Feedback Form

Pathways to Decarbonization – February 24, 2022

Feedback Provided by:

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Following the February 24 engagement webinar, the Independent Electricity System Operator (IESO) is seeking feedback from stakeholders on the items discussed during the webinar. The webinar presentation and recording can be accessed from the engagement web page.

Please submit feedback to engagement@ieso.ca by **March 16**. Please attach research studies or other materials for consideration by the IESO to support your submission.

If you wish to provide confidential feedback, please submit as a separate document, marked "Confidential". Otherwise, to promote transparency, feedback that is not marked "Confidential" will be posted on the engagement webpage.

Policy

Topic	Feedback
Are the assumptions indicated reasonable and comprehensive in terms of scale and timing?	• Capital Power understands that the IESO has (i) used existing policy as the basis for its assumptions in the Moratorium scenario (ii) exercised from judgment with respect to policy assumptions used the Pathways scenario, and (iii) that neither scenario is intended to be the basis for an integrated resource plan. Accordingly, it will be critically important for stakeholders, the IESO, and policy makers to understand the assumptions underpinning the IESO's analysis. Capital Power recommends the IESO determine whether the NREL technology-specific assumptions apply to the Ontario context. As the IESO has noted in the LTRFP engagement, Ontario has a unique development environment and expected resource costs should therefore incorporate jurisdiction-specific resource costs. • Policy assumptions not directly supported by existing government policy or legislation should be explicitly identified. Where the IESO has exercised judgment in selecting policy assumptions, could the IESO provide brief but explicit reasons supporting its assumptions with respect to policy? • It is not apparent from the materials what specific policy is being assumed with respect to CCUS and offshore wind. Policy assumptions should be explicit and informed by both federal and provincial policy announcements, such as the Ontario Ministry of Energy's recent consultations on Geologic Carbon Storage, and the federal government's recently released discussion paper on a Clean Energy Standard in Canada's electricity sector. To the extent that assumptions include or exclude the costs of additional infrastructure required to support their adoption, these assumptions should be made clear in the IESO's analysis. (E.g., increased transmission investment, hydrogen production and transport, carbon sequestration and transport.) • If a carbon border adjustment is not assumed, the IESO's model should reflect expectations that imports and wheel-throughs from other jurisdictions come from carbon-intensive sources. Absent a carbon border adjustment, imports should be assigned an intensity factor derived

Topic	Feedback
	from the North American supply mix. This will ensure a more accurate reflection of the carbon intensity of Ontario's electricity supply when relying on imports and mitigates against the risk of resource shuffling. (I.e., exporting low carbon electricity while importing the same amount from a carbon-intensive resource/supply mix, resulting in no net decrease to carbon emissions.)

Topic	**Feedback**
Are there other considerations for the IESO?	• Relevant policies with respect to land use and permitting impacting the development of transmission lines and generation should be identified and used to inform the IESO's analysis to the extent feasible. If infeasible, then the exclusion of these policies from assumptions should be explicitly noted. • Significant investments in transmission will be required to support the addition of renewable energy resources. The costs and feasibility of developing requisite transmission infrastructure, must be included in both the Moratorium and Pathways scenarios as sufficient investment in transmission will be required to ensure reliability, and these costs will materially impact the delivered cost of energy. Risks of delays in transmission construction must be considered in the development timelines for resources relying on new transmission to support delivery of electricity to the end user.

Demand

Topic	Feedback
Are the assumptions indicated reasonable and comprehensive in terms of scale and timing?	• Absent reasons supporting the use of distinct demand scenarios, the same demand forecast should be used for the Moratorium and Pathways Modelling. If the IESO uses distinct demand forecasts for each model, reasons supporting this decision should be made explicit in the analysis. This will help stakeholders and government to understand the impacts of direct changes to demand forecasts, and the indirect impacts of policy and macroeconomic conditions that impacting demand forecasts under each scenario. Similarly, absent reasons supporting the use of distinct Conservation Program assumptions, the same should be used for each scenario.

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Are there other considerations for the IESO?	• The IESO is being asked to consider an increasing number of internal and external factors expected to impact demand, transmission planning, and supply costs. It may be helpful for the IESO to establish dedicated working groups or working sessions for the purpose of defining supply costs and demand forecasts with greater precision.

Resources

Topic	Feedback
Are the assumptions indicated reasonable and comprehensive in terms of scale and timing?	• Capacity factors of renewable resources need to consider Ontario-specific capacity factors for both wind and solar technologies. It appears NREL's capacity factors are more than those supported by Ontario's experience, even if it's assumed that technology will improve over time. • NREL has not identified the variable operating and maintenance ("VOM") costs associated with battery storage. It's Capital Power's understanding that battery storage incurs VOM costs, but that these are often embedded in OEM long term service agreements. The VOM costs of battery storage must be derived from vendor-specific service agreements and used in the IESO's modeling. Failing to do so risks skewing both CAPEX and OPEX numbers, misrepresenting operating costs and capabilities of certain storage technologies. • Could the IESO please provide detailed forecasts underpinning its assumptions regarding firm imports? • Costs for each technology will need to assume macroeconomic conditions and input resource costs (e.g., fuel type, steel, and raw materials) as well as relevant levies and tariffs. • Details of costs developed "In House" for hydro must be made public and include data commensurate with the detail provided by NREL. If there is a distinction in costs between small-scale and large-scale hydro, this should further be identified. Particularly important to assessing the all-in costs of developing hydro resources will be understanding the costs of transmission required to transfer electricity from existing and immovable hydro resources to load. This point has been made in comments above, but the costs of increasing investment in transmission to support both scenarios

Resources

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	must be identified as part of the analysis. Capital Power notes that the realized costs of three projects recently developed in Canada (Muskrat Falls (824 MW), Keeyask (695 MW), and Site C (1,098 MW) are estimated to cost $32.1 B for a total of 2,617 MW, avg. $12,265/kW-installed). Capital Power does not foresee costs for large hydro projects materially changing over time. To the extent possible, forecasted water levels and environmental/flood restrictions should also be considered over the study period. If not feasible to include this information in analysis, this should be noted. • Capital Power understands that SMR R&D costs are recovered through rates, and deployment as soon as 2028 has been announced. Accordingly, it's reasonable to assume enough information exists currently to develop baseline expectations for SMR CAPEX and OPEX and the IESO should undertake to do so. Assuming $0 cost for SMRs will materially and unnecessarily distort the IESO's analysis under both scenarios. • Advancements in solar technology that permit dual axis tracking should be modelled and paired with storage solutions to accurately represent the capability of renewable technologies to load-follow and supplement the generation profile of rooftop solar resources.

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Are there additional data sources that we should consider	• Third party sources should be used to confirm and support assumptions used by NREL. If not available or not used, this should be noted. • Financing costs will be impacted by Ontario's market design. Capital Power notes the significant efforts the IESO has undertaken to address investor concerns with respect to revenue

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	mechanisms, but the availability and structure of contracts continues to be discussed with stakeholders. To the extent that market structure in Ontario will impact NREL assumptions with respect to financing costs, adjustments will need to be made to reflect Ontario's investment environment.
Are there other considerations for the IESO?	• Sensitivity analysis should be performed to understand the impact of changes to input prices for raw materials, fuel, capital, as well as the impacts of supply chain constraints and impacts of trade and tariff restrictions. If no assumptions are made with respect to these inputs, or no sensitivity analysis performed, then the IESO's analysis should xplicitly identify assumptions informing its approach.

General Comments/Feedback

As a committed developer of wind, solar, and efficient natural gas-fired generation (with CCUS), we believe that the net-zero carbon supply mix of the future will require the integration of a suite of technologies. This view is consistent with the approach taken in the discussion paper recently released by Environment and Climate Change Canada ("ECCC").[1] In its paper, *A Clean Electricity Standard in support of a net-zero electricity sector*, ECCC has noted that the definition of Net-Zero Electricity contemplates some low-emitting generation facilities may continue to operate past 2035, though emissions from these facilities will need to be balanced by removals in - or attributed to - the electricity sector. Natural gas-fired generation with CCUS is identified as one example of low-emitting generation that will play a role in supporting the energy transition while helping limit impact to ratepayers.

Capital Power believes that by evaluating technologies based on the full suite of benefits they bring (e.g., reliability, operability, affordability, sustainability) and preserving a technology-neutral stance with respect to the supply mix, the IESO can advance Ontario's interests in further decarbonization and electrification while not risking distortion to investment signals. Material advancements are being made with respect to what is currently natural gas-fired generation, and the critical value natural gas-fired generation brings to the grid is expected to be enhanced as CCS, CCUS, and hydrogen technologies move towards commercialization. Investment in technologies like CCUS, hydrogen blending, and Direct Air Capture (DAC) today, will reduce the cost of longer-term technologies such as hydrogen

[1] A clean electricity standard in support of a net-zero electricity sector: discussion paper - Canada.ca

(distributed in a dedicated network) that may play a greater role over decarbonizing the sector and the economy over the medium to long term. At the same time these technologies will help ensure a reliable, affordable, and sustainable electricity supply. Capital Power commends the IESO on its efforts to undertake this analysis and looks forward to participating in subsequent stakeholder sessions.