AUC Inquiry Module B

Written submission responding to expert reports

BUSINESS RENEWABLES CENTRE CANADA

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Introduction

The Business Renewables Centre-Canada (BRC-Canada) appreciates the opportunity to provide input into Module B of the Alberta Utilities Commission's (AUC's) Inquiry into the ongoing economic, orderly and efficient development of electricity generation in Alberta.

Corporate procurement has been essential to enable investment in new, low-price, non-emitting electricity supply in Alberta's market. BRC-Canada is uniquely positioned to provide input around the impacts of electricity market design changes on this important corporate renewables procurement market. BRC-Canada brings the unique perspectives of corporate buyers. Buyers have emerged as key parts of the energy market for enabling new private-sector supply investment by helping to absorb market risk.

Module B Context

Under Module B of the AUC's Inquiry into "the ongoing economic, orderly and efficient development of electricity generation in Alberta," the AUC has been directed to consider "the impact the increasing growth of renewables has to both generation supply mix and electricity system reliability." The AUC has acknowledged that the Alberta Electric System Operator (AESO) undertook work with a similar scope around system reliability alongside Module B,[1] also directed by the Minister of Affordability and Utilities.[2] The AESO reported to the Minister on this work, known as the "Market Pathways Initiative," at the end of January.[3]

Evidence under review in this submission

The evidence available for review, response and critique are two reports commissioned by the AUC, collectively referred to as "the expert reports":

1. London Economics International LLC (LEI) — reviewing prior studies to inform reliability and affordability assessments; and assessing future fundamentals of the current energy market design to evaluate resource adequacy and electricity bill impacts; and

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[1] AUC, "AUC inquiry into the ongoing economic, orderly and efficient development of electricity generation in Alberta – Module B: AUC inquiry process for Module B", https://www.auc.ab.ca/featured/auc-inquiry-into-the-ongoing-economic-orderly-and-efficient-development-of-electricity-generation-in-alberta-module-b/

[2] AESO, Executive Working Group Sprint I Pre-reading Materials, October 6, 2023, slide 14, https://www.aesoengage.aeso.ca/37884/widgets/156642/documents/122918

[3] Ibid.

2. Longview Communications & Public Affairs (Longview) — gauging perspectives of certain select, targeted stakeholders regarding Alberta's power market.

BRC-Canada was not consulted by Longview in the preparation of its report. Indeed, BRC-Canada received no communication whatsoever from Longview, nor did the AUC provide a mechanism for stakeholders to reach out to Longview to provide input. BRC-Canada filed its statement of intent to participate in the Module B proceeding on December 21, 2023, fully 48 days before the expert reports were filed in the proceeding. This was ample time for BRC-Canada's views to be sought by the AUC and/or the expert consultant.

About BRC-Canada

BRC-Canada is an initiative of the Pembina Institute. BRC-Canada exists to enable businesses and institutions to access renewable energy for their emissions reduction needs across Canada. This means working closely with buyers and developers of renewables and assisting them in shortening their learning curves as they figure out the best path to power purchase agreements. Our growing organization currently has about 60 participants from across all sectors of the Canadian economy.

These projects enabled by Alberta's open corporate renewables procurement market represent over $6.4 billion of new, direct capital investment and provide nearly 6,300 jobs at peak construction. Once operating, they will support ongoing local economic activity, such as spending for operations and maintenance, including over $35 million per year in municipal property tax payments and over $10 million in annual lease payments to rural landowners. The projects supply the energy market with lowest-cost energy supply for all consumers. With more deals and new projects, these economic development benefits will only grow.

In light of the significance of this private-sector activity in driving investment in new electric energy supply in Alberta's electricity market, BRC-Canada's unique perspective is essential to a fulsome understanding of the functioning of Alberta's electricity system and the policy constructs necessary to attract new supply.

Approach and overall reaction

Two core principles underlie BRC-Canada's fundamental perspective around electricity market policy evolution in Alberta, and govern the comments in this submission:

1. Supply adequacy in Alberta's carbon-constrained future electricity system relies on considerable new investment, which, in turn, relies on investor confidence, which, in turn, relies on stable and predictable legislation governing the market framework; and
2. Within a stable overall market framework, detailed regulations, rules and policies should continuously improve in a gradual and measured fashion to optimize the functioning of the stable market framework in light of evolving circumstances and emerging technologies.

The two principles are equally essential sides of the same coin: to ensure a stable overall market framework lives and develops sustainably alongside a dynamic and evolving sector. Together, they represent an implicit compact between the public and private sector: the government establishes, maintains and commits to the predictable, stable market framework, and generators bring private risk capital to supply Albertans power at lowest cost and without public debt.

The importance of a stable market framework

On the first principle, there is simply no electricity system that relies on private investment that can sustain reliability over the long run without investor confidence to attract new supply. No matter what framework is chosen, a sudden and unfair market overhaul that fails to respect existing investment expectations can only undermine go-forward investor confidence. Even long-term contracts can be cancelled without compensation, if the political animus exists. Demonstrating disregard for electricity generation investor expectations can only mean challenges and higher cost in attracting future investment in new or refurbished supply, under any framework.

The importance of continuous design improvement within a stable market framework

Generators do not have an investment expectation in an entirely static market, nor is that a reasonable approach. Rather, generators anticipate that regulations, rules and policies will continuously improve to maximize the overall legislated market framework's effectiveness at achieving system objectives such as reliability, affordability, and decarbonization, in response to evolving circumstances and technologies. Typically, this can be accomplished without changes in the legislative framework, through ancillary markets, rules, and regulations within the existing legislation.

A fair assessment of the energy-only market framework would assume continuous design improvement

As such, the energy-only market framework should not be assessed on its ability to maintain reliability under an assumption that the regulations, rules and policies around that framework are unchangeable. Any analysis that assumes the existing policy context in order to critique the existing market framework is engaging in flawed methodology: in reality, no stakeholder is asking for the existing market framework with no changes in design.

For instance, when storage technologies improve to the point of offering an economic option for supporting supply adequacy, maintaining other reliability parameters (such as frequency management), stabilizing prices, and displacing higher-cost transmission, stakeholders and policy-makers should assume that the detailed design of the existing market framework evolves to accommodate economic uses of storage. Storage will be a key technology in supporting reliability and affordability in an energy-only market. Inhibiting the development of storage with the sub-optimal regulatory structure and tariff design currently in place (as described below) is counter to maintaining the energy-only market.

As such, assuming this energy-only market design when assessing the energy-only market framework consigns it to failure on achieving reliability and other system objectives. This is not unique to storage enablement — it applies also to other market design details, such as the bid price ceiling and responding to reliability threats with ancillary markets and tailored service procurements. It also means that system planners and operators must forecast realistically, in order to identify and respond to reliability challenges in a timely manner, as explained further below.

BRC-Canada questions the value of any assessment of the energy-only market framework that assumes a permanent, static market design. We offer the responses below in that spirit.

Response to expert reports

Overall, BRC-Canada does not find that the LEI report supports valuable conclusions around the sustainability of the energy-only market or the merits of fundamental changes to the market framework. In particular, the LEI analysis is undermined by the following errors, misunderstandings and inappropriate assumptions:

1. The analysis misunderstands the role of environmental attributes in Alberta's electric energy market and this misunderstanding supports the conclusion that this is a factor that undermines the proper functioning and sustainability of the energy-only market;
2. The analysis fails to understand the opportunity for various dispatchable energy technologies to mitigate revenue uncertainty under a technology-agnostic approach, because it gives preferential consideration to one particular type of dispatchable technology;
3. The analysis assumes that the details of the energy-only market design are static and assesses the market on that basis, without allowing for incremental improvements that enable the market to maintain reliability, particularly relating to storage development and system forecasting; and
4. The analysis misunderstands the risks that climate change poses to different types of generation technologies.

Together, these errors render the analysis uncompelling and undermine any meaningful conclusion.

With respect to the Longview report, BRC-Canada's perspective was not sought for this report, but some stakeholder comments in the Longview report repeat some of these same misconceptions and flawed perspectives..

Environmental attributes do not distort the energy market

A power purchase agreement or a PPA is a long-term electricity supply agreement between two parties, typically a power producer and a buyer. Usually, the agreement involves the delivery of electricity and in the case of renewable energy, renewable energy certificates (RECs) from a renewable energy generator to a buyer. The electricity can be delivered to the buyer's site through the power grid, where the buyer would take legal ownership of the electrons, like in a physical PPA, or only the environmental attributes of the renewable energy can be sold and not the electrons, like in a virtual PPA.

PPAs are widely used for market-driven energy procurement because they provide assurance of funding for developers, help buyers with energy price volatility, and help them meet their emission targets. Globally since 2008, PPAs have signed on 148 GW of renewable energy. Although commonly used for renewable energy, PPAs can be applied to any other energy technology. Indeed, they have supported financing for many forms of electricity supply, including thermal generation, over the last two decades, as described further in this section.

In several sections, the LEI report suggests that corporate environmental, social, and governance (ESG) drivers are distorting the energy market and undermining its ability to function properly. These sections explicitly state or imply:

- that renewable energy is insulated from energy market dynamics (e.g., "corporate interest in ESG … is dramatically increasing the development of renewable generation, independent of market price signals"); and
- that free markets for secondary products from power generators are inappropriate in an energy-only market design (e.g., "[t]he construction of these projects does not depend solely on revenues from the Alberta wholesale electricity market").

The inclusion of these unsupportable positions in the analysis undermines the credibility of the analysis's conclusions.

Renewable energy is not developed "independent of market price signals"

In Alberta, corporate and institutional buyers — such as businesses, institutions and municipalities — can purchase energy directly from generators. The ability for load to forward contract for energy from specific generators has been part of the energy-only market design from its start and has been exercised by a variety of consumers with a variety of generation sources. This is not new, nor unseemly: it has been part of how generators of all types have shared merchant risk in order to enable financing for new generation investment. In other words, this dynamic has played a key role in enabling new generation supply in Alberta, supporting supply adequacy. Generators benefitting from long-term offtake agreements have never been viewed as developing "independent of market price signals." The report is correct in identifying that private sector actors have recently chosen to contract more with renewable energy. These private sector consumers' and capital-providers' create market-based expectations for corporate emissions reductions. Buyers can claim tangible credits for purchasing their power from new, additional clean or renewable sources, reducing the carbon footprint of their operations, for either voluntary (ESG) purposes or compliance (industrial carbon pricing)

offsets.[4] This improves their competitiveness in terms of accessing capital markets and mitigating their direct carbon pricing risks. These private sector actors are procuring renewable energy to improve their financial competitiveness.

Indeed, this improvement to their competitiveness has been beneficial to Alberta. Alberta's major emitters have retained competitiveness in the face of carbon pricing through ready access to low-cost offsets. It has also made Alberta more attractive to global capital allocation by enabling major global investors to meet ESG targets by siting in Alberta, where they can procure non-emitting energy and/or emissions offsets for their operations, which is appealing to creditors and investors. This market choice helps attract new investment to Alberta from global companies looking for opportunities to sustainably supply their power needs and meet their commitments. In November 2021, Amazon chose Calgary for its $4.3-billion cloud computing operation, crediting access to renewable energy in Alberta as a key factor.[5] These benefits are summarized in our fact sheet, *Alberta's Corporate Renewables Procurement Advantage*.[6]

Clearly, the buyers' demand that is driving renewable energy growth in Alberta is not "independent of market price signals," in general. But they are not even "independent" of the electricity market price signal, in particular. The buyers factor the electric energy market price into their analysis for whether to enter offtake contracts with new renewable energy. The LEI report suggests the market price is somehow circumvented. That is not the case at all and suggests a misunderstanding of the contracts-for-difference (CfDs) that underlie vPPAs. Through the contract-for-difference, the renewable energy developer shares some of the project's merchant risk (though certainly not all, many developers retain merchant exposure for significant proportions of their projects)[7] with their buyer(s). The merchant exposure does not evaporate — it is shared with another market actor via a market instrument, an offtake agreement. In deciding whether to enable a new renewable energy project through such an agreement, a buyer will have to factor the anticipated market price that the generated energy will capture into its consideration. There is no non-market distortion involved here. The price signal applies to these market actors, including potential downside market risk in terms of the

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[4] Offsets are enabled through Alberta's Technology, Innovation and Emissions Reduction (TIER) regime, which establishes a fair calculation of offsets generated by renewable energy that can be sold to large final emitters with TIER reduction obligations.

[5] The Canadian Press, "Amazon to open cloud computing hub near Calgary with promise of $4.3B investment, 950 jobs", November 8, 2021. https://www.cbc.ca/news/canada/calgary/amazon-hub-calgary-investment-1.6241214

[6] https://businessrenewables.ca/resource/fact-sheet-albertas-corporate-renewables-procurement-advantage

[7] Business Renewables Centre-Canada, *Renewables in Review: 2023*, 9. https://businessrenewables.ca/resource/brc-canada-renewables-review-2023-0

prices that the renewable energy projects will fetch from the market over the term of the contract.

As such, the buyers are responding to their electricity market exposure as consumers: they are concerned about rising electric energy prices, particularly with rising carbon costs embedded in those prices as carbon pricing becomes more stringent. Indeed, every buyer tracked in BRC-Canada's Deal Tracker (a comprehensive list of all long-term contracts announced for renewable energy offtake),[8] has load in Alberta and is therefore exposed to the market price as a consumer. A renewable energy offtake deal offers a hedge against rising thermal energy costs. So, buyers are responding to the "market price signals" of the lowest-cost new energy supply available — wind and solar — which also happens to protect against rising carbon costs.

Far from independent of market forces, these buyers are responding to a complex confluence of market forces, which they are uniquely positioned to do, well beyond the capacity of centralized government agencies or expert consultants. These "buyers" are not acting "independent of market price signals." To the contrary, they are aggregating an entire suite of market signals, resulting in greater overall efficiency, and more efficiently than centralized government decisions could.

Offtake agreements that share merchant risk to enable project bankability are not limited to renewable energy and not limited to recent years. Moreover, as discussed further in the next section around dispatchable power, all market participants have access to these offtake opportunities, and it is a market decision of buyers to decide with whom to contract.

Ancillary markets for secondary products improve rather than distort the energy-market's function

Both the LEI report and some stakeholder comments in the Longview report suggest that environmental attributes generated by renewable energy are distorting the energy market. That is not the case: cross-market interactions enabled by secondary products are not distortional; they add efficiency to each market's function, by enabling lower-cost supply.

When cogeneration facilities generate steam for oil production while also supplying low-cost electricity, a considerable share of the installed generating capacity in Alberta that does not contribute to system flexibility, nobody claims that this distorts the market. When an Alberta coal power facility markets its fly-ash to concrete suppliers, because the secondary product of fly-ash is useful in building materials (as well as paints, adhesives, composites, bricks, roads, etc.), nobody claimed that this distorted the energy

[8] Business Renewables Centre-Canada, "Deal Tracker". https://businessrenewables.ca/deal-tracker

market. When natural gas generators with carbon capture market their highly purified carbon dioxide to carbon utilization industries (as demonstrated by Carbon Upcycling at ENMAX's Shepard Energy Centre, and with considerable plans for expansion in Alberta), it will not distort the energy market and, in fact, these carbon utilization opportunities have received and will continue to receive considerable public subsidy. In each instance, the supplementary revenue can improve the economics of electricity supply, leading to better consumer outcomes.

Similarly, the fact that there is private-sector market demand for carbon offsets and renewable energy certificates is not a detriment to the energy market's functioning. It has enabled additional lowest-cost energy supply in Alberta's market, reducing prices for consumers. The fact that other generation types can access markets for secondary products demonstrates that the concept of "market distortion" from renewable energy certificates is a double-standard applied by commentators. The fact that different generation types have different attributes (none of which are wholly good or wholly bad, as discussed in the next section) does not justify choosing one generator's secondary products over another's.

The concern around revenue certainty for certain preferred "dispatchable" power misunderstands the market and system needs

The LEI report and stakeholder comments in the Longview report fail to apply technology-neutrality, giving preferential consideration to one type of dispatchable technology, namely natural gas, and misunderstanding the market revenues realized by dispatchable power and the market options that dispatchable power has to mitigate merchant risk, in the following ways:

- by implying that renewable energy is unique in failing to guarantee reliability (e.g., LEI report says "the production of that clean energy is not perfectly aligned with when consumers want their electricity"); and
- by stipulating that greater fluctuation in power market prices and lower power market prices will render dispatchable power uneconomic (e.g., the LEI report says "[a]n increasing frequency of $0/MWh prices will challenge the economics for existing power plants and new dispatchable generation investments" and "will mean … generators that have to pay for fuel will be running in those hours at a loss").

No generation technology guarantees reliability without "back-up" and renewable energy does not weaken supply adequacy

Despite a number of comments in the LEI report and by stakeholders summarized in the Longview report, there is no binary class of generators that ensure reliability versus a class that undermines reliability.

For starters, there is no generator that can produce energy "perfectly aligned with when consumers want their electricity," a key critique that the LEI report applies only to growing ESG-supported renewable energy. Every generator has planned and unplanned outages and derates and, in this way, every generator requires "back-up" from the fleet of other generators. Indeed, thermal generators are often derated during summer peak, which typically occurs when extreme heat causes high air conditioning load at the same time that it decreases the efficiency of thermal generators. This is projected to worsen as climate change amplifies extreme heat and makes it more frequent.

Moreover, renewable energy does not undermine supply adequacy. First, there are many dispatchable renewable energy options, including biomass, geothermal, hydro, and wind or solar with hybrid storage.

Second, wind and solar energy simply provide a lower-cost option, when it is available, displacing higher-cost generation and, thereby, decreasing electricity prices for consumers. Despite some of the comments in the Longview report, the addition of, say, 100 MW more wind or solar energy does not create a need for additional dispatchable supply — it simply replaces the highest cost dispatchable supply when it is operating and decreases costs for consumers.

This may impact the economics of certain "dispatchable" generation types like thermal generation that do not complement wind and solar (the lowest-cost energy option available), but that only highlights the superior attributes of other dispatchable generation types that do, as discussed in the next section.

More low-price market hours do not compromise the economics of all dispatchable generation

The LEI report's repeated statements — mirrored by some stakeholders summarized in the Longview report — that more frequent low-price hours are challenging for the economics of new dispatchable generation rely on two central errors:

1. despite comments in the LEI report, $0/MWh moments do not increase losses for truly dispatchable generation; and
2. the position assumes the operating approach of thermal generation whereas other dispatchable generation benefits from low-price hours.

For this reason, these several conclusory statements around loss of dispatchable generation are not compelling.

First, it is not the case that more frequent floor price moments of $0/MWh will mean "other generators that have to pay for fuel will be running in those hours at a loss." If a generator has a marginal operating cost (e.g., it pays for fuel), it should bid into the power pool at its marginal operating cost or higher and therefore not be in merit at $0/MWh. There is no reason for a truly dispatchable facility to operate below its marginal operating cost and certainly not at $0/MWh.

If a facility with a greater than $0/MWh marginal operating cost is bidding at $0/MWh, then it must have an operating reason not to be dispatched down. In that case, the facility is not truly dispatchable. It's lack of flexibility is not contributing to the grid in a high-variable-renewables scenario that is now inevitable because of the unequaled low energy costs of those renewables. LEI says that although there are more $0/MWh in the future decarbonization scenarios, the *average* market price is rising. If a particular thermal generation asset cannot increase its revenues by capturing the *rising* average market price, then it clearly has operating restrictions that render it inadequate for the energy market. There is no reason to favour these generation types, particularly when there are new generation options available that are truly dispatchable and flexible and offer grid services that these inflexible thermal generators do not.

This leads to the second error: the analysis of uneconomic dispatchable generation under the market dynamics of high penetration of low-cost renewables assumes that the dispatchable generation is thermal. By contrast, other forms of dispatchable generation, particularly energy storage, see improved economics when the spread between low- and high-price hours increases. In other words, $0/MWh moments create additional arbitrage opportunity for energy storage.

Moreover, unlike some thermal generation (particularly those that inexplicably "run at a loss"), storage is not only easily and instantly dispatched down during $0/MWh moments, but it additionally improves system performance and mitigates volatility by absorbing excess supply in these same moments. In that sense, it has stronger and more valuable "dispatchability" and "flexibility" than thermal generation. The implied presumption that thermal generation is especially and uniquely needed — in contrast with other dispatchable options — is flawed, arising from the modelling bias against storage (discussed further in the next section).

Similarly, the Longview report has summarized stakeholder assertions that the existing market framework affords inadequate revenue certainty for dispatchable supply. There is no regulatory impediment to any form of dispatchable supply securing an offtake agreement of the sort that LEI claims renders renewable energy development "independent of market signals" (see above). Thermal generation has secured this type

of offtake agreement in the past. The existing energy market gives buyers an incentive to shape the energy supply in their offtake agreements, to offer a more valuable hedge against energy price uncertainty. For that reason, there are recent examples of storage facilities under development (both pumped hydro and battery energy storage) securing offtake agreements. There is no reason that other forms of dispatchable supply, including thermal generation, could not also secure offtake agreements, except that the free market may be selecting against their emissions, in which case, there may be an opportunity for thermal generation with emissions abatement.

The market should be allowed to work to select the highest-value generation at the lowest-cost. The fact that the economics of some thermal generation is challenged by high variable renewables penetration is not a failure of the market; rather, it is an efficient market outcome.

As such, the fact that some thermal generation cannot survive low market prices does not support LEI's conclusion that the market will attract "fewer dispatchable generators creat[ing] more supply adequacy concerns." Of course, for the market to function properly and select for the better dispatchable supply that is available, there must not be policy impediments to that alternative supply. That leads into the next key issue identified within the LEI report, covered in the next section.

Reliability in Alberta will require storage and better system forecasting

To the extent that reliability challenges are surfacing under the existing market framework, these have arisen as a result of two key failings of Alberta's electricity policy regime that are not inherent to the energy-only market framework. If these errors are not resolved, their deleterious outcomes for system reliability will only worsen as we transition to lower-cost renewable energy generation. In particular:

1. existing policy has failed to remove long-identified barriers to energy storage, despite the fact that it has clearly emerged as an essential technology for system reliability, meaning that the AESO and LEI analyses fail to employ storage appropriately to deal with system challenges; and
2. the AESO has repeatedly under-estimated the growth of new technologies, undermining the forward outlook necessary to enable planning and measured responses to emerging challenges.

As a result, both in the analysis and in reality, the energy-only market is not permitted to function as intended in order to maintain supply adequacy by attracting the new supply that is actually needed.

Assuming minimal energy storage growth because of current policy barriers prevents the market from working effectively

Despite the merits of storage for system reliability articulated in the last section, the growth assumed for storage in the LEI analysis, pulled from the AESO's current preliminary long-term outlook (LTO), were notably low. Both 2035 and 2050 decarbonization scenarios in the preliminary LTO forecast storage plateauing at 597 MW by 2027, with no additional growth thereafter, even as variable renewable energy continues to grow. By contrast, there are 140 MW already under construction, adding to the 190 MW already operating for a total of 330 MW already operating by early 2025. There are another 398 MW with regulatory approval, all with in-service dates by mid-2026, reaching 728 MW. Nearly 7,000 additional MWs have been announced in some stage of development, pre-approval.

There are likely two main reasons for the weak storage growth. First, the analyses assumed current policy, which unfairly impedes storage. Despite the AESO identifying the need to remove barriers to storage, including through tariff amendments, in its 2019 Storage Roadmap,[9] no legislative, regulatory, or tariff changes have actually been implemented. The AESO has attempted to pursue tariff reform over the last three years, but so far unsuccessfully, though it recently announced it would pursue relatively weak and compromising amendments through the AUC this year. Meanwhile, the government's attempt to define storage in legislation and enable its role as non-wires alternatives — first approved by cabinet over two years ago in advance of the introduction of Bill 86 in the fall of 2021 — eventually passed as Bill 22 in the spring of 2022. But it remains unproclaimed (not in effect) at this time and lacks the regulatory changes necessary to enable storage's role as non-wires alternative.

The result is that storage is not yet able, at the time of the preliminary LTO or the LEI analysis, to act as non-wires alternative or to revenue stack across the several services it provides. It is also tagged with an unfair transmission tariff that effectively treats it as any other load, despite that it does not cause new transmission needs like load — rather, it mitigates transmission need by acting as load precisely when system load is low and acting as supply when load is high. As such, the analyses have assumed that these barriers remain for storage, preventing it from offering an economic solution to supply adequacy challenges, and leaving the system more reliant on thermal generation that LEI concludes is uneconomic under future scenarios.[10]

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[9] AESO, *AESO Energy Storage Roadmap*, August 2019, 16.

[10] The unfair treatment of storage is exacerbated by the LEI analysis's equating "reliability" with "supply adequacy", because whereas thermal generation can aide supply adequacy, storage is able to support a wider breadth of reliability parameters.

Assuming that the energy-only market framework will not evolve over time to achieve objectives of affordability and reliability does not mean that the energy-only market cannot achieve electricity system objectives. The only conclusion that can be drawn is that regulatory, rule and policy changes may be required to enable the energy-only market to function properly. The removal of unfair barriers against storage are some of those "continuous improvement" policy and design changes that are necessary to allow the energy-only market to work.

The second likely reason for forecasting such weak storage growth relative to the demonstrable private sector interest in storage development is the reliance on hindsight for storage's economics. As discussed in the next section, the AESO has, in the past, underestimated the growth of emerging technologies, and this is currently applicable to their storage forecast.

Flawed forecasting has delayed needed policy and market improvements

There is a demonstrable directional bias in the AESO's forecasting that underestimates the growth of emerging technologies. This has been seen consistently with wind and solar in the last several LTOs. For example, the 2021 LTO forecast less new solar capacity development by 2041 than was announced in a single private-sector offtake agreement by the time the LTO was released. Unsurprisingly, the 20-year solar forecast was surpassed in less than two years. Recognizing that it was inaccurate did not require the benefit of hindsight: a number of stakeholders immediately pointed out the discrepancy when the LTO was presented. The factors that would drive much faster growth were knowable at the time the LTO was prepared and released.

The directional bias against new generation types likely has a number of causes, but three have been apparent. First, the forecast does not foresee the rapid cost declines that are common as deployment accelerates, known as Wright's Law. This can be repaired by observing deployment acceleration globally, because technology prices follow a global market. This would have made the trends for solar apparent and the same can now be said about storage.

Second, the AESO has commonly applied a relatively high weighted average cost of capital (WACC) to new generation supply investments. This particularly overestimates the costs of capital-intensive generation types, where the total costs are disproportionately upfront capital, like renewable energy and storage. The overestimation of WACC likely results from a relatively pessimistic view of merchant risk for investors in new supply, leading to low debt-to-equity ratios and higher equity return expectations. In reality, the availability of offtake agreements — available to all generation types, though the private-sector seems to prefer low-cost renewables and storage, at the moment, as described in prior sections — mitigate merchant risk and enable much

higher debt-to-equity ratios and lower equity return expectations. The combined effect is for the AESO's analysis to over-estimate the costs of capital-intensive technologies that have access to offtake agreements.

Finally, third, and related to the previous two, the LTO bases assumptions on what has been seen empirically. Understandably, owing to their risk-averse and conservative approach that arises from their mandate, the AESO prefers to forecast on the basis of what is familiar and what it has already seen. But this has the effect of skewing forecasting against new technologies, particularly those with novel operating approaches, like storage.

The relevance of this, currently, is that it leads to the underestimation of the prospects for storage to support reliability. This undermines the supply adequacy analysis, because that analysis, then, focuses on the revenue certainty challenges for thermal generation whose economics do not pair well with low-cost renewables, as explained in the prior section. The maintenance of supply adequacy in Alberta's energy-only market relies on a paradigm shift that recognizes that energy storage will be competitive in the existing market framework (though requiring the dismantling of policy and design barriers). Excluding storage exacerbates the reliability outcomes in the analysis.

Unfortunately, this also exacerbates a vicious cycle: with pessimistic forecasting for storage, there is weaker urgency for resolving policy barriers to storage. By acting slowly to resolve these unfair barriers, as summarized in the prior section, storage growth is stifled. To complete the cycle, this exacerbates weak forecasted growth.

The negative impacts go beyond stifling an important technology, like storage. It also means that system planning fails to build the necessary infrastructure to accommodate more realistic growth of new technologies; and the system operator finds itself behind the eight-ball when unanticipated reliability challenges emerge from a profoundly different generation mix than had been forecast. For instance, there are readily available technology solutions to support voltage and frequency management, but these were not implemented in a timely fashion, which has created recent localized reliability concerns.

Renewable energy is forecastable, more diverse than assumed, and more resilient against climate change

A number of comments in the LEI report suggest a misunderstanding of the predictability of renewable energy production, the temporal spread in production achievable through geographic diversity, and the resilience of renewable energy against climate change.

It bears mentioning that weather forecasting is able to predict both wind and solar energy production with a good amount of forewarning and accuracy, sufficient to enable ramping up of other generation sources. AESO reports that their short term forecasts for wind and solar availability — used to manage load variability — have continuously improved and now have an error of under 4%.[11] Moreover, although the LEI analysis assumes wind generation profiles on the basis of historical data, the wind fleet will continue to diversify as it grows in different regions of the province. As such, there will be far fewer very low wind energy moments under future wind energy growth scenarios.

Finally, suggestions that reliability will be aggravated by the impacts of climate change on renewable energy are incorrect. Reliance on unabated thermal generation is a greater risk because of the growing climate policy stringency that will render it more costly and restricted. Moreover, while it is difficult to compare the impacts of extreme weather on different generation types, thermal generation is far from immune to worsening climate impacts. As noted above, thermal generation is typically derated in extreme heat and can also be susceptible to extreme cold impacts.

[11] AESO, *Annual Market Statistics 2022*, 46. https://www.aeso.ca/assets/Uploads/market-and-system-reporting/2022_Annual_Market_Stats_Final.pdf

Market improvements to ensure reliability

As explained in the Introduction, BRC-Canada's position is not that the energy-only market should be retained statically in its current design. To the contrary: continuous improvement in market design details are necessary to maintain the sustainability of the overall market framework over the long run. The problem with the AESO LTO and LEI analysis is the assumption that these improvements aren't made.

To support the maintenance of investor confidence through re-commitment to the existing energy-only market, and the market framework's effectiveness at realizing electricity system outcomes, BRC-Canada recommends the following improvements:

1. Policy and tariff changes to enable storage and treat storage fairly, including proclamation of Bill 22, as described above;
2. Improved forecasting and planning to inform policy evolution and enable timely implementation of initiatives and technologies that can resolve system and reliability challenges that could be anticipated with proper forecasting;
3. Market enhancements, such as growing ancillary services and targeted local storage procurements, to support reliability within the energy-only market framework; and
4. Policy reforms to enable demand-side management — according to the LEI analysis, a relatively small amount of additional storage and economic demand-side management opportunities could resolve the modelled supply adequacy challenges.

With these reforms in place, the energy-only market can continue to provide the most cost-effective means of enabling investment in the new generation supply necessary to maintain supply adequacy. This will include accommodating the offtake agreements that are available to all suppliers, but allow the market to select for the private sector's preferred supply options, including a mix of lowest-cost energy (wind and solar) and dispatchable generation.

As demonstrated in our fact sheet, *Designing Programs for Corporate Renewables Procurement*,[12] jurisdictions with emitting grids across North America are undertaking significant initiatives to open their electricity systems to corporate renewables

[12] https://businessrenewables.ca/resource/fact-sheet-designing-programs-corporate-renewables-procurement

procurement. Those that moved first realized the strongest and earliest benefits, but followers realized that the tide of ESG expectations is inevitable. For Alberta to take a drastic market framework overhaul that restricts these opportunities would mean swimming against the stream flowing across the continent, while also undermining investor expectations in a way that would chill new investment under any market framework. Reducing investor confidence to deploy private capital in Alberta's electricity system — and beyond — is the surest way to make reliability, affordability and decarbonization unattainable for Alberta.