March 16, 2022

IESO
Independent Energy System Operator
Email: engagement@ieso.ca

Re: Pathways to Decarbonization

To whom it may concern,

Morgan Solar Inc appreciates the opportunity to provide feedback on the preliminary Pathways to Decarbonization assumptions in this submission after attending the IESO's February 24, 2022 engagement webinar.

Morgan Solar supports energy policy and grid decarbonization that:

- Phases-out GHG-emitting energy sources as rapidly as possible
- Prioritize renewable energy over more polluting sources
- Incentivize energy conservation and energy efficiency, especially demand response
- Recognizes the degree of technological advancement and cost improvement in clean energy and energy storage

Renewable energy, especially photovoltaics, coupled with a variety of energy storage technologies (batteries, pumped hydro, compressed air, thermal energy) has already crossed the threshold to be the most economical energy generation option in the world; far more cost effective than nuclear or fossil fuel options. Future planning needs to take into account the real state of low costs today[1,2] coupled with a view on the degree of further cost reductions that should be assumed based on past learning curve trends.

Morgan Solar also supports the recommendations in Ontario Clean Air Alliance's report 'Getting Ontario to a Zero-Carbon Electricity Grid by 2030'[3] and the calls by 32 Ontario municipalities (representing 60% of Ontario's population) to completely phase out gas-fired electricity generation[4].

The imperative for global decarbonization is upon us and if Ontario is an early mover this will create unique opportunities for technologies companies like Morgan Solar, as well as other renewable energy component and system companies that have developed around Ontario. If Ontario is an early mover in overall system decarbonization including decarbonization of building heating then the solutions that will be developed here will be exported to other jurisdictions when the rest of the world catches up with us

If Ontario moves last, we will pay to buy solutions from elsewhere while wasting resources on fuels as we continue to emit.

Sincerely,

Morgan Solar Inc.
John Paul Morgan
President & Chief Technology Officer

Policy

Topic	Feedback
Are the assumptions indicated reasonable and comprehensive in terms of scale and timing?	We encourage adopting an accelerated gas generation phase-out date, by 2030 instead of 2035. Further, the assumption under pathways to 'Evaluate policy opportunities to enable net zero emissions by 2050 or earlier timeframe' should be "as soon as possible", not "by 2050".
Are there other considerations for the IESO?	The City of Toronto's Net Zero Strategy technical model[5] revealed that taking early action now saves money in the long run; the net present value of the Net Zero by 2040 Scenario is $135 million less than that of the Net Zero by 2050 Scenario[6], a difference of 1%. "In other words, achieving net zero by 2040 ends up costing less than achieving net zero by 2050." What savings exist from switching off fossil fuels, and what cost or price risks do we take on by staying on fossil fuels.

Demand

Topic	Feedback
Are the assumptions indicated reasonable and comprehensive in terms of scale and timing?	Demand response will need to be deployed more frequently; it is unclear on why there is such a low limit on the number of annual applications.
Are there other considerations for the IESO?	Heat pumps are a major component of decarbonizing buildings; however , many models that will be employed in Ontario rely on resistive heating backups when operating at the lowest ends of their temperature range. This will mean as temperatures drop there will be a moment when simultaneously a lot of heat pumps have their energy use increase by a factor 4 as they transition to resistive heating; demand response is needed.

Resources

Topic	Feedback
Are the assumptions indicated reasonable and comprehensive in terms of scale and timing?	There should be no cap on the price of energy efficiency purchased by the IESO. The cost of nuclear power, including small modular nuclear reactors (SMR), appears to be unrealistically low given historical experience. It is a very big stretch to claim SMR is also at a TRL 6 level now. Its use in modeling is inconsistent with the statements by the IESO that only completely mature technologies should be considered.
Are there additional data sources that we should consider	The First in Service date proposed for SMR in the Potential Resource Options on Page 6 of the Pathways document is 2032. By that time, we might also have space based solar power arrays beaming down wireless solar energy 24 hours a day. We propose that you treat space based solar as science fiction, as well as SMR reactors until they are commercially proven. With wind, water, and solar we have enough existing proven resources[7,8] to get the job done without needing to even look at concepts like SMR or space based solar power.

Are there other considerations for the IESO?	We echo the recommendations made by Ontario Clean Air Alliance (OCAA), the decarbonization study should also analyze costs & benefits of: ● returning gas plants' GHG pollution back to 2017 levels as soon as possible ● 100% of the gas plants' GHG pollution is subject to the federal carbon tax ● IESO purchases all available energy efficiency, wind, solar energy resources available at prices below the price of purchasing nuclear ● IESO purchases all Distributed Energy Resources (DER) that costs less than nuclear electricity ● IESO maximizes its purchases of Quebec waterpower via existing transmission lines before it dispatches gas-fired generation ● future expansion of transmission capacity to Quebec ● the model should include the full potential of bi-directional EV chargers ● following the completion of the transition to 100% zero emissions energy generation by 2030, a small number of gas plants may be left on standby reserve so that they may provide emergency backup power, if needed in response to extreme conditions ● thermal storage technology, as is being incentivized for use alongside residential heat pumps in Nova Scotia and Quebec ● the study should not assume RNG or hydrogen are used for space and water heating, and should not assume new nuclear ● the outcomes of the study should be expressed in $/MWh, as opposed to as gross figures, which will make the cost savings of electrification more clear

Sources (links active as of March 16, 2022):

1. Lazard Levelized Cost of Storage v7 Report. https://www.lazard.com/media/451882/lazards-levelized-cost-of-storage-version-70-vf.pdf
2. Lazard Levelized Cost of Energy https://www.lazard.com/media/451905/lazards-levelized-cost-of-energy-version-150-vf.pdf

3. Ontario Clean Air Alliance, *Getting Ontario to a Zero-Carbon Electricity Grid by 2030*, 2022. https://www.cleanairalliance.org/wp-content/uploads/2022/03/Zero-Emissions-Report-2022-feb-25-v_02.pdf
4. "Ontario Municipalities that have endorsed gas power phase-out", Ontario Clean Air Alliance www.cleanairalliance.org/ontario-municipalities-that-have-endorsed-gas-power-phase-out
5. City of Toronto. *TransformTO Net Zero Framework Technical Report*, p104, Figure 52. Year-over-year investments and returns over the Do Nothing scenario, 2020 - 2050, 0x40 Scenario (Note: The Net Zero by 2040 Strategy (0x40 Scenario) was adopted by Toronto City Council December 15, 2021, www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173759.pdf
6. City of Toronto. *TransformTO Net Zero Framework Technical Report*, p17, 3. Taking early action now saves money in the long run www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-173759.pdf
7. Jacobson, M.Z., "Countries, States, Districts, Counties, Cities, Towns, and International Businesses That Have Reached or Committed to 100 Percent Renewable Energy in One or More Energy Sectors Plus Eight Proposed U.S. Laws/Resolutions to go to 100 Percent" *100% Clean, Renewable Energy and Storage for Everything,* Cambridge University Press, New York, 427 pp., 2020 web.stanford.edu/group/efmh/jacobson/WWSBook/WWSBook.html
8. Jacobson, M.Z., "Zero air pollution and zero carbon from all energy at low cost and without blackouts in variable weather throughout the U.S. with 100% wind-water-solar and storage", *Renewable Energy,* https://web.stanford.edu/group/efmh/jacobson/Articles/I/21-USStates-PDFs/21-USStatesPaper.pdf