alberta's energy-only wholesale market. The Panel specifically noted that it does not support a clean power call that provides Government-backed contracts for energy or a feed-in tariff. The Panel believes that contracts that do not have market exposure will remove incentives to develop renewable generation projects that provide the greatest value to Alberta's energy market and instead incentivizes renewable generation projects that produce energy regardless of the impacts on the market.

Power Advisory Commentary: A clean power call through an RFP for RECs is a significant change for Alberta's energy market and a fundamental departure from the existing energy-only market design and structure. That is, until the Government's adoption of Alberta's Climate Leadership Plan and since the opening of the Alberta wholesale energy market, Alberta's supply mix was in no way predefined by Government policies where all investment decisions for new generation projects have been made mainly based on wholesale energy market prices and projected energy revenues. Further, any investment decisions to develop new generation projects have been made without any Government-backed contracts. The forthcoming clean power call introduces the element of a distinct 'out of market' mechanism aimed to help facilitate development of renewable generation.

The above points were of concern to the Panel. Despite challenges to integrate renewable generation projects resulting from a future clean power call, the Panel felt that a level of revenue certainty through contracts outside of the Alberta wholesale energy market will be required in order to best ensure timely development of renewable generation projects.

Therefore, the Panel's recommendations attempt to strike a balance by providing contracts for RECs in order to help provide revenue certainty (which also should help to provide project financing) while attempting to ensure that new renewable generation continues to participate within Alberta's wholesale energy market on an

as level playing field as possible when competing with other generation (e.g., gas-fired generation, etc.).

Because the contracts will be designed to provide revenues for RECs only, renewable generation under these contracts will need wholesale energy market revenues as a complement to contracted REC revenues. Therefore, two key points are fundamental to the ultimate success of the forthcoming clean power call. First, the RFP and associated contracts for RECs need to be carefully designed. For example, any pre-determined caps on REC prices within the RFP may dampen contracted REC revenues which may place a greater requirement for contracted renewable generation to receive adequate wholesale market energy revenues. Therefore, projections of Alberta's demand/supply balance, supply mix, and forecast of wholesale energy prices will be extremely important for any potential clean power call participants. Second, future wholesale market energy revenues have the potential to be relatively low especially if natural gas prices stay at relatively low levels (that temper offer prices from gas-fired generation) and renewable generation is developed on balance faster than retirements of coal-fired generation. Under this scenario (assuming the "low growth" demand scenario from the AESO's Long-Term Transmission Plan (LTP)), wholesale energy prices will likely face downward pressure resulting from significant supply of relatively low marginal cost generation being dispatched. Therefore, if this scenario were projected to materialize, it will impact how potential participants will bid into the clean power call, which in turn supports the above point that the clean power RFP and contract for RECs must be carefully designed.

Impact and Opportunity for New Generation

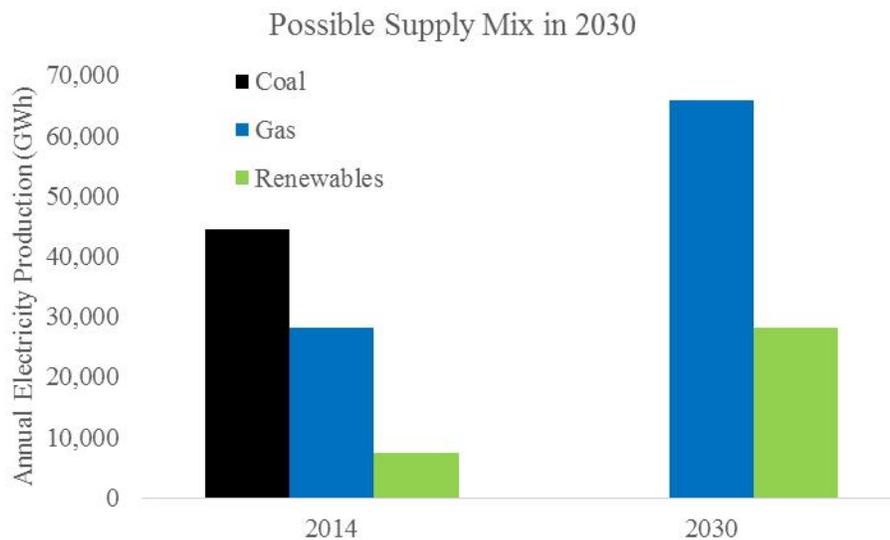
Recapping from the above section, the Panel's recommendations for the electricity sector focus on three key recommendations: 1) establishing a price on carbon; 2) phasing out coal-fired generation by 2030; and 3) accelerating renewable generation development.

On balance, gas-fired generation will benefit from the recommendations presented by the Panel and the policy direction adopted by the Alberta Government. The removal of coal-fired generation from the supply mix by 2030 will require investments in other dispatchable resources in order to help maintain the reliability of Alberta's power system during the transition. The Panel correctly notes that Alberta enjoys relatively cheap prices for natural gas with supply liquidity compared to other jurisdictions. This lowers costs and risks for developing gas-fired generation in Alberta compared to other jurisdictions that have higher natural gas prices.

The Panel recommended that 50% to 75% of the retired coal-fired generation be replaced by renewable generation. The remaining 25% to 50% will likely be replaced by gas-fired generation.

With over 6,200 MW of operating coal-fired generation today that are now planned to retire by 2030, this creates a potential for 1,500 MW to 3,000 MW of new gas-fired generation projects to be developed by 2030, before any consideration of potential growth in energy demand.

On November 23, 2015 the AESO published the 2015 LTP³ outlining the transmission development plan expectations in the near-term and long-term for Alberta. The AESO indicated that based on economic slowdown in Alberta mainly due to low oil prices, the 2015 LTP has been based on the “low-growth” forecast scenario from the 2014 Long-Term Outlook. The low-growth scenario expects energy consumption to continue to increase in the near-term before flattening in the long-term as large capital project deferrals in the oil sands largely eliminate load growth. Based on the low-growth scenario, the AESO expects energy demand in Alberta to grow from 77 TWh in 2014 to 94 TWh in 2030. Given the AESO’s energy demand forecast, renewable generation may project to produce over 28 TWh of energy in 2030, of which over 20 TWh will be from to be developed renewable generation⁴. Therefore, nearly 6,000 MW of new renewable generation may be developed and in-service by 2030⁵.



Source: Alberta Utilities Commission and Power Advisory

As of this time, the recommended clean power call does not set any targets for any specific renewable technology (i.e., fuel) and instead focuses on the purchase of RECs through contracts

³ For more information on the 2015 LTP: <http://www.aeso.ca/transmission/22021.html>

⁴ Renewable generation (hydroelectric, wind, bioenergy and solar) accounted for roughly 9% of the Alberta electricity production, or just over 7 TWh (source: AESO)

⁵ Based on the assumption of all new installed renewable generation being wind generation with a 40% capacity factor

with renewable generation. Relative to other renewable generation, this may initially offer advantages to develop wind generation projects since wind generation can currently provide relatively low cost energy and therefore may require relatively less revenue from contracted RECs in order to make up any shortfalls from wholesale energy market revenues. However, long-term revenue attrition from the impacts of high wind generation saturation levels may create opportunities for other renewable energy generation resources. Therefore, the design of the clean power call (e.g., evaluation criteria) and premium given to community engagement should influence which renewable generation technologies are ultimately pursued, developed, and awarded contracts.

Preliminary Conclusions

This adopted Climate Leadership Plan has many implications for Alberta's wholesale energy market and the development of renewable generation. The resulting opportunities and challenges are summarized within the points below.

- Phasing out coal-fired generation by 2030 will pose challenges to Alberta's energy market and potentially for the reliability of Alberta's power system. The market design and structure of the wholesale energy market operated by the AESO was initially implemented without significant supply from renewable generation, especially variable (i.e., wind and solar) generation. Therefore, challenges to instantaneously balance Alberta's power system through market mechanisms in the wholesale energy market will likely increase in the future as coal-fired generation is retired and renewable generation increasingly comes on-line. Therefore, the AESO will need to explore changes to the present market design and market rules to best integrate renewable generation in a reliable and economic manner. For example, because many renewable generation resources are intermittent regarding their energy production (e.g., wind and solar), Alberta's power system may require additional flexibility from resources that can provide operability and dispatchability. Therefore, the AESO may need to consider mechanisms to value these flexibility attributes and in turn ensure that resources that meet these attributes are effectively compensated.
- While principles to limit 'out of market' mechanisms to facilitate the development of renewable generation are sound, the design of such mechanisms (e.g., the clean power call) and the integration of such mechanisms within Alberta's wholesale energy market will be challenging but not impossible. Newly contracted renewable generation should economically participate within Alberta's wholesale energy market, but striking the right balance between effectively procuring renewable generation through contracts and having contracted renewable generation adhere to fundamental market design principles and operations. These objectives need to be balanced.
- The design of the clean power call RFP and REC contract will ultimately drive the success of the future development of renewable generation. This contracting mechanism has been selected so as to best ensure development of renewable generation projects in order to meet

very clear Alberta Government policy objectives, therefore the efficacy of the contracts must not be compromised.

- Because executed contracts resulting from the clean power call will only provide REC revenues, renewable generation projects will need revenue adequacy from Alberta's wholesale energy market. Therefore, forward energy prices and projected energy market revenues will be equally important for renewable energy developers in understanding how to develop their projects and ultimately bid their projects in response to the clean power call.
- The future Alberta energy demand/supply balance with more emphasis on the changing future supply mix and its ability to meet the reliability needs of Alberta's power system will ultimately drive wholesale energy prices. Therefore, the timing to retire coal-fired generation in conjunction with the timing of renewable generation coming into service have the potential to either create increases in wholesale energy price volatility or could dampen wholesale energy prices as relatively low marginal cost generation increasingly sets wholesale energy prices (especially if natural gas prices stay at relatively historic lows). In other words, if the pace of renewable generation coming on-line is faster than the retirement of coal-fired generation, coupled with relatively low natural gas prices resulting in relatively low offer prices from gas-fired generation, wholesale energy prices may be relatively low therefore putting downward pressure on energy market revenues. As a consequence under this scenario, participants within the forthcoming clean power call will need to factor in these potential future energy market scenarios in order to help determine the value of RECs and REC prices to be bid into the call.
- Depending on future Alberta energy demand/supply scenarios given the dynamics of decreasing coal-fired generation and increasing renewable generation, revenue adequacy from the wholesale energy market may be a future issue. If this issue were to be projected with some confidence that it may become a reality, the AESO and existing market participants should give serious consideration to establishing a Capacity Market in Alberta. That is, if revenue adequacy becomes a future issue within Alberta's wholesale energy market, all generators (i.e., incumbent and new entrants) will likely require supplemental market revenues to ensure cost recovery with competitive rates of return on their investments.
- Overall, existing Alberta wholesale market participants and prospective renewable energy developers looking to participate in the forthcoming clean energy call should be very diligent regarding the design of the forthcoming clean energy RFP and REC contract, future energy market revenues, and potential need to evolve Alberta's wholesale market design and market rules in order to accommodate changes to Alberta's supply mix which will most likely impact the operations of Alberta's wholesale energy market.