Power Workers' Union Submission to the Integrated Energy Resource Plan Consultation
ERO 019-9285, December 13, 2024

The Power Workers' Union (PWU) applauds the government for initiating the development of an integrated resource planning approach and for pursuing the objectives of this consultation:

- *To guide the build-out of an affordable, reliable and clean energy system to meet the exceptional growth needs of Ontario;*
- *To consider a long-term view of energy use across the economy and all sources of energy;*
- *To keep our clean energy system affordable, reliable and abundant*.

To this end the government's overarching question in this consultation is: "*What policy options and actions should the government consider in the integrated energy resource plan to achieve Ontario's vision for meeting growing energy needs, keeping energy affordable and reliable, ensuring customer choice and positioning us to be an energy superpower?"*

The PWU 2021 submission to the Ministry of Energy Northern Development and Mines (MENDM) advanced several recommendations regarding the province's long term energy planning approach and the implementation criteria for the needed reforms to several key elements of Ontario's planning environment, including:

1. Ontario needs a transparent, accountable and effective long-term energy planning framework to develop reliable and affordable energy infrastructure.
2. Policy Priorities should establish goals and objectives for such areas as: total cost to ratepayers; emission reductions; job creation; GDP; energy security; and other government policy objectives such as roles for indigenous peoples.
3. Government should provide clear, transparent, non-prescriptive Policy Priorities than can be planned for and are sufficiently measurable to support accountability.
4. Procurements for low emission baseload should start [then].
5. Ontario should not be unnecessarily exposed to the risk of having inadequate electricity resources as it should not take the IESO four years to prepare a procurement process.
6. Specifying Ontario's demand needs—baseload and intermediate—is the solution that allows the province to act both early and prudently to satisfy its future energy requirements.

The PWU is pleased that the intent of many of these recommendations are reflected in the government's vision paper*: Ontario's Affordable Energy Future: The Pressing Case for More Power*. The PWU agrees with the Minister's key message that energy policy will determine the future success of Ontario. However, while the government's vision puts forth many objectives to address these issues, in the three and half years since the MENDM consultation, this ERO asks many of the same questions. The implementation details for achieving planning reform goals remain largely undefined and the requisite evolution of the governance model remains unactioned and stuck in the status quo. As a result, the PWU continues its support of the recommendations in its 2021 MENDM Submission (see Appendix 1) as well as in its 2023 submission to the Ministry on the IESO's Pathways to Decarbonization Report. In 2024, the PWU launched a series of papers to help advance public discussion of the growing reliability, affordability and deliverability risks (*see Appendices 2-5*). The appendices form part of this submission, providing much detail on implementation strategies for the recommendations.

The PWU offers the following comments on the priorities outlined in the vision paper:

- ***Planning for growth:*** Ontario needs an energy demand forecast that reflects the government's priority for abundant, clean, affordable and reliable energy that encompasses a range of transparently-developed, risk-informed, high, medium and low scenarios. This information is not currently included in the IESO's Annual Planning Outlook (APO).
- ***Affordable and reliable energy:*** There should be a clearly identifiable authority(ies) accountable for affordability of the overall energy system (electricity and gas). The sector requires careful consideration for incenting adoption of flexible fuel switching technologies that could contribute to emission reductions while lowering electricity infrastructure development costs by leveraging AI-enabled Behind the Meter (BTM) demand side management (DSM) through rate designs, not through electricity market mechanisms. The hyperbole in Ontario surrounding markets, customer choice and Distributed Energy Resources (DERs) requires a comprehensive, transparent, independent analysis to establish real economic benefits for Ontario.
- ***Becoming an energy superpower:*** To advance this initiative requires a good understanding of the demand growth in Ontario and that of its neighboring jurisdictions. Currently, with the conservative demand forecast in the IESO's APO which drives its procurement strategies, there is a high risk that the province will have insufficient generation to meet its own growing domestic needs let alone generating electricity for export. Two additional realities may block progress as an energy superpower: (1) Going forward, Ontario will be a growing importer of natural gas to ensure the reliable electricity Ontario's economy depends upon; and (2) most electricity exports over the next twenty years would be from new natural gas-fired generation.
- ***Environmental impact of the proposal:*** The current planning approach underestimates the magnitude of the electricity required to decarbonize the economy and creates the risk that demand will outpace supply and leave Ontario without the abundant clean energy the government seeks. Furthermore, Ontario is at risk of having an electricity system that is more emission-intensive than neighboring jurisdictions, losing the clean energy reputation currently so valued by the government and attractive to growing industrial investments.

To ensure that, in the Minister's words, "*Ontario does not fail due to a lack of ambition*", the PWU recommends five strategic imperatives:

1. Establish evidence-based, validated, and risk-informed energy demand forecast ranges required to enable effective and sustainable energy planning by all stakeholders for a reliable and affordable system;
2. Evolve the sector's governance to align accountabilities for achieving the vision's objectives as the transition progresses;
3. Develop and build new clean, baseload generation assets as quickly as prudently possible;
4. Nurture innovations to help smooth demand as close to load as possible; and,
5. Develop the lowest cost, most economically beneficial transition pathway to the reliable clean energy system required to meet Ontario's growth and electrification needs.

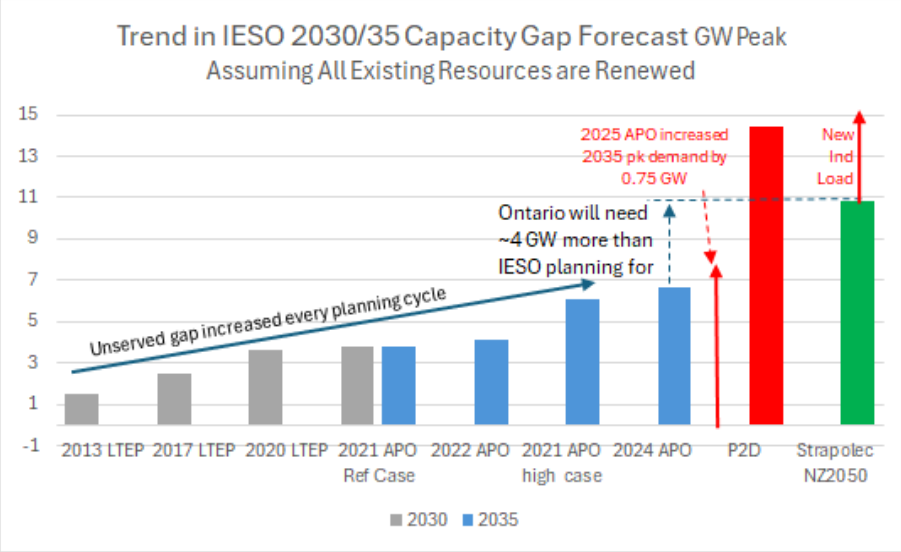
These recommendations respond to many of the EROs' questions as summarized in Table 1. This submission closes with a discussion of the emission implications of the current approach.

Table 1 - ERO Posed Questions	PWU Reference
Overarching Question	
• Policy options and actions for the integrated energy resource plan to achieve Ontario's vision	Rec #1,2,3,4,5
Planning for Growth	
• Based on the EETP's final report, what are priorities to enhance planning across natural gas, electricity and other fuels?	Rec #2
• Opportunities to enhance the province's approach to procuring electricity	Rec #3,4,5
• Greater access to electricity and accelerated grid-connections	Rec #4
• Ensuring transmitters' certainty to competitively progress development	Rec #1,3
• Policy guidance for OEB on long-term role of natural gas	Rec #1,2,4,5
• Supporting Indigenous leadership and participation	* N/C
• Enhancing provincial planning processes to better integrate municipal, distributor and regional planning processes?	Rec #2
• Interjurisdictional cooperation on energy trade, transmission infrastructure (ex. pipelines / interties), and transportation electrification	Intro comment, Rec #1
• Technical information and forecasts to best support stakeholders as the economy grows and increasingly electrifies	Rec #1,2,4
Affordable and Reliable Energy	
• Steps to enable households and businesses to manage and make informed decisions about their energy use	Rec #4
• Ensuring the electricity system supports customers who choose EVs	Rec #4
• Empower customers to generate or store energy on-site	Rec #4
• How to best leverage DER to enhance local and province wide grids to support energy system needs reliably and at the lowest cost?	Rec #2,4,5
• Policy or regulatory changes to address financial risks and DER adoption	Rec #4
• Barriers that limit new LDCs duties to enable more efficient grid operations, leverage new technologies and further integration of DERs?	Rec #4
• How to enhance collaboration between the OEB, the IESO, local distribution companies, industry stakeholders, and local communities to support investment and integration of DER?	Rec #2
• Maintaining an affordable energy system throughout the energy transition	Rec #2,5
Becoming an Energy Superpower	
• Opportunities to capitalize on nuclear technology/innovation leadership	Into comment, Rec #1,4
• Opportunities to leverage Ontario as a clean energy leader	
Environmental Impact of the Proposal	
Maintaining Ontario's clean energy advantage and using it to electrify the economy to reduce emissions in Ontario and potentially in neighbouring jurisdictions are key goals.	Emissions comment section
The approach to planning energy resources, impacts on land (e.g., impacts to farmland) and on local environments and ecosystems, such as watersheds.	* N/C
*N/C - No comment, PWU supports the objective in the vision paper	

Recommendation #1 - Establish evidence-based, validated, and risk-informed energy demand forecast ranges required to enable effective and sustainable energy planning by all stakeholders for a reliable and affordable system.

There is more significant growth in Ontario's electricity demand than is captured in the IESO's APO. This demand growth points to an increasing risk of an energy shortfall for the province. A stakeholder and policy maker endorsed provincial demand forecast provides a critical base for mobilizing and involving stakeholders to meet Ontario's needs. Unfortunately, the conservative approach to demand forecasting adopted for the APO lacks transparency and does not align with the time it takes to develop non-emitting resources infrastructure, especially at the scale required.

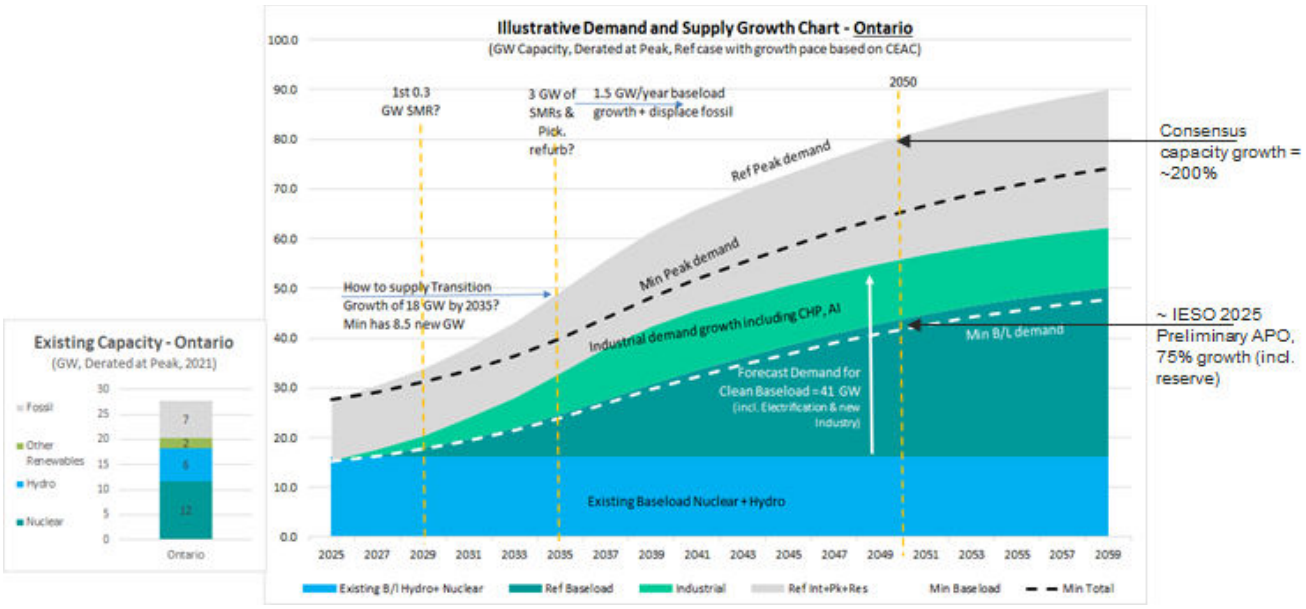
The lack of transparency makes the forecasts virtually opaque to stakeholders, inhibiting the exploration of independent innovations. The conservative approach and misalignment with development timelines has resulted in the ever-increasing system reliability capacity gap previously described by the PWU.[1] Most importantly, the capacity gap worsens with the most recent 2025 APO forecast, as illustrated in the figure below.



Given the long lead times required to develop new infrastructure, the growing unaddressed capacity gaps represent significant risks for brownouts and blackouts during the next 10 years.

A consensus of third-party demand forecasts for Ontario shows that the province should be developing three times as much new capacity as currently suggested in the IESO's 2025 APO forecast as shown in the figure below. Even a minimum case demand forecast suggests a need to double the APO's 's identified capacity growth.

[1] PWU Discussion Paper # 1, Ontario Needs Better Planning to Avoid an Electricity System Crisis, March 2024.



This portrayal provides insight into how much demand is baseload in nature (24x7, 365 days/year) vs intermediate/peak/ reserve needs that can vary daily, weekly and seasonally. The need to specify procurement requirements in terms of baseload and intermediate supplies has been consistently recommended to the IESO as necessary to ensure technology agnostic objective procurements.[2] Chart reflects de-rated at peak capacities of the potential supply mix. Industrial demand approximately consistent with the IESO 2025 APO forecast. Electrification energy demand reflects consensus 3rd party forecast cited by the CEAC. The reference and minimum capacity cases reflect significant efficiency and DSM optimization strategies. A high demand case (not shown) could add 15-25% for hard to decarbonize sectors.[3]

The PWU has consistently recommended that the IESO include a risk-informed high demand case scenario in its Outlooks to share with stakeholders.[4] It is notable that Toronto Hydro included such a risk informed demand forecast in its recently approved rate application that suggests the demand in Toronto could be three times as high as the IESO assumes in its 2025 APO forecast. Absent ongoing transparent consideration of a high demand case, the forecast resource adequacy capacity gap risks will continue to worsen with subsequent APOs.

Developing consensus on the magnitude of demand is critical as it impacts the development planning for electricity system infrastructure. Currently, bulk system plans for new transmission are all under sizing the required capacity.

As such, the PWU applauds the government's vision paper priorities for integrated planning that: electricity forecasts must consider scenarios that reflect high growth, driven by population and GDP growth, accelerated electrification and evolving technological trends; and, coordinated system planning is informed by evidence-based forecasts that take the pace of electrification into account. These priorities are urgently required to help Ontario face the immense development challenge of achieving a reliable, affordable and sustainable energy system.

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[2] PWU submission to the MENDM, 2021; PWU Discussion Paper # 2, Mitigating Ontario's Electricity System Reliability Risks Requires A New Planning Approach, May 2024.
[3] Scale to high case from Strategic Policy Economics, Electrification Pathways for Ontario, 2021.
[4] Strategic Policy Economics, Electricity Markets in Ontario, 2020; PWU submissions to the IESO on its APO, AAR, and Resource Adequacy from 2019-2023; PWU submission to the MENDM, 2021.

Recommendation #2 - Evolve the sector's governance to align accountabilities for achieving the vision's objectives as the transition progresses.

The PWU supports Ontario's commitment to its energy vision: regular integrated energy resource planning with enhanced agency roles; and, strengthened linkages to local, regional and inter-jurisdictional planning processes. These are common themes in previous PWU consultation submissions over the last three years.[5]

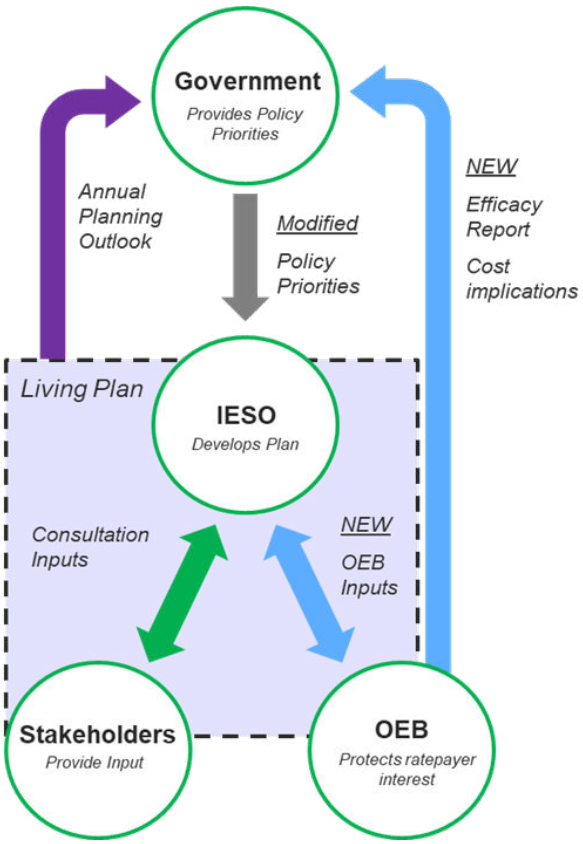
With respect to agency roles, the PWU MENDM submission outlined several innovations in roles and responsibilities for the government, the OEB and the IESO. The PWU's submission was intended to identify solutions that would help mitigate several recognized risks that could impact government objectives:

- Pressure to address climate change
- The complex energy transition
- Electricity supply reliability
- Higher costs to ratepayers
- Emerging fiscal constraints

These concerns were echoed in the submission for the Green Ribbon Panel (GRP).[6]

The recommended governance modifications were based on a detailed analysis of the gaps in accountability within the electricity sector as outlined in the PWU MENDM submission. A critical issue involves the overall system cost – who in the sector has the accountability for the cost implications of system level planning, procurement and operations?

Figure 1: Roles in an Updated Planning Framework



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

The vision paper identifies the "*need for independent, external advice into the energy planning framework, including advice on the integration of energy planning with other government objectives, such as housing and economic development*".

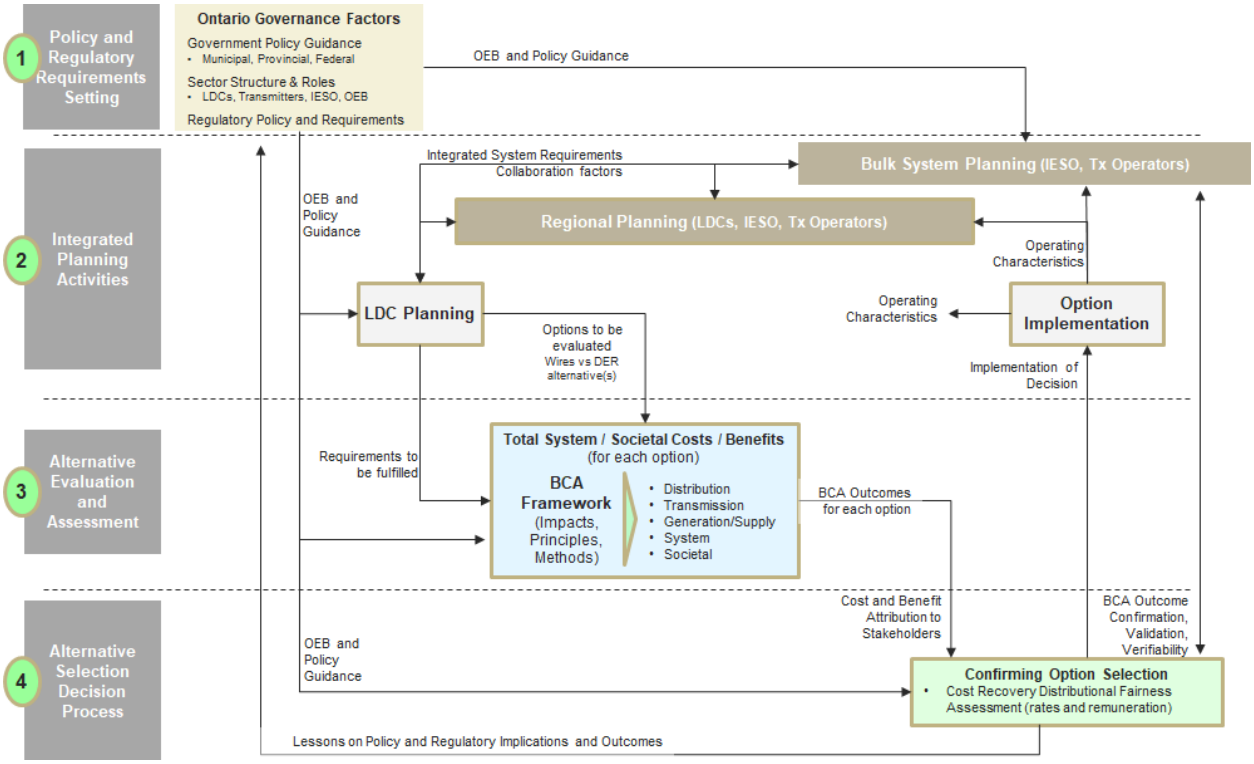
The process identified in the above figure for an OEB assessment of IESO planning efficacy would ensure transparency in the derivation of the demand forecasts, compliance to the policy priorities and the cost effectiveness of any resource adequacy outcomes. It would provide an accountability

[5] PWU submission to the MENDM, 2021; PWU submission to the OEB, Considerations for Developing a DER BCA Framework, Jan 2023.
[6] Green Ribbon Panel (GRP) Submission for the Ministry of Energy, Northern Development and Mines review of Ontario's long-term energy planning framework, 2021.

mechanism of total system costs that emerge from planning decisions. The more encompassing the policy priorities, e.g., total system cost to ratepayers; socio-economic benefits such as, emission reductions, job creation, GDP, and energy security, the greater will be the impact of such an accountability mechanism. This is imperative given the foundational role Ontario's energy system plays at the heart of the economy.

With respect to strengthening linkages to local, regional and inter-jurisdictional planning processes, the PWU recommended a significant reform to the regional planning processes, anchored on the OEB Framework for Energy Innovation Benefit-Cost Analysis (BCA) initiative.[7]

This process is illustrated in the figure below that shows how OEB processes for using full system and socioeconomic BCAs can improve transparency and outcomes across the integrated regional planning and decision-making spectrum.



Such an integrated process will necessarily accelerate and align planning and implementation efforts across all levels, forcing greater synergies and parallel activities and reducing inefficiencies within the current misaligned linear processes of the IESO's legacy practices. The Ministry is encouraged to review the implementation recommendations contained in the PWU submission (see Appendix 7).

[7] PWU submission to the OEB, Considerations for Developing a DER BCA Framework, Jan 2023.

Recommendation #3 - *Develop and build new clean baseload generation assets as quickly as prudently possible*.

The government is taking affirmative action to accelerate the development of the baseload supplies Ontario urgently needs, but supply gap risks remain.

The PWU supports the government's commitment to invest in Ontario's nuclear advantage and applauds the government's recent direction to explore the viability of developing new nuclear assets at OPG's owned Wesleyville, Nanticoke, and Lambton sites, recognizing their legacy energy and transmission infrastructure advantages.

As noted earlier, even as a transparent and fully considered energy demand forecast is yet to be prepared, Ontario should advance the development of more than 40 GW of clean new baseload supply. That is more than double the capacity need implied in the IESO's P2D and current APO,[8] – and triple what could be commissioned at the sites identified above. This capacity will be needed to support the transition to a clean economy and minimize the use of natural gas-fired generation after 2050, even if that demand forecast materializes more slowly.

The PWU supports the government's intervention in this pursuit of needed baseload capacity, as the IESO's current resource adequacy framework is incapable of procuring the most economically beneficial bulk system infrastructure for the province. The resource adequacy initiatives are focused on markets and short timelines and lack procurement criteria that support the priorities of the government's vision. This focus would need to radically change to enable the IESO to successfully navigate Ontario through the energy transition. These issues are more fully explained in the PWU's discussion papers on affordability.[9]

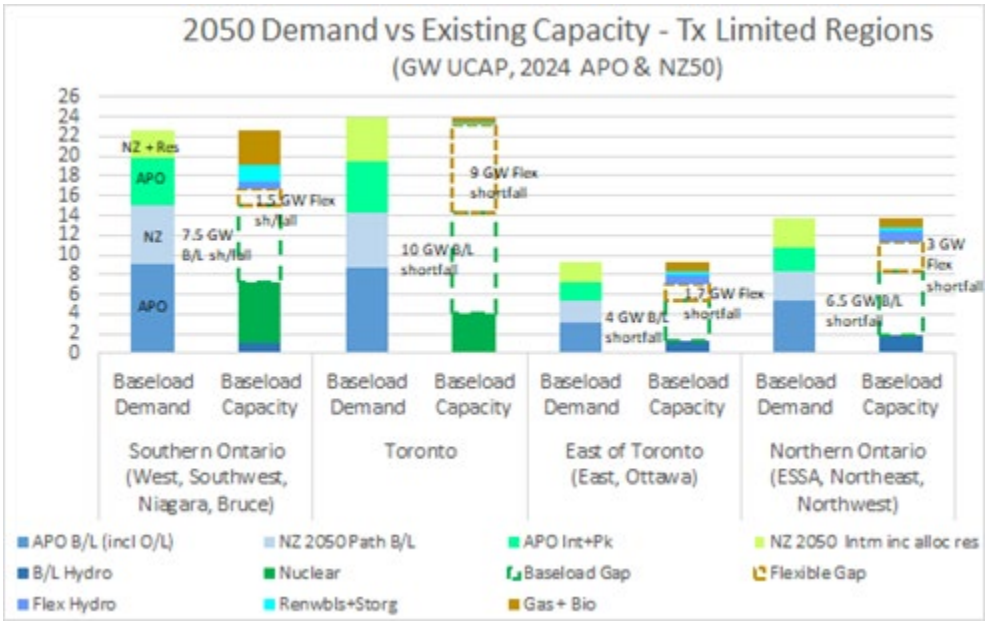
The PWU recommends that the government consider not only supplying the GTA and Southwestern Ontario with new clean baseload power from the sites identified above, but also regions in Eastern and Northern Ontario where baseload capacity shortfalls of over 10 GW are forecast to emerge in the next 20 years. The figure below summarizes the implications for Ontario's regions and a fuller discussion can be found in the PWU discussion paper.[10]

In addition to the government's announced assessments for the OPG-owned Wesleyville, Nanticoke and Lambton brownfield energy sites, the PWU encourages the government to explore other potential sites in the North and East. These could include such examples as the former OPG-owned Thunder Bay property, which may still be available for reacquisition, as well as the potential to collaborate with the Federal Government on locating new generation at the Federal nuclear licensed Chalk River facility. A Chalk River initiative may also offer significant development risk reduction and open interprovincial collaboration and interconnection benefits, e.g., energy trade

[8] Baseload needs underpinning the 2025 APO demand forecast approximate the 17.8 GW of new nuclear in the P2D Pathways scenario, despite the exclusion of most electrification implications from the 2025 APO.
[9] PWU Discussion Paper #3: Mitigating Affordability Risks to Ontario's Electricity System Requires Accountability, May 2024.
[10] PWU Discussion Paper # 2, Mitigating Ontario's Electricity System Reliability Risks Requires A New Planning Approach, May 2024.

with Quebec. Identification of additional potential sites, including hydro opportunities, should also be explored.

There is minimal downside risk to initiating these assessments amidst rapid demand growth. The assessments can only help equip planners with ensuring Ontario has viable, ready to go, supply siting options. Furthermore, timelines for predevelopment and stakeholder consultation work provide the ability to monitor and adjust when actual build commitments are made as further clarity on the energy transition progress emerges over the next few years.



Recommendation #4 - Nurture innovations to help smooth demand as close to load as possible

The PWU's discussion paper on Deliverability considered the mammoth task Ontario faces in transitioning its energy system to address the growing demand described earlier.[11]

This paper established that deliverable risks can be mitigated by reducing demand variability to mitigate the need for more flexible supplies and buy time to enhance capacity of transmission and, more importantly, the distribution system. The recommendations include: empowering LDCs to implement feeder-based storage assets; and, incenting/regulating both individual use of AI-driven Behind the Meter (BTM) demand side management (DSM) (e.g. with bidirectional EV charging, dual fuel heat pumps, and smart appliances) and also the effective extension of this capability for virtual power plants (VPPs). The recommended approach includes development of appropriate rate designs, not the IESO's current focus on market-based solutions or Distribution System Operators (DSOs).

Existing analyses show that the effectiveness of market-based solutions is highly questionable given Ontario's vision for a low-emission supply mix. Furthermore, in Ontario, markets-based solutions cannot achieve the maximum benefits at the scale required. Rate-based solutions are the only viable approach.

In support of the vision paper's identified opportunity to install more efficient and smarter controls, exploring rate enabled, AI-driven BTM DSM solutions could be low cost and provide significant benefits. It also represents a "no regret" action for properly pursuing BCAs of possible rate designs.

Pursuing the above recommendation will help dispel the myths and hyperbole evident in the rhetoric around DER potential, customer choice and the markets solutions for DERs. Implementation of a rigorous and mathematically validated BCA framework will bring these facts to light. As discussed in the PWU's deliverability paper, the PWU provided an assessment of the IESO-commissioned DER Potential Study that articulated how its premise and findings are misleading to policy makers. The PWU recommends that the government pay careful attention to how customer choice is prioritized in light of cost-effectiveness considerations e.g., the degree to which choice is subsidized at the expense of other rate payers and taxpayers particularly when offering choice provides no system benefits.

The PWU recommends that the Ontario government expeditiously initiate an independent, transparent assessment of the costs and benefits of DER for the province.

Incorporating the merits of, and opportunities for such AI-driven BTM DSM innovations within the regional planning process highlighted in the previous figure can help unlock an efficient and accelerated dialogue for cost effectively addressing Ontario's energy needs and advancing the transition.

[11] PWU Discussion Paper #4: Ontario's Electricity System's Deliverability Risks Require Innovations in the Distribution System, September 2024.

Recommendation #5 - Develop the lowest cost, most economically beneficial transition pathway to the reliable clean energy system required to meet Ontario's growth and electrification needs

Informed by the recommended risk-informed range of demand forecast, the recommended assessment of nuclear and hydro development options over time, a well-informed potential for LDC-installed feeder storage capacity, and rate-based AI enabled BTM DSM, the remaining needs for Ontario's clean energy transition will become evident, particularly for the short- and medium-term.

Understanding the development schedules for these assets and possible demand forecast ranges, a pathway for procuring additional resources can be developed. Planning effectiveness would be greatly enhanced by defining the resource needs in terms of supply options that would optimally match demand: baseload (e.g. nuclear and hydro); intermediate (e.g. gas-fired generation or portfolio of low emitting technologies with storage); and peak demand, including reserve, (e.g. low utilization gas -fired capacity). The PWU discussion papers on reliability and affordability highlighted the negative reliability and cost implications of not using a demand-characterized procurement requirement and instead relying on market frameworks that are ideally suited to gas-fired generation.[12]

To best serve the interests of Ontario rate payers and taxpayers, the process for developing the best pathway should be based on full system cost to supply the type of demand being addressed. It should also incorporate a comprehensive socio-economic benefit decision framework to help guide the optimum assessment of the pathway options. Total cost assessments would include all the supporting elements (such as storage) for the solution to meet the baseload, intermediate or peak needs as well as the transmission and distribution system implications.

Analyses suggest that identifying and evaluating the transition pathway options will quickly highlight the increased risk to reliability that will result from delays in procurement of new baseload nuclear and or hydro. Delays will also lead to increased reliance on carbon-emitting, gas-fired generation facilities and higher emissions during the transition. Important elements of the process for developing pathway options for Ontario energy system vision include:

- Leveraging the natural gas distribution system to mitigate the need for winter capacity growth (such as leveraging dual fuel heat pumps and the use of renewable natural gas and electrolytic hydrogen to bleed down the gas system emissions as is being piloted by Enbridge)
- Leveraging any emerging hydrogen economy to reduce the need for peaking supplies in general. Electrolytic hydrogen offers an effective demand response capability as is being piloted by Atura. Smaller distributed electrolysers are also suitable for use in a VPP.
- Evaluate, based on total system cost, the cost effectiveness of renewables for reducing emissions by displacing output from Ontario's gas-fired generation fleet.

[12] PWU Discussion Paper #4: Ontario's Electricity System's Deliverability Risks Require Innovations in the Distribution System, September 2024.

- The cost-effectiveness of using renewables to reduce emissions from gas-fired generation will be heavily influenced by government carbon pricing policies for generation and/or policies to achieve emission reductions regardless of cost.
- The discussion papers show that renewables-based solutions could cost 60% to 100% more than nuclear-based options.

Developing the pathway options should inform three important government objectives:

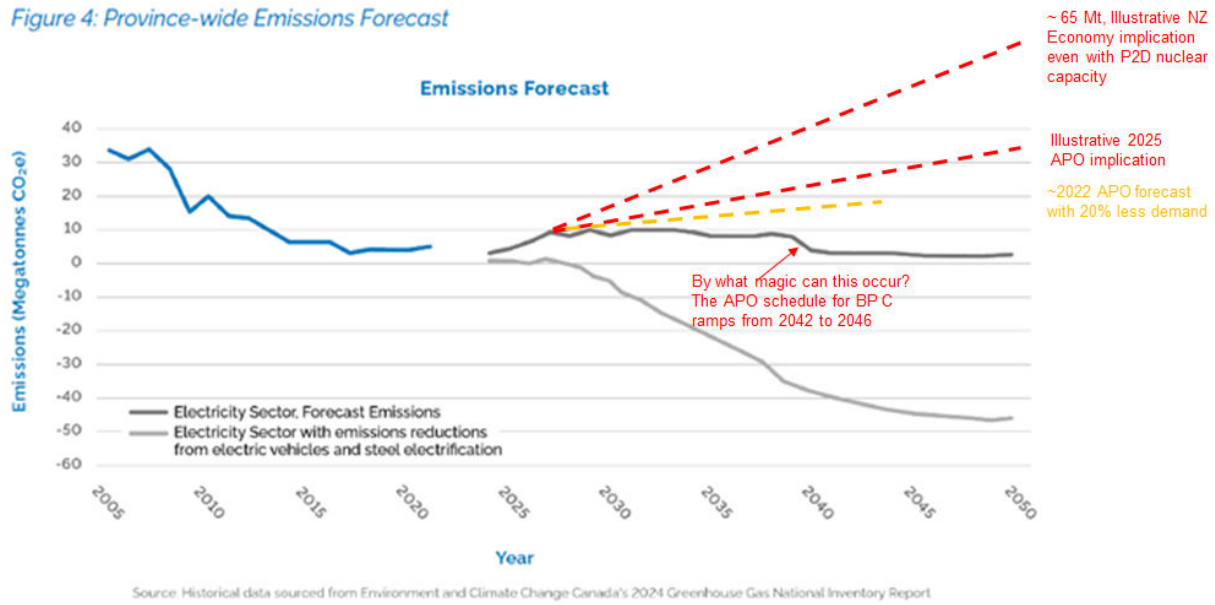
1. Clarity will emerge regarding government policy direction for the OEB on the role of natural gas in Ontario's energy transition to a clean economy.
2. With the identification of viable cost-effective pathways, the emissions implications will be evident, including the effective cost of emissions abatement within the electricity system.
3. The existence of viable development plans under the high demand scenarios will indicate whether viable export strategies are possible.

Comment on electricity system emissions

The vision paper places great emphasis on linking Ontario's clean energy supply with its economic prosperity. The province's actual emission performance and reputation as a "clean" energy provider is at risk without aligning the assessment of the emission implications with the range of emerging demand scenarios and viable transition supply options.

The vision paper includes a portrayal of Ontario's future electricity system emissions that could create misleading impressions for policy makers, as illustrated in the figure below.

Figure 4: Province-wide Emissions Forecast



Source: Historical data sourced from Environment and Climate Change Canada's 2024 Greenhouse Gas National Inventory Report

The figure was originally published in the IESO's Spring 2024 update and released concurrently with the 2024 APO, but was not clear about the underlying supply mix assumptions. It is notable that in the 2024 APO the IESO stated: "*The diversity of future supply mixes will directly impact interjurisdictional trade, marginal costs and emissions of the electricity system. As such, these system outcomes are not forecasted in this APO.*"

Yet, the IESO's Spring update states that: "*IESO scenarios for an orderly phase-out of natural gas show that by the late 2030s natural gas will only be required as back-up to protect the system when reliability is most at risk. Based on the IESO's forecasts, Ontario's clean energy advantage will improve before then. By the end of this decade, as demand grows and new non-emitting supply comes online, every kilowatt-hour created in Ontario becomes cleaner, reinforcing the value of electrification.*"

It remains unclear as to which forecasts the emissions forecast is aligned with. The orderly phase out of natural gas generation has been dismissed as too costly.

The 2022 APO forecast 20 Mt of emissions by 2043. Non-emitting supply mix options have not materially evolved since preparation of the 2022 APO yet demand in the 2025 APO shows almost 30% increase since then. Even with the *Powering Ontario's Growth* (POG)-identified nuclear

capacities included in the 2024 APO, emissions should be expected to be approximately 35 Mt.[13] The figure also incorrectly suggests a magical drop in emissions in 2040, for which there is no known viable explanation. Under the higher expected demand discussed earlier, emissions could approach 65 Mt even with the P2D-identified additional 17.8 GW of nuclear generation. A perspective on emissions implications for electricity system pathways has been developed and broadly communicated.[14]

A more robustly and transparently derived infrastructure development transition plan is warranted to provide clarity to policy makers of the emissions implications of actual, viable affordable and reliable transition pathways, a key priority in the vision paper.

Closing

There is evident urgency to creating an effective energy planning framework for Ontario. Unlocking the opportunities identified in the government's vision paper requires an urgent reform of Ontario's long- term planning framework and revised roles and accountabilities for the Ministry, the IESO and the OEB.

The PWU has a successful track record of working with others in collaborative partnerships. We look forward to continuing to work with the Ministry and other energy stakeholders to strengthen and modernize Ontario's electricity system. The PWU is committed to the following principles: Create opportunities for sustainable, high-pay, high-skill jobs; ensure reliable, affordable, environmentally responsible electricity; build economic growth for Ontario's communities; and, promote intelligent reform of Ontario's energy policy.

We believe these recommendations are consistent with, and supportive of Ontario's objective *"to build-out of an affordable, reliable and clean energy system to meet the exceptional growth needs of Ontario*." The PWU looks forward to discussing these comments in greater detail with the Ministry and participating in the ongoing stakeholder engagements.

[13] Taking 2025 APO demand forecast less emissions savings from APO-assumed nuclear new build (PNGS, DNNP by 2035 and Bruce C by 2045) leaves 2050 with 25 Mt more than in 2027 after PNGS shutdown.
[14] Strategic Policy Economics, "Electrification Pathways for Ontario, 2021.

Appendix 1 Power Workers' Union (PWU) Feedback to the MENDM on its Reforming the Long-Term Energy Planning Framework Consultation

April 27, 2021

The Power Workers' Union (PWU) is pleased to submit comments and make recommendations to the Ministry of Energy, Northern Development, and Mines (MENDM) regarding the consultation on reforming Ontario's long term energy planning framework. The PWU is a strong supporter and advocate for the prudent and rational reform of Ontario's electricity sector and recognizes the importance of planning for low-cost, low-carbon, high-value energy solutions to enhance the competitiveness of Ontario's economy.

The PWU supports the MENDM's initiative to reform energy planning in Ontario and create an effective, transparent, and accountable energy planning framework.

The PWU has been a participant in Ontario's energy planning consultations, including IESO engagements related to Market Renewal, the Annual Planning Outlook, and Resource Adequacy. The PWU's recommendations have focused on the need to consider climate change, total system cost, and procurement approach reforms that cost-effectively leverage Ontario's energy infrastructure investment dollars. More specifically, the PWU has consistently highlighted the urgent need to reform Ontario's procurement process to avoid what now appears to be an inevitable supply shortfall.

Last year, the PWU submitted recommendations to the Ministerial Advisory Council (MAC) for the MENDM consultation regarding the impacts of COVID-19 on Ontario's energy sector and potential innovative approaches to help stimulate economic recovery. These recommendations included actions that would sustain Ontario's economic recovery and maximize the benefits from the province's energy infrastructure investments, including: new nuclear; hydrogen; and biomass. The opportunity also exists to leverage federal program funding to synergistically achieve interrelated policy objectives. The PWU's submission recognized the importance of ensuring that these recommended actions would not impose additional financial burdens on taxpayers or ratepayers.

Contents

Executive Summary

The MENDM's call for reform is timely given several factors: the growing complexity of managing Ontario's energy system transition to a net zero economy; the need to take immediate, affirmative action to address climate change, as endorsed by Ontario's energy sector leaders[15]; and the growing risk profile on multiple policy fronts for government should these challenges not be addressed.

These factors present a tsunami of risks for the planning of Ontario's energy future: successfully achieving carbon emissions reductions in the electricity sector and across all sectors of the economy; ensuring that Ontario's identified supply gap does not result in an energy shortage; the imperative to include other energy resources, natural gas, hydrogen and biomass, as part of the "energy" plan and to integrate rapidly-emerging technologies cost effectively; the cost implications of the energy transition on ratepayers; and, the increased fiscal challenges arising from the COVID-19 pandemic.

The required energy transition will be complex, and warrants integrating planning across the entirety of Ontario's energy system: not just electricity, but also natural gas and the emerging hydrogen economy.

A Cycle of Planning Missteps

Recommendation ES-1: The energy planning framework should mitigate government risks by ensuring transparency and accountability in the processes and roles.

Over the last 25 years, Ontario's electricity sector has been in a constant state of transformation where policy responses and governance structures have failed to provide clarity and a stable investment climate for stakeholders. During this period, electricity resources have been procured that were misaligned with demand, and higher costs for ratepayers inevitably followed. These planning failures led to corrective policy interventions by respective governments in previous planning cycles that compounded the instability and resulted in additional cycles of suboptimal procurements.

Developing a framework for transparently planning Ontario's energy future with clearly defined stakeholder roles and accountabilities represents an opportunity for government to improve the efficacy of energy planning and yield better outcomes with less risk of planning failures and costly policy interventions.

The Reliability Crisis

Recommendation ES-2: Ontario needs a transparent, accountable and effective long-term energy planning framework to develop reliable and affordable energy infrastructure.

Unfortunately, a situational analysis shows that Ontario is in the midst of another unfolding planning failure.[16] The IESO has been forecasting a capacity gap in electricity supply for some time.[17] It plans on renewing and ramping up use of existing natural gas fired generation resources whose contracts are expiring. However, these resources alone are insufficient to replace the capacity from the retiring Pickering nuclear generating station.[18] Furthermore, increased use of these resources will result in

[15] OEA, 2021
[16] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[17] Brouillette, 2014
[18] IESO, 2020

increased exposure to the price volatility of the U.S. natural gas market, the costs of an increasing carbon price, higher carbon emissions, and reduced energy security. The latter will undermine Ontario's attempts to achieve its 2030 emissions targets.[19] In addition to this being the subject of prior PWU submissions,[20] some public groups are aware of this risk and have been actively expressing their opposition to the current plan and gaining support from municipal councils across Ontario.[21,22]

Currently, no credible plan has been advanced to address the requisite acquisition of new resources. Implied reliance on the ability to import from Quebec and the U.S. has been shown to be infeasible on the one hand and at significant risk due to U.S. climate policy objectives on the other. [23] Quebec cannot meet Ontario's growing winter heating load, instead currently relies on imports from Ontario in the winter. Both import options would lead to less energy security for Ontario. Yet the required procurement process for new resources will not be underway for many years, further delaying Ontario's ability to meet the forecast needs. Finally, the IESO has been clear that it has not factored in the impacts of electrification required to achieve Ontario's emissions targets as it has no policy guidance enabling it to do so.[24] Coupling the lack of supply solutions for the existing known capacity shortfall with the unfolding reality of new electricity demand from electrification of the economy points to a planning failure that will be hard to avoid without immediate policy action.

A 3-Part Solution

There are three elements to a comprehensive energy planning framework: Policy Priorities; Planning Roles; and Infrastructure Implementation. Each element requires a transparent, accountable process for the overall planning framework to be successful.

Policy Priorities:

> ***Recommendation ES-3:*** Government should provide clear, transparent, non-prescriptive Policy Priorities than can be planned for and are sufficiently measurable to support accountability.
>
> Ultimately government is responsible for making policy and is accountable for the outcomes. A clear set of Policy Priorities is a prerequisite for Ontario's future energy planning given the complexity of the province's ongoing energy transition and its associated risks. The Policy Priorities will establish what governs the planning process and the creation of measures of effectiveness which will ultimately drive how accountability is enabled and its outcomes.

[19] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[20] PWU, PWU Response to the Non-Emitting Resources Subcommittee's Draft Report, "Participation in Ontario's Future Electricity Markets", 2019; PWU, IESO Incremental Capacity Auction High Level Design Submission, 2019; PWU, PWU Submission on IESO Technical Planning Conference Materials, 2020; PWU, PWU Submission on Resource Adequacy Engagement, 2020; PWU, PWU Submission on Resource Adequacy Engagement, 2021.
[20] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[21] City of Toronto, 2021
[22] Ontario Clean Air Alliance, 2021
[23] Strategic Policy Economics, "Renewables and Ontario/Quebec Transmission System Interties: An Implications Assessment", 2016
[24] IESO, 2020

Recommendation ES-4: Policy Priorities should establish goals and objectives for such areas as: total cost to ratepayers; emission reductions; job creation; GDP; energy security; and other government policy objectives such as roles for indigenous peoples.

Energy Infrastructure investments can be leveraged to advance the economic prosperity of the province and achieve a range of policy objectives across government. Situational analysis shows that whole-of-government objectives should inform and shape both Policy Priorities and procurement criteria for the energy sector.

To maximize these benefits for Ontario's future prosperity, enabling new nuclear options in the supply mix conversation is an immediate imperative. Policy Priorities regarding how to best obtain the benefits offered by new nuclear should be included in the procurement criteria to encourage the same benefits from all options. The economics of supply mix choices are compelling with a nuclear solution creating upwards of $90B more in direct GDP than known alternatives.[25] Policy tools combined with creative business models can further reduce the cost of nuclear and attract private funds to mitigate government fiscal constraints.

Planning Roles:

Robust governance structures are needed to promote transparency and accountability in planning.

Recommendation ES-5: Using an IESO "Living Plan" approach, supported by the OEB's participation and annual reporting against the Government's Policy Priorities could require minimal change to existing roles, create negligible burden to planning timelines, and provide the accountability required to bolster the process.

There are several gaps in accountability in Ontario's current energy planning framework. These can be addressed by expanding the current practices of the IESO and the OEB. This would promote accountability and transparency, improve public trust in the process, and reduce government risk. The effectiveness of the planning process can be improved through appropriate roles for the IESO and the OEB in decision-making processes:

- Government's Policy Priorities for energy planning should be transparently communicated to the IESO and the OEB.

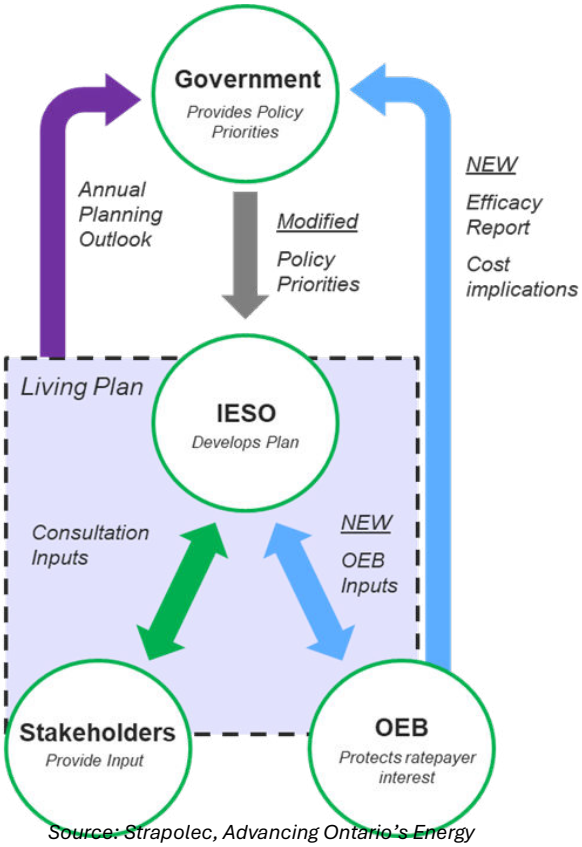
[25] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

- IESO can develop APOs that are explicitly responsive to the Policy Priorities, using its existing process as a 'Living Plan' approach to stakeholder engagement, including Indigenous Peoples.
- OEB can bring accountability to societally driven energy Policy Priorities through participation in the IESO's "Living Plan" and by providing an annual efficacy report. The OEB's mandate aligns with the assessment of societal impacts and already straddles the natural gas and electricity domains for rate decisions.

These minor changes to roles of the OEB, the IESO, and the Government could improve the effectiveness of the planning process while adding more transparency and oversight with minimal burden.

The *Policy Priority* and *Living Plan* processes may obviate the need for further LTEPs, or at least reduce its scope, as the APO could provide a more flexible, responsive and timely function during the pending energy transition and periods of rapid change.

Figure 2: Roles in an Updated Planning Framework



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

Infrastructure Implementation

Recommendation ES-6: Procurements for low emission baseload supply should start now.

Ultimately, energy planning results in the development and delivery of infrastructure. It is in this implementation of energy infrastructure that the outcomes of the planning framework are determined and where ultimate accountability is measured and falls to government. Unfortunately, when this form of accountability falls on government, it is well after the fact with little recourse. Elections are one, after the fact, form of holding government accountable, as are reports from Ontario's Financial Accountability Office and/or Auditor General. For the planning framework to be successful, Policy Priorities should transparently shape procurement criteria and hence frame the expected cost-benefit outcomes and provide earlier accountability in the decision-making process. Such complex procurement criteria require conventional RFP processes to convey them to bidders.

Starting the procurement process now comes with little if any risk. A demand analysis shows that 2 GW to 5 GW of low emission baseload is already inherently needed in the IESO's existing forecast supply gap.[26] Low GHG-emitting baseload would displace the use of natural gas-fired generation for baseload, enabling it to provide the peak and reserve capacity it is most suited for. Building new, large-scale low-carbon baseload resources of any kind will take time to develop and commission –

[26] Strategic Policy Economics, DER in Ontario, 2018

the siting challenges that all options face. Nuclear may in fact the easiest given existing licensed sites.

The evidence clearly shows that Ontario faces a greater risk of under procurement. In addition to this capacity gap, Ontario's emissions will be affected by the continuing trends in electrification as consumers continue to seek low-carbon solutions. Achieving Ontario's existing 2030 emission target could increase the supply gap by 3 to 5 GW over what the IESO has currently forecast. Ontario needs substantial new, low-carbon electricity resources to avoid a supply shortfall.

Consultations and requests for expressions of interest could occur in 2021, with RFPs targeted for issuance in 2022, thereby advancing the availability of non-emitting supplies by 5 years.

Additional Recommendations

The PWU respectfully provides the following additional Policy Priority and Implementation recommendations.

Policy Priority Recommendations

Recommendation P1: Planners require a clear mandate to independently identify and explore emerging risks and their implications for Ontario's energy system and government established Policy Priorities.

Recommendation P2: Policy Priorities must recognize that climate action is driving an indisputable and significant need for electrification that must be included in Ontario's energy plan.

Recommendation P3: Policy Priorities should recognize the need for integrated planning across electricity, natural gas, hydrogen and biomass economies as emerging technology innovations could affect the need for capacity buildout.

Recommendation P4: Sustaining system reliability through the energy transition warrants planning now for the future.

- ***Recommendation P4-1:*** Long-term procurement planning should place a policy priority on acquiring non-emitting resources.
- ***Recommendation P4-2:*** Policy Priorities should consider that carbon pricing under the Emissions Performance Standard (EPS) be applied to natural gas-fired generation in a manner similar to the Federal Output-Based Pricing System (OBPS), including any future contractual arrangements with existing assets that arise from IESOs resource acquisition strategy.
- ***Recommendation P4-3:*** System planning should be based on a strategically-driven timeline to 2050 in order to minimize the system reliability risks of a capacity shortfall.

Recommendation P5: A new resource acquisition planning framework should prioritize a "low system cost" approach while concurrently addressing the evolving nature of demand, including regional needs.

- ***Recommendation P5-1:*** Planning for new resource acquisitions must consider the cost implications and benefits of integrated bulk, regional, and local solutions.

Recommendation P6: Optimizing the economic benefits of leveraging infrastructure investments should be included in Policy Priorities and applied to the IESO's procurement process.

- ***Recommendation P6-1:*** The energy planning framework should consider using infrastructure development tools for public-private partnerships to minimize and share costs and risks in new low carbon infrastructure like nuclear generation.

Implementation Recommendations

Recommendation I1 – Ontario should not be unnecessarily exposed to the risk of having inadequate electricity resources as it should not take the IESO four years to prepare a procurement process.

Recommendation I2 – Specifying Ontario's demand needs—baseload and intermediate—is the solution that allows the province to act both early and prudently to satisfy its future energy requirements.

Recommendation I3 – The IESO should create near-term dates to kick start the paradigm shift for procuring Ontario's energy needs by 2022.

Objectives of the MENDM Energy Planning Framework Consultations

On January 27, 2021, Ontario's Ministry of Energy, Northern Development and Mines (MENDM) opened a consultation to "refocus Ontario's long-term energy planning framework to increase the effectiveness, transparency and accountability of energy decision-making in Ontario," with the goal of promoting "transparency, accountability, and effectiveness of energy planning decision making," increasing investment certainty, and ensuring the interests of ratepayers are protected.

MENDM suggested that a new process could involve greater reliance on the IESO and the OEB, with their desired outcome being to "empower technical planners, such as the IESO, to plan the most reliable and cost-effective system." To that end, MENDM has posed the following nine questions to stakeholders:

1. *How can we promote transparency, accountability and effectiveness of energy planning and decision-making under a new planning framework?*
2. *What overarching goals and objectives should be recognized in a renewed planning framework?*
3. *What respective roles should each of the Government, IESO, and the OEB hold in energy decision-making and long-term planning?*
4. *What kinds of decisions should be made by technical planners at the IESO and the OEB as regulators?*
5. *What types of decisions should require government direction or approval?*
6. *Are there gaps in the IESO and the OEB's mandates and objectives that limit their ability to effectively lead long-term planning?*
7. *Should certain planning processes or decisions by the IESO, the OEB, or the government receive additional scrutiny, for example through legislative oversight or review by an expert committee?*
8. *How often and in what form should government provide policy guidance and direction to facilitate effective long-term energy planning?*
9. *How do we ensure effective and meaningful Indigenous participation in energy sector decision-making?*

These questions span the important aspects of successfully reforming the energy planning framework with the first question reflecting the all-encompassing objective of the reform. To fully address the objectives, a situational and a gap analysis were conducted to frame the recommendations in this submission. This context helps to illustrate a high-level planning framework. A summary of how these recommendations align with the above questions is provided in the appendix.

The Energy Planning Framework

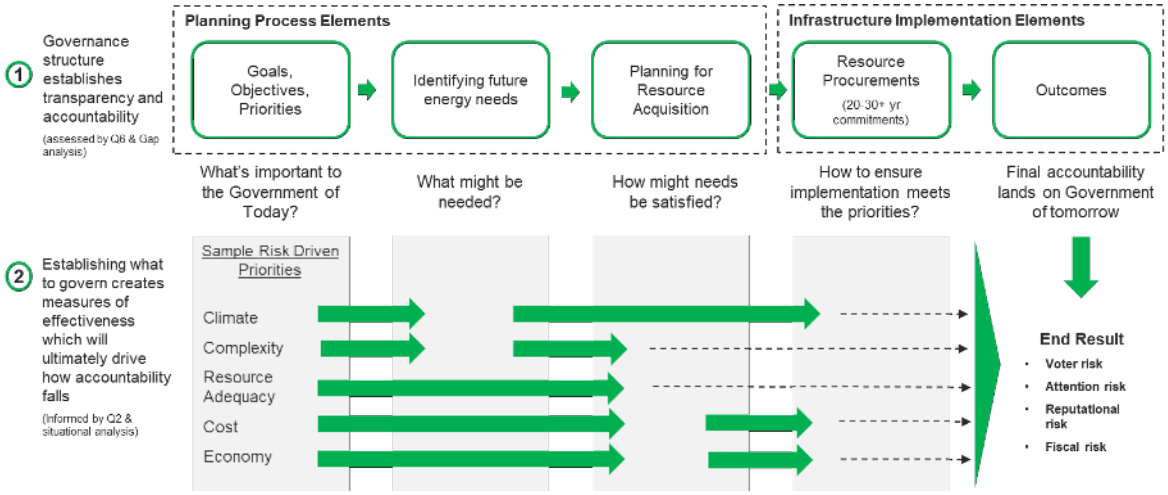
An effective energy planning environment involves the successful pairing of planning process and infrastructure implementation elements.

The *planning process* involves three highly integrated elements:

1) Setting goals, objectives and priorities – those that matter to the government of the day;
2) Identifying future energy needs – as established by informed forecasting of future conditions;
3) Planning for resource acquisition –to satisfy the needs for a reliable, sustainable, and affordable electricity system.

The *infrastructure implementation elements* include the procurement of resources, in accordance with the resource acquisition plan, which ultimately leads to the outcomes for which final accountability inevitably lands on government.

Figure 3: Three Elements for Framework Improvement



Source: Strapolec Analysis

Three elements influence the success of the framework's ability to deliver favourable outcomes:

1) *Developing the governance structure* that establishes transparency and accountability for the decisions made throughout the process;
2) *Setting the government's Policy Priorities* to clearly define what the planning process must achieve and ultimately the measures of success the government will be accountable for;
3) Ensuring the infrastructure implementation is in alignment with the Policy Priorities.

The recommendations in this submission are provided to help inform how the energy planning framework could be successfully reformed by improving the above three elements.

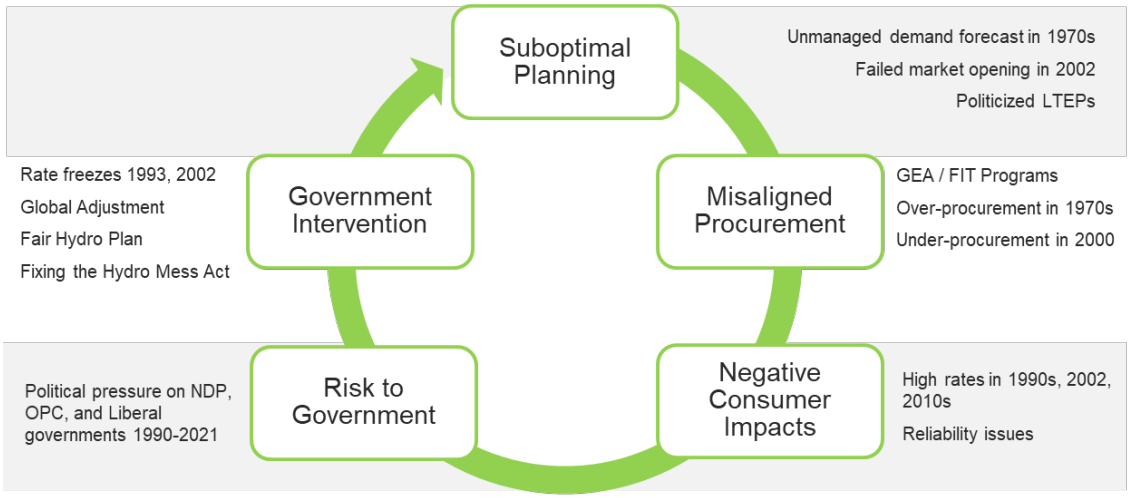
Developing the Governance Structure

The following recommendations are based on an historical analysis of some of Ontario's previous planning failures and a gap analysis of existing roles versus two principles of good governance: transparency and accountability.

Recommendation ES-1: The energy planning framework should mitigate government risks by ensuring transparency and accountability in the process and roles.

Energy planning has been a source of risk to government for the past 25 years, with a repeating cycle of suboptimal planning and associated undesirable outcomes ultimately presenting risks to government, who has ultimate accountability for energy planning. Suboptimal planning failures have ranged from under procurements to over procurements, which ultimately manifests as either high costs to rate payers, cost-shifting among rate classes, and growing financial support from taxpayers. The ensuing pressure on government presents as political risk, compelling government to intervene in planning. Such interventions inevitably bypass the formal planning process, prompting the cycle to repeat. This cycle of sub optimal energy planning has plagued governments of all stripes since the 1990s. Yet, these planning challenges and risks persist today with Ontario appearing to be on the path to repeating history by under procuring for Ontario's future.[27]

Figure 4: The Cycle of Suboptimal Planning



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

At the root of this cycle are problems of *governance.* Governance is defined by the OECD as "the process by which public institutions conduct public affairs and manage public resources" [28] Principles of *accountability, transparency,* and *agency independence* are key features of good governance.[29] These critical elements have been conspicuously absent in the recurring planning failures seen in Ontario to date. Gaps in transparency and accountability persist and Ontario's "independent planning agencies" are increasingly managed by directives.

[27] Strategic Policy Economics, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021; Informed by Warren, 2015; Vegh, 2017; Vegh, 2020.
[28] OECD, 2007
[29] Vegh, 2017

Breaking this cycle of intervention requires an energy planning framework that promotes these fundamental principles and delivers reliable, cost-effective outcomes for Ontario's energy consumers. Doing so will reduce future risks to government and minimize the need for government intervention.

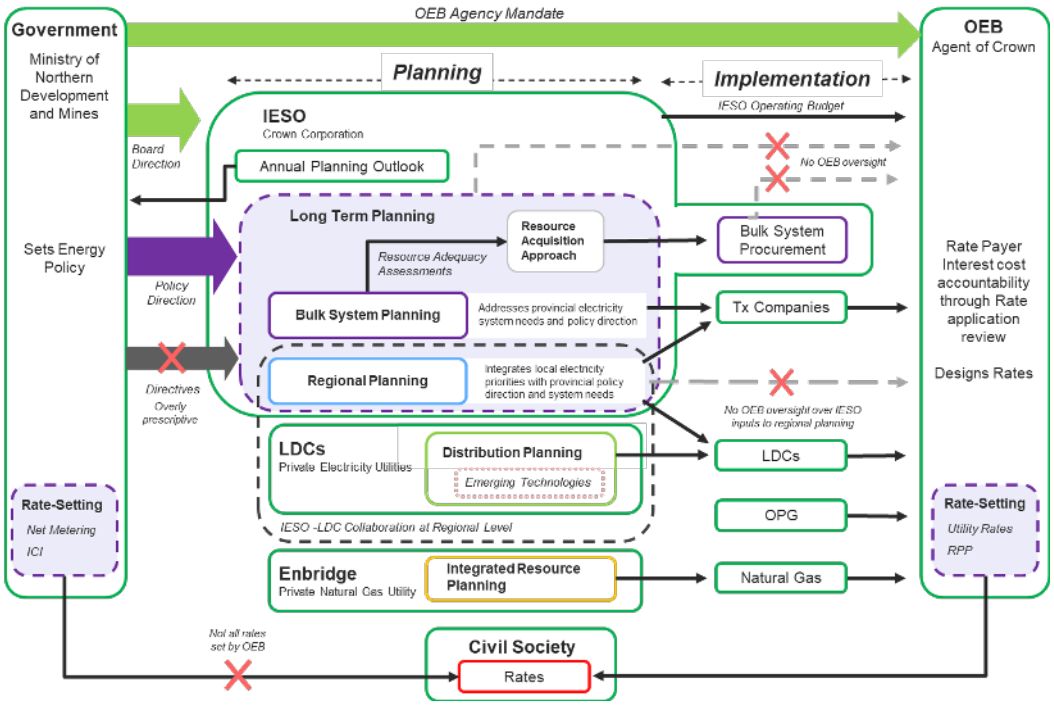
Accountability measures are required throughout the planning framework. Accountability means decisions are "owned" by the body making them.[30] In Ontario, the government is responsible for planning decisions, and is ultimately held accountable by voters during elections, and by Officers of Parliament like the Auditor General and the Financial Accountability Office. However, these mechanisms only hold the government accountable *after* decisions are made. To ensure plans are effective, Ontario needs accountability measures that apply *before* plans are finalized to avoid future outcomes from planning failures.

Recommendation ES-2: Ontario needs a transparent, accountable and effective long-term energy planning framework to develop reliable and affordable energy infrastructure.

In Ontario's current energy planning framework, the IESO directs regional and bulk system planning, while LDCs direct and implement distribution planning. The OEB provides accountability on behalf of ratepayers by reviewing utility rate applications and the IESO's operating expenses, and sets rates. Government provides the OEB with its mandate, but has also set rates.

For the IESO, Government provides direction as a member of the IESO's Board, policy direction for the IESO's planning activities, and other directives on miscellaneous particular matters, some of which are material to overall outcomes.

Figure 5: Ontario's Energy Planning Framework



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

[30] Vegh, 2017

Several accountability gaps exist in this framework:

a. **Government Directives to the IESO** are not always transparent and can be overly prescriptive, limiting the IESO's ability to utilize its independent expertise and provide effective planning.[31]
b. **The overall planning process** has no mechanism that links accountability to the interests of ratepayers and the financial viability of the sector. The IESO has no explicit requirement to address the cost-benefit tradeoffs of total system cost regarding how demand for electricity is met. The OEB provides an accountability measure, only "*after*" implementation plans are proposed by regulated entities. No such check occurs on the inputs to those plans, or the planning decisions made that have driven them. This creates economic/business uncertainty for utilities/generators that need stability and certainty in the regulatory environment to support their own planning exercises. The delayed review also impacts on the OEB mandate to balance ratepayer interests against the need to ensure the viability of the sector.
c. **Bulk system resource acquisitions** outside of the OEB regulated entities lack mechanisms linking decision accountability to ratepayer interests and investor risks. How the IESO balances its short-run (energy supply) risks against its long run (capacity availability) risks impacts on how investor and ratepayer risks are balanced.[32]
d. **Rate-setting** is performed by both the OEB and the government. Rates set by government, such as the ICI and Net Metering programs, currently have no accountability links to the OEB for assessing ratepayer interests. The ICI and net metering programs have both had unintended rate impacts to class B ratepayers. The associated challenges with these rates have been the subject of several MENDM consultations that have incurred substantive government attention.[33] The Electricity Act does not require the IESO to consider consumer impacts, including the possible transfer of risks between categories of ratepayers or between ratepayers and taxpayers.[34]
e. **After-the-fact accountability**: Existing accountability measures do not address outcomes until public awareness has grown, usually several years after the decisions are made.[35]

Ontario's reform of its energy planning framework should address these accountability gaps with measures that are applied *before* the fact, not afterwards. Such measures can provide an "early warning" to government about the risks that may arise during the energy planning process. The OEB may be well-placed to perform this role.

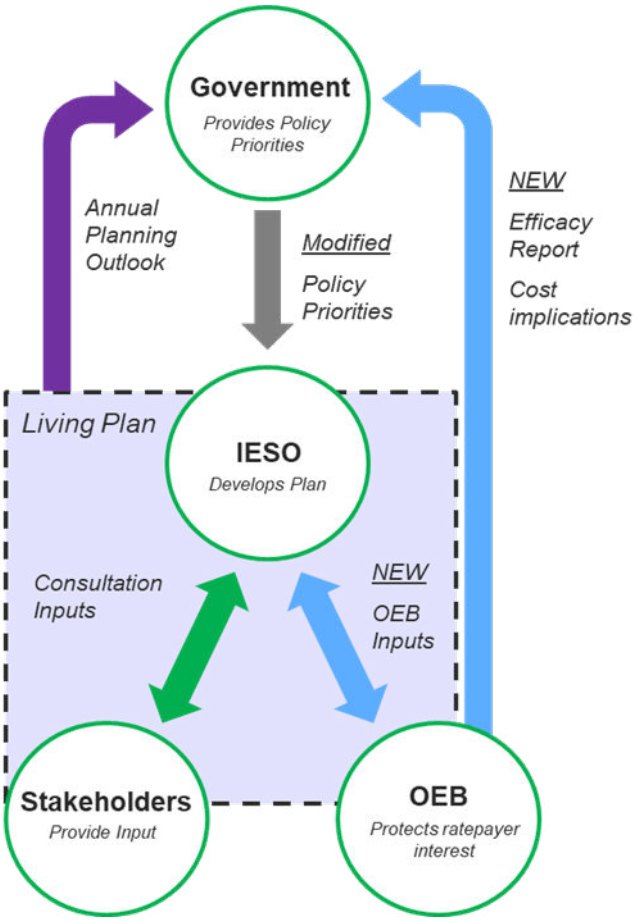
Recommendation ES-5: Using an IESO "Living Plan" approach, supported by the OEB's participation and annual reporting against the Government's Policy Priorities, could require minimal change to existing roles, create negligible burden to planning timelines, and provide the accountability required to bolster the process.

A revised energy planning framework can play to the strengths of the IESO and the OEB to create a more transparent, accountable, and effective planning framework. In this framework:

[31] Office of the Auditor General of Ontario, 2015
[32] Strategic Policy Economics, 2020
[33] Ministry of Energy, Northern Development and Mines, 2019; Ministry of Energy, Northern Development and Mines, 2020.
[34] Electricity Act, 1998, Part II.2, Subsection 25.29 (3)
[35] Vegh, 2017

a. **The Government, as an alternative to the prescriptive and politicized nature of the previous 2017 LTEP,**[36] [37] would set energy policy through a document that articulates the province's energy Policy Priorities. This single reference document would be publicly communicated to the IESO and the OEB to provide guidance on the execution of their respective mandates. The government would periodically update these Policy Priorities as required and/or in response to annual reports by the IESO and OEB regarding their progress towards achieving the government's objective of the Policy Priorities. Government decision-making authority would continue to apply to procurements that commit the province to expenditures above a set threshold. The Policy Priorities document would establish the measures of success, including final accountability.

Figure 6: Roles in an Updated Planning Framework



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

b. **The IESO** would receive Policy Priorities from the Government and undertake energy planning to meet the objectives set out therein. Their scope should include electricity and the implications to electricity of other energy resources, such as natural gas and hydrogen.

The IESO's current stakeholder engagement process has been effective and successful in creating what is essentially a "Living Plan". Future IESO consultations on the planning process should include inputs from the OEB. The IESO would maintain its plan as necessary in response to stakeholder and/or OEB feedback. Its Annual Planning Outlooks would provide the government with its assessment of the current state of Ontario's energy plan and its alignment with the government's Policy Priorities.

c. **The OEB** currently acts on behalf of energy ratepayers for both electricity and natural gas.[38] The OEB could further represent civil society's interests with inputs to IESO's *living plan* consultations, where these interests relate to the Policy Priorities to which the OEB has been charged, and as these interests pertain to the implications of IESO's plan on electricity and natural gas rates.

[36] Vegh, 2020
[37] MENMD letter to stakeholders dated January 5th articulated a desire to eliminate political interference
[38] Ontario Energy Board Act, 1998, S.O. 1998, c. 15, Sched. B

The OEB should be relied upon to set all rates in accordance with its assigned Policy Priorities including the rate programs currently administered by the government.

The OEB would provide annual reports to government on the efficacy of IESO's APO as it relates to the Policy Priorities assigned to the OEB and including the cost implications to ratepayers. These reports would be publicly available to provide an independent assessment of the expected outcomes of the IESO's activities to the government and the public.

With respect to the IESO's electricity planning mandate and its role to provide system expertise, the OEB's efficacy reports would remain focused on the *outcomes* of the IESO's planning activities as they relate to specific Policy Priorities that the OEB has been charged to review. This would not constitute *oversight* of the IESO's operations.

Trusted, transparent and effective processes expertly informed by the IESO and OEB could obviate the need for additional oversight/committees.

Setting Policy Priorities

The second question posed by the consultation concerns overarching goals and objectives that should be recognized in a renewed planning framework. These goals and objectives should define the substance of what the planning framework is governing.

Under Section 25.29 of the current Electricity Act, 1998, an LTEP may include goals and objectives respecting:

- The cost-effectiveness of energy supply and capacity, transmission and distribution;
- The reliability of energy supply and capacity, transmission, and distribution, including resiliency to the effects of climate change;
- The prioritization of measures related to the conservation of energy or the management of energy demand;
- The use of cleaner energy sources and innovative and emerging technologies;
- Air emissions from the energy sector, taking into account any projections respecting the emission of greenhouse gases developed with the assistance of the IESO;
- Consultation with Aboriginal Peoples and their participation in the energy sector, and the engagement of interested persons, groups, and communities in the energy sector;

The above list of goals and objectives are applicable to the government who currently owns the accountability for producing LTEPs. However, the Act places these items at the discretion of the minister. To advance the government's objectives to depoliticize the planning framework and rely on the expertise of the IESO and the OEB, these goals and objectives should be detailed by government as a set of Policy Priorities for long-term energy planning.

Recommendation ES-4: Policy Priorities should establish goals and objectives for such areas as: total cost to ratepayers; emission reductions; job creation; GDP; energy security; and other government policy objectives such as roles for indigenous peoples.

Ontario's energy transition and its focus on reducing emissions materially affects many of the desired objectives of the energy planning framework reform process. Energy Infrastructure investments can be leveraged to advance the economic prosperity of the province and achieve a range of policy objectives across government. Situational analysis shows that whole-of-government objectives should inform and shape both Policy Priorities and procurement criteria for the energy sector.

To maximize these benefits for Ontario's future prosperity, enabling new nuclear options in the supply mix conversation is an immediate imperative. Policy Priorities regarding how to best obtain the benefits offered by new nuclear should be included in the procurement criteria to encourage the same benefits from all options. The economics of supply mix choices are compelling with a nuclear solution creating upwards of $90B more in direct GDP than known alternatives.[39] Policy tools combined with creative business models can further reduce the cost of nuclear and attract private funds to mitigate government fiscal constraints. The following recommendations have been developed from an assessment of the planning risks in the energy sector and potential mitigation options that Policy Priorities may enable.

[39] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

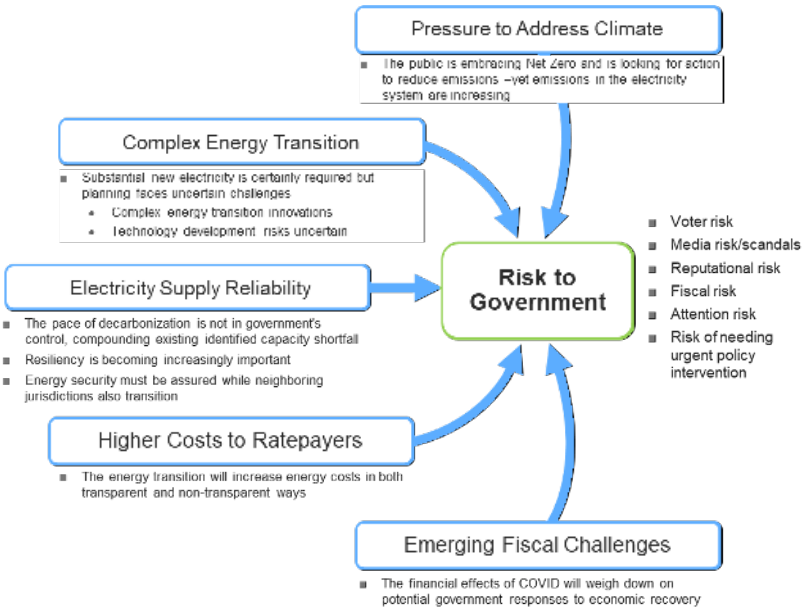
Recommendation P1: Planners require a clear mandate to independently identify and explore emerging risks and their implications for Ontario's energy system and government established Policy Priorities.

The challenge of managing the emerging risks facing Ontario's energy system is becoming increasingly complex. Experience has shown that delaying mitigating policy responses to critical issues can generate new risks and compound existing ones. These emerging risks include:

- Pressure to address climate change
- The complex energy transition
- Electricity supply reliability
- Higher costs to ratepayers
- Emerging fiscal constraints

Failure to address these planning imperatives fuels the cycle of suboptimal planning and the manifestation of government risks described earlier, such as voter risk, media and reputational risks, attention risks to address them, and fiscal risks arising from urgent interventions.

Figure 7: Risks Converging on Government



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning,

The Electricity Act requires the IESO to submit a technical report to the Minister of Energy that addresses the adequacy and reliability of Ontario's electricity resources including "any other matters the Minister may specify".[40] The IESO's latest APO does not provide any contingencies for emission reductions in its plan as they have not been given a mandate to do so.[41] The PWU previously provided feedback recommending that the IESO include scenarios that address these demand uncertainties.[42] Unless specified by the Minister, the IESO is not required to address climate uncertainties, the implications of the energy transition on resource adequacy for supply reliability, or even the costs and benefits of how electricity demand will be met. No authority is currently providing information that would inform the public about the implications of the energy transition, as would an electricity forecast showing the results of electrification. Such objectives should be addressed by the government's Policy Priorities to be considered by the IESO.

[40] Electricity Act, 1998, Part II.2, Subsection 25.29 (3)
[41] IESO, 2020
[42] PWU, Submission on IESO APO January Engagement Session, 2021; PWU, 20-Year Planning Outlook Stakeholder Engagement Meeting 2 Feedback, 2019

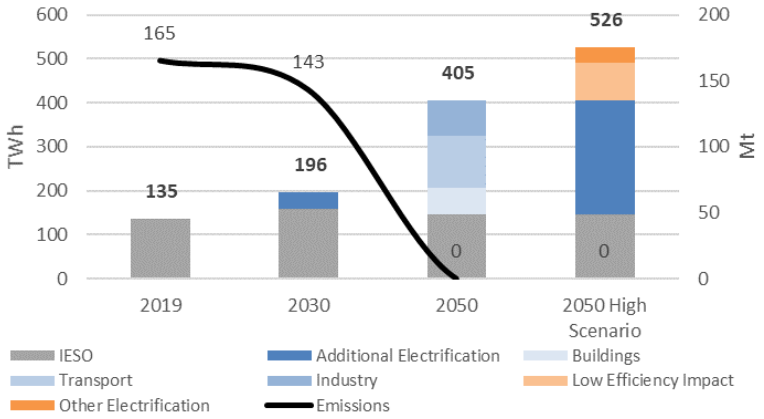
Recommendation P2: Policy Priorities must recognize that climate action is driving an indisputable and significant need for electrification that must be included in Ontario's energy plan.

As previously noted, the public's calls to address climate change are growing louder, including the need to reduce the province's emissions, an objective that all senior executives of Ontario's energy infrastructure are now endorsing.[43]

Many options for reducing emissions across Canada are presently being explored including:[44] fuel switching (primarily electrification and hydrogen); efficiency improvements; carbon capture; and, direct air capture. The potential efficacy of these options varies by region across Canada. For example, in Ontario the largest emission reductions in the province's primary emitting sectors are likely to be achieved via efficiency gains and electrification. These two options could eliminate 65% of Ontario's emissions:[45]

- *Buildings* - Heat pumps and electric water heating for both residential and commercial buildings
- *Transportation* - EVs for passenger vehicles and EVs and hydrogen options for freight
- *Industry* – Electric heating for light industry process heat and technology switching for heavy industry (e.g., hydrogen)

Figure 8: Emission Reduction and Electrification Pathway to 2050



Source: Strapolec, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

Note: 2019 data used in place of 2020 to remove impact of COVID-19 pandemic on

Implementing these electrification options would increase Ontario's electricity 2050 demand by a minimum of 270 TWh over today.[46] This demand estimate results from direct electrification (e.g. EVs, heat pumps) and indirect demand for hydrogen electrolysis. This is three times as much electricity as the province consumes today and double the demand forecast by the IESO for 2040 (after awarding greater efficiency benefits than planned).[47] The upper bound could exceed 20% more. These new demand levels should be important criteria for planning Ontario's long-term energy system.

The other immediate concern is a potential 15% increase in electricity demand in 2030 that will be required to meet Ontario's 2030 emission targets.[48] By any measure, this emerging demand for electricity represents a significant challenge for planning Ontario's long-term energy future.

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[43] OEA, 2021
[44] Canadian Institute for Climate Choices, 2021
[45] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[46] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[47] IESO, 2020
[48] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

Recommendation P3: Policy Priorities should recognize the need for integrated planning across electricity, natural gas, hydrogen and biomass economies as emerging technology innovations could affect the need for capacity buildout.

Planning for the energy transition involves the interplay of three key sectors:

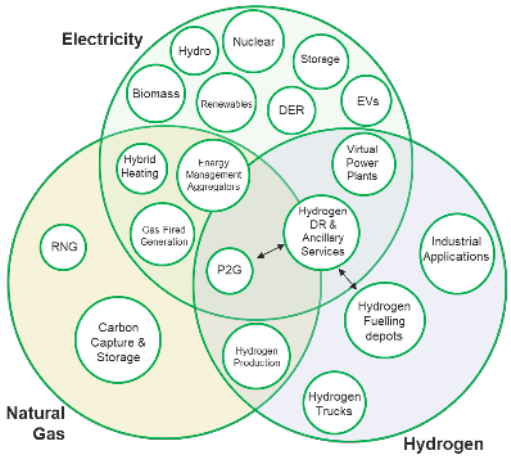
1) ***Electricity,*** the future emission-free energy source
2) ***Natural gas*** for heating and electricity generation
3) ***Hydrogen*** use by industry and heavy transport

Conventional planning strategies to optimize the use of existing assets, such as hydro, nuclear, biomass and the natural gas distribution systems, may be disrupted by the need to integrate new hydrogen and other emerging technologies, such as:

- ***Hybrid heating*** devices that are dual-fueled by both natural gas and electricity can reduce peak electricity system needs.
- ***Energy management systems*** that can optimize home heating, EV charging, and water heating.
- ***Community storage*** can be located near demand loads and smooth variable demand, potentially reducing grid infrastructure costs by enabling greater use of baseload supply. ***EVs*** can provide mobile storage and act as ***virtual power plants***.
- ***Hydrogen electrolyzers*** provide a cost-effective source of demand response and ancillary services that could be regionally distributed across the province near load centers (e.g. LDCs) where the benefits are most needed.

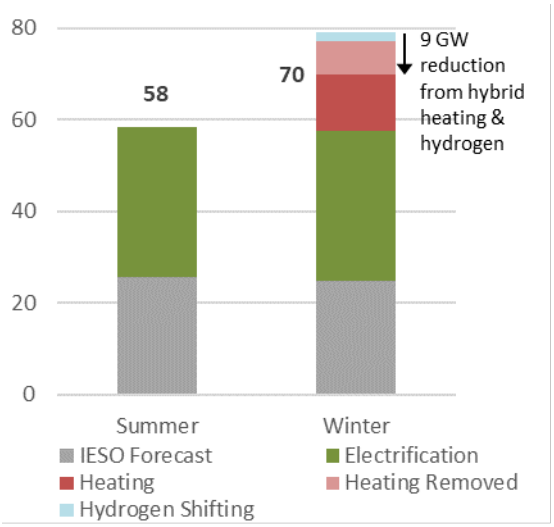
Some of these opportunities are already being explored. The IESO is currently running a pilot with the OEB's support that combines the functions of the natural gas system, hydrogen production and electricity system ancillary services.[49] The plethora of technologies will drive system efficiencies towards a greater need for larger baseload generation. Ontario has the opportunity to build upon its foundation of low-emitting nuclear and hydro baseload generation and integrate emerging technologies.

Figure 9: Innovation Ideas for a New Energy System



Source: Strapolec Analysis

Figure 10: Seasonal Capacity Drivers
(GW by Season, 2050, Pre vs. Post Optimization)



Remaining 2 GW reduction in peak comes from reduction in required reserve capacity and smart demand side management

Source: Strapolec, Advancing Ontario's Energy Transition: Electrification Pathways, 2021; IESO, 2020

[49] Enbridge Gas Inc., 2018

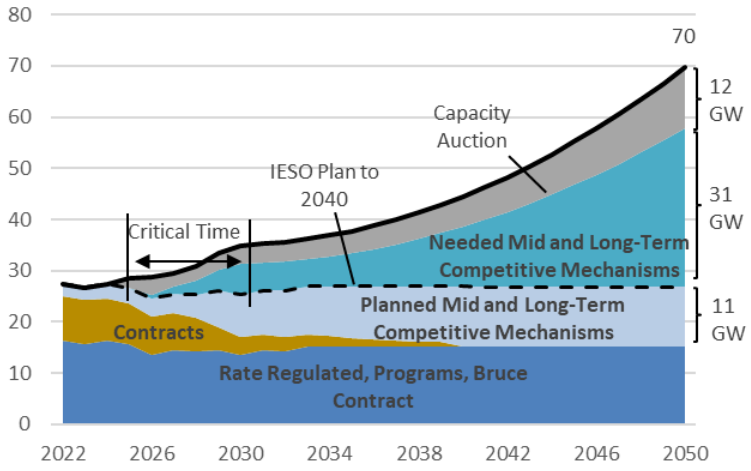
Recommendation P4: Sustaining system reliability through the energy transition warrants planning now for the future.

A situational analysis shows that Ontario is in the midst of an unfolding planning failure. The IESO has identified the need to acquire 15 GW of generation resources to sustain the reliability of Ontario's system.[50] The IESO's currently planned mid-term competitive mechanisms are RFPs for 3-year contracts to renew expiring resource contracts.[51] However, in spite of the availability of the dual-fuelled Lennox station and the refurbishment of Ontario's low-emission nuclear fleet, the province's natural gas-fired generation fleet will be insufficient to replace the capacity of the retiring Pickering station and meet the IESO's projected capacity demand. The supply gap after these options are exercised approaches 3 GW in the late 2020s, increasing to 4 GW by 2040.[52]

Yet, no credible means to address this shortfall has been advanced. The procurement of new resources is required.

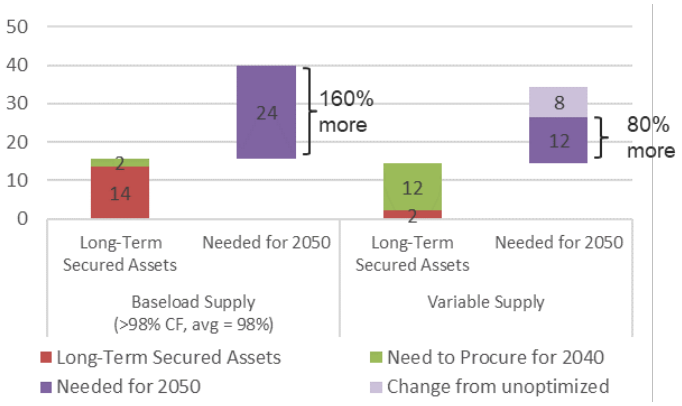
Adding to this challenge is the 2050 forecast need for 70 GW, of which 40 GW is new capacity including 24 GW of new low-emission baseload.[53]

Figure 12: Ontario Procurement Needs with Electrification
(GW by Year)



Source: IESO, 2020; Strapolec, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

Figure 11: Incremental New Supply Required by Demand Type
(GW, IESO 2040 vs. 2050)



Source: IESO, 2020; Strapolec, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

Renewing existing or securing new natural gas-fired generation presents significant risks for Ontario: fuel price volatility; carbon pricing; and increased emissions. The latter will complicate Ontario's ability to achieve its 2030 emissions targets. The bottom line, the current approach to procuring electricity resources does not consider the ramifications of decarbonizing Ontario's economy.

[50] IESO, 2020
[51] IESO, Resource Adequacy Engagement, March 22, 2021
[52] IESO, 2020
[53] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

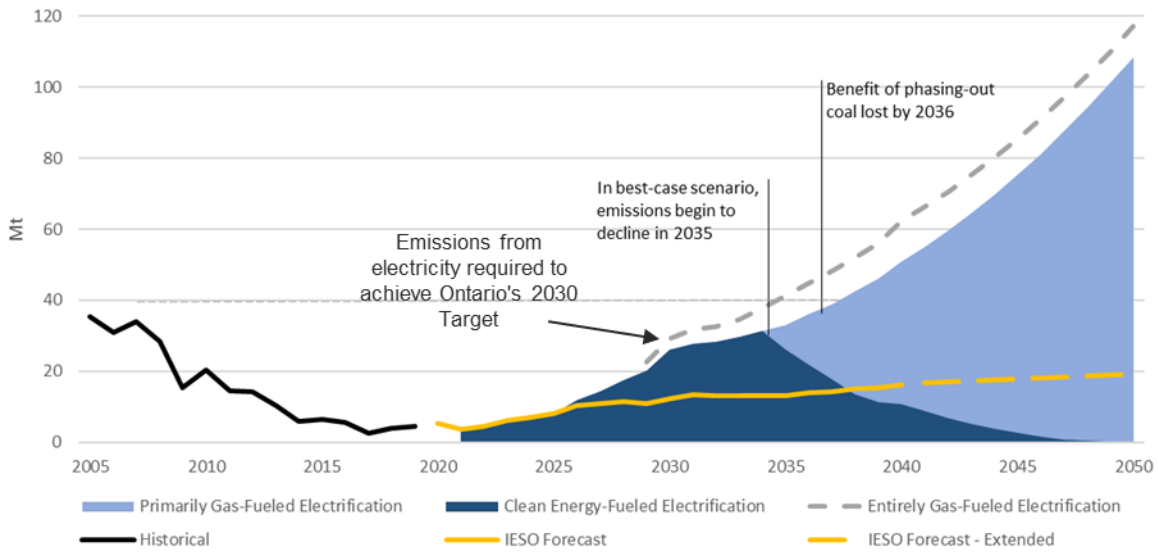
Recommendation P4-1: Long term procurement planning should place a policy priority on acquiring non-emitting resources.

The absence of a low-emission replacement for the retiring Pickering station is a major factor contributing to the IESO's forecast 500% increase in Ontario's electricity system emissions.[54] Some public groups are aware of this risk and have been actively expressing their opposition to the current plan and gaining support from municipal councils across Ontario.[55] Investments in today's electricity infrastructure will be required to create a low-emitting grid. With the anticipated new demand from electrification of the economy and absent the availability of new non-emitting generation, emissions from the electricity sector could far exceed those seen in 2005 prior to the phase out of coal, putting Ontario at risk of losing its status as a clean energy region.[56]

Recommendation P4-2: Policy Priorities should consider that carbon pricing under the EPS be applied to natural gas-fired generation in a manner similar to the OBPS, including any future contractual arrangements with existing assets that arise from IESOs resource acquisition strategy.

The EPS effectively places no carbon price on most of the output from Ontario's natural gas fleet.[57] A carbon price on natural gas-fired generation emissions will send an economic signal to investors that incents low-emitting resource options. It would also incent natural gas generators to consider investing in carbon capture or direct air capture. The terms should also be applied to any imported energy.

Figure 13: Emissions Implications of Electrification Under Emitting and Clean Supply Options
(Mt)



Source: Strapolec, Advancing Ontario's Energy Transition: Electrification Pathways, 2021; IESO, 2020

[54] IESO, 2020
[55] Ontario Clean Air Alliance, 2021
[56] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[57] Strategic Policy Economics, Advancing Ontario's Energy Transition: Leveraging Policy Tools, 2021. Note: Emissions up to 420 tonnes per GWh are exempt from the carbon price under the EPS. The carbon price is paid on any incremental emissions above that threshold. This threshold effectively excludes most natural gas generation in Ontario.

Recommendation P4-3: System planning should be based on a strategically-driven timeline to 2050 in order to minimize the system reliability risks of a capacity shortfall.

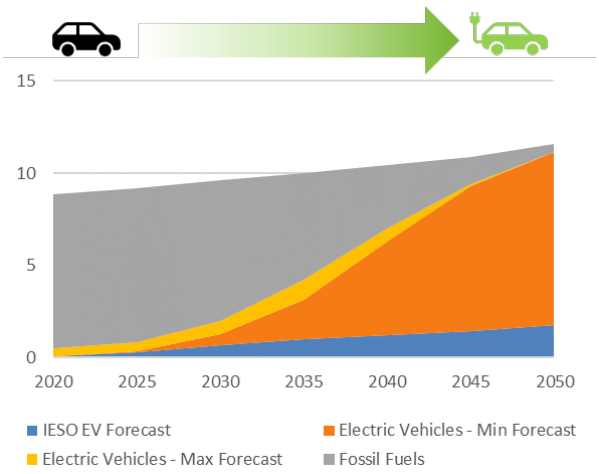
Developing the large-scale energy infrastructure required to almost triple Ontario's generation capacity by 2050 and supply the future 70 GW will be a mammoth undertaking. Bulk sources for low-emitting firm generation of this scale along with transmission take many years to develop. All options: wind, hydro, natural gas with carbon capture and storage, as well as nuclear will face siting challenges including public opposition and NiMBYism of one form or another. Even if procurements were to start today, the likelihood of the needed generation being available before 2035 is unfavorable. This will result in a transition period of high emissions from Ontario's electricity sector, putting at risk the reductions achieved closing the province's coal stations.

It is becoming increasingly important that Ontario consider the timing for new generation required to address electrification and develop a transparent and accountable approach for securing the requisite low emitting supplies. In addition, the near-term rise in demand will materialize from the electrification decisions made by the public and businesses e.g., EVs, Hydrogen, and building heating. The associated increase in near-term demand for carbon-free electricity represents a near-term system reliability risk.

Consumers are increasingly choosing EVs and auto manufacturers are responding with more models. The government of Canada has set a target of 100% EV passenger vehicle sales by 2040.[58] The provinces of Quebec and BC are both more aggressive with equivalent targets set for 2035.[59]

Many passenger vehicle manufacturers have committed to cease fossil-based vehicle production by 2040.[60] For example, General Motors, has committed to do so by 2035.[61] EV forecasts to 2035 indicate EV penetration will far exceed the levels assumed in IESO's latest APO.[62]

Figure 14: Passenger Vehicle Stock Forecast
(Million Vehicles)



Demand from electrification could well exceed current planning assumptions by up to 33 TWh before 2030 putting Ontario at risk of being unable to meet 2030 emissions targets of 143 Mt. [63]

This near-term risk means critical planning decisions should be made as soon as possible regarding Ontario's long-term supply requirements for 2030. These decisions will also have long-term consequences for Ontario's future emissions profile. Looking to 2050, 30 years does not allow much time for re-imagining and undertaking to almost triple the capacity of Ontario's electricity system.

[58] NRCan, 2021
[59] Jarratt, 2020
[60] Daimler , n.d.; Hyundai, n.d.; White, 2021
[61] Wayland, 2021
[62] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[63] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

Recommendation P5: A new resource acquisition planning framework should prioritize a "low system cost" approach while concurrently addressing the evolving nature of demand, including regional needs.

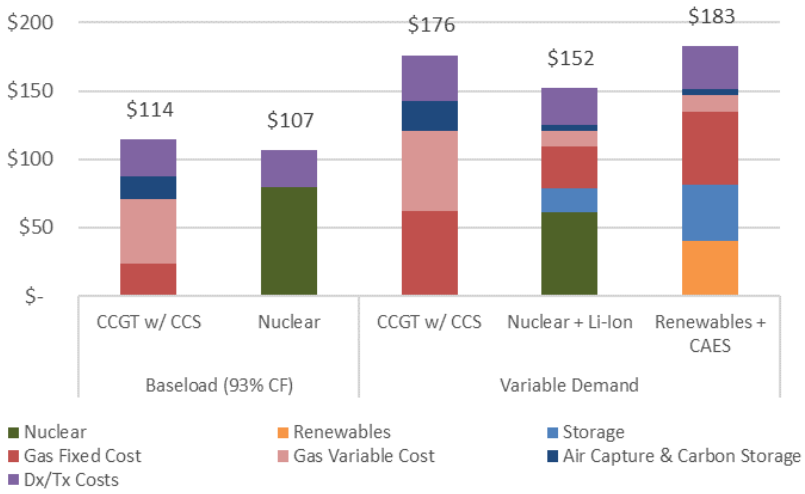
Reforming Ontario's energy planning framework presents two opportunities: procuring low-cost, lower risk solutions that meet Ontario's baseload and variable supply; and, more emission reductions.

Baseload demand requires firm, reliable, non-emitting supply that is available and affordable 24x7.

- Ontario's base electricity demand is currently met by its dependable, cost-competitive nuclear fleet and hydroelectric assets. Other low-emitting technologies are emerging e.g., SMRs, natural gas generation with carbon capture and storage to backstop renewables.
- Variable demand requires flexible supply that minimizes the cost of the associated lower usage of the capacity.
- Flexible supply has typically been natural gas fired generation, which if equipped with carbon capture, could remain a viable option. However, variable demand can also be met by hybrid solutions, such as integrating the operation of local energy storage technologies with bulk system nuclear, renewables, and transmission assets.

While nuclear is available to cost-effectively provide non-emitting baseload supply, the fossil fuel-based options require access to storage for captured carbon.

Figure 15: Cost of Options to Supply Baseload and Variable Demand
($/MWh CAD, 2050)



Source: Strapolec, Advancing Ontario's Energy Transition: Electrification Pathways,

Recommendation P5-1: Planning for new resource acquisitions must consider the cost implications and benefits of integrated bulk, regional, and local solutions

Planning Ontario's low-cost, low-carbon energy system for the future will require integrating bulk, regional and local solutions in a manner that enhances energy security, reliability, and total system costs. This will facilitate the development of cost-effective hybrid solutions that best meet specific energy demands. New energy management innovations—IT and AI—are another enabler but also come with costs to the province's overall electricity system. Distributed assets combined with bulk baseload can reduce the unit energy cost of the Dx and Tx infrastructure.

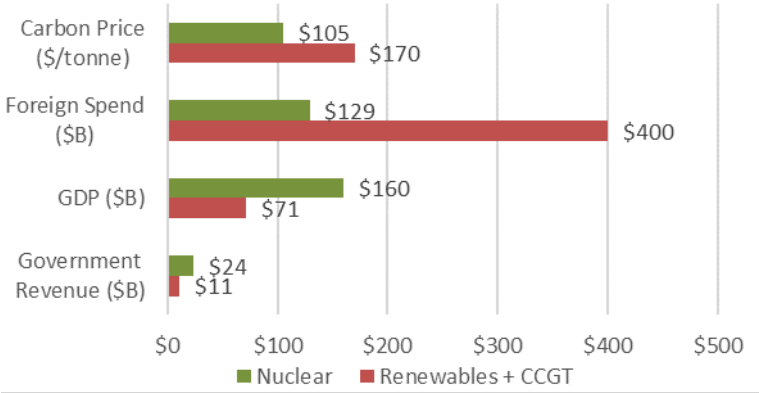
Recommendation P6: Optimizing the economic benefits of infrastructure investments should be included in Policy Priorities and applied to IESO's procurement process.

Significant societal benefits result from investments in large energy infrastructure projects. Ontario's nuclear industry and refurbishment program provide good examples.[64] Ontario's Policy Priorities should reflect the importance of such expenditures and the resulting societal benefits

Additionally, these kinds of investments should form part of a "made-in-Ontario" resource acquisition planning strategy. Policy Priorities would include:

- *Accelerate decarbonization:* Low-cost electricity minimizes the required carbon price to accelerate climate action.
- *Secure domestic energy supply:* Assures regional energy security, security against extreme events & retains spend in Ontario.
- *Enhance economic growth:* Infrastructure spend creates direct GDP, jobs, and tax revenues for government.
- *Strengthen Industrial policy:* Nurtures business opportunity by attracting investment and creating jobs in globally-competitive firms exporting in emerging sectors, such as EV manufacturing, hydrogen technologies, and nuclear.
- *Enhance Innovation:* Nurtures domestic science, technology, & innovation in strategic technologies.

Figure 16: Economic Impacts of Infrastructure Choices
($/Tonne vs. $B)



Note: Values normalized to an equivalent electricity cost basis of $114/MWh

Source: Strapolec, Advancing Ontario's Energy Transition: Electrification Pathways, 2021 Note: Values normalized to an equivalent electricity cost basis of $114/MWh

The numerous analyses detailing the environmental and economic benefits of Ontario's nuclear technologies suggests the new nuclear option should be explored sooner than later.[65] Nuclear-based solutions may generate upwards of $90B more direct GDP than alternatives.[66] Policy Priorities regarding how to best leverage these existing, domestic, low-carbon energy assets should be captured in the IESO's procurement criteria. Benefits of such policies are further explored in Appendix 3 that has been previously supplied to the MENDM.

Recommendation P6-1: *The energy planning framework should consider using infrastructure development tools for public-private partnerships to minimize and share costs and risks in new low carbon infrastructure like nuclear generation.*

The essence of a public private partnership is the management and sharing of risk. Leveraging innovations in governance, finance, and regulation can enable creative business models to mitigate risks

[64] Bruce Power, 2020
[65] Strategic Policy Economics, 2015; Strategic Policy Economics, Renewables and Ontario/Quebec Interties, 2016; Strategic Policy Economics, Ontario's Emissions and the Long-Term Energy Plan, 2016; Strategic Policy Economics, 2018.
[66] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021

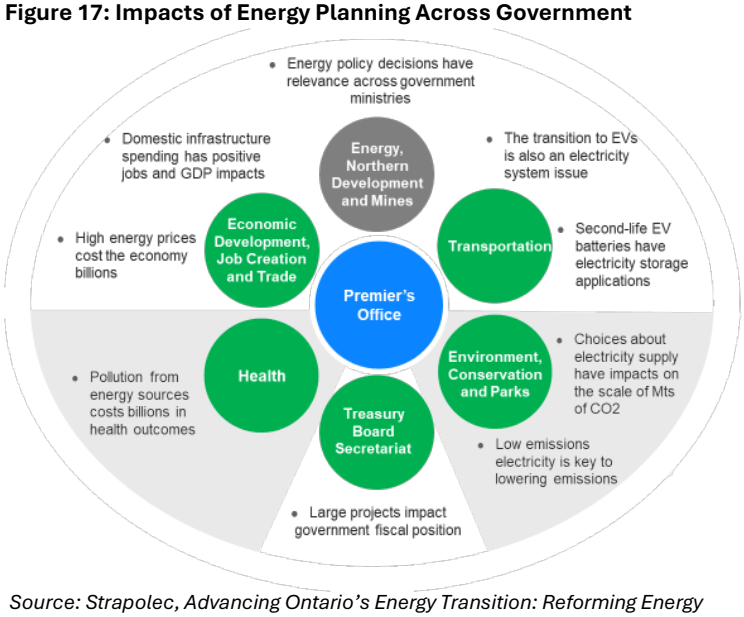
to both government and the private sector on large infrastructure projects, like nuclear new builds. Societal benefits may warrant public investment or cost sharing between rate payers and taxpayers.

Mitigating these collective risks can reduce the cost of infrastructure projects. The Canadian Infrastructure Bank, Green Bonds, long-term energy planning, and regulated returns can all help enable of affordable, reliable, and sustainable solutions.[67] By optimizing the risk profile of projects, the private sector may help accelerate decarbonization and help reduce the fiscal burden on government. New nuclear build, given its significant capacity to avoid greenhouse gas emissions should be considered by government as a form of "clean/green" energy and be included in investment taxonomies that provide preferential funding mechanisms e.g. green bonds.

Recommendation ES-3: Government should provide clear, transparent, non-prescriptive Policy Priorities than can be planned for and are sufficiently measurable to support accountability

In addition to the MENDM's specific interest in advancing long term energy planning and the spending implications for new infrastructure on the government's fiscal position, many other ministries also have vested interests in the pace, journey and outcomes of Ontario's energy transition.[68] Moving forward, the Policy Priorities for long-term energy planning should form a cohesive reflection of the policies of the affected government ministries.

Figure 17: Impacts of Energy Planning Across Government



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

Through Policy Priorities, government can transparently set the agenda for Ontario's energy policy and lay the groundwork for effective and accountable energy planning and implementation.[69]

Examples of high-level Policy Priorities relevant to energy planning span several critical areas including: pressure to address climate change, emerging fiscal constraints; and a reliable, sustainable and affordable, low-carbon energy system that provides long-term, domestic-based energy security.

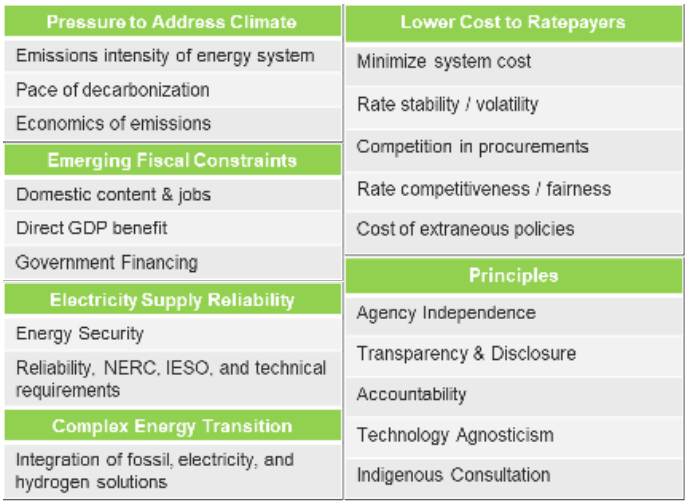
To be effective within a reformed energy planning framework, the Policy Priorities should be:

- Clear enough for the IESO to incorporate in its planning.

[67] Strategic Policy Economics, Advancing Ontario's Energy Transition: Leveraging Policy Tools, 2021
[68] Strategic Policy Economics, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021
[69] Strategic Policy Economics, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

- General and non-prescriptive enough for the IESO and the OEB to independently determine the best solutions.
- Measurable enough to facilitate performance tracking.
- Prioritized relative to their importance to each other to help guide planning/procurement decisions.

Figure 18: Sample Policy Priorities



Source: Strapolec, Advancing Ontario's Energy Transition: Reforming Energy Planning, 2021

Infrastructure Implementation

Recommendation ES-6: Procurements for low emission baseload should start now.

Ontario's capacity gap significantly broadens in 2028 – only 7 years from now. Waiting until 2025 for the IESO to complete its procurement framework design could leave Ontario without cost-effective, viable energy solutions. The IESO is aware that Ontario's forecast peak summer capacity needs exceed available existing capacity by 4,200 MW in 2040, or 10%.[70] The electrification of Ontario's economy will only exacerbate the need for building new capacity in the province.

As described earlier, Ontario now faces the risk of a supply shortfall before 2030.The pending supply gap was noted in Ontario's 2013 Long-Term Energy Plan (LTEP), almost a decade ago and in subsequent LTEPs without procurement action being taken.[71] More recently, the need to develop a competitive mechanism that can procure long-term, low-cost, non-emitting resources has been continually communicated to the IESO through the various engagements related to system planning and developing procurement mechanisms[72]. However, the need for new low emissions resources has not been advanced into the resource acquisition plans. a delayed procurement process will result in:

1. ***Procurement of gas-fired generation*** because only new gas-fired generation can be built on such short timelines at the scale required meet Ontario's needs – assuming the site selection processes encounters no opposition.[73]
2. ***Long-term commitments to higher greenhouse gas (GHG) emissions*** **out to 2050,** because the economic life of new gas-fired generation plants is 20 years+. The emission consequences— Ontario's ability to meet its emission targets is compromised--were also discussed earlier. The province's "clean energy jurisdiction" status will also be compromised as well as the reductions achieved by Ontario's decarbonization initiatives – from EVs to hydrogen. Given these negative impacts on the province's climate objectives, public opposition to new gas plant siting is inevitable.[74]
3. ***A higher cost solution —*** current forecasts predict that neither new nor existing gas plants will be Ontario's cost-effective solution by the end of the decade.[75] Given the expected increases in carbon pricing, the new natural-gas fired generation will become uneconomic sooner.
4. ***Reduced energy security for Ontario –*** As natural gas consumption in the U.S. increases due to their coal plants being shut down, system planners around the Great Lakes region (including Ontario's IESO) have identified this increasing reliance on natural gas as a reliability risk given existing pipeline

[70] IESO, 2020
[71] Ontario, Achieving Balance: Ontario's Long Term Energy Plan, 2013; Ontario, Delivering Fairness and Choice: Ontario's Long Term Energy Plan 2017, 2017.
[72] PWU, PWU Response to the Non-Emitting Resources Subcommittee's Draft Report, "Participation in Ontario's Future Electricity Markets", 2019; PWU, IESO Incremental Capacity Auction High Level Design Submission, 2019; PWU, 20-Year Planning Outlook Stakeholder Engagement Meeting 2 Feedback,2019; PWU, PWU Submission on IESO Technical Planning Conference Materials, 2020; PWU, PWU Submission on Resource Adequacy Engagement 2020; PWU, PWU Submission on the IESO's January 2021 Annual Planning Outlook Engagement, 2021
[73] Strategic Policy Economics, Advancing Ontario's Energy Transition: Electrification Pathways, 2021
[74] Ontario Clean Air Alliance, 2021
[75] Bloch et. al., 2019

constraints, especially during extreme cold weather events.[76,77] As an example, Ontario ran out of natural gas during the last Polar Vortex.[78] The recent extreme weather event in Texas saw gas prices rise in Ontario.[79]

Recommendation I1 - Ontario should not be unnecessarily exposed to the risk of having inadequate electricity resources as it should not take the IESO four years to prepare a procurement process.

The IESO currently has a four-year plan to develop their long-term competitive procurement mechanisms. The approach appears to be driven by a process overcomplicated by a singular focus on electricity markets solutions and associated resource constraints within the IESO.[80] Analyses show that capacity market solutions are not economically and environmentally suitable for meeting Ontario's emerging needs. A traditional RFP process is more appropriate.[81]

Recommendation I2 - Specifying Ontario's demand needs—baseload and intermediate—is the solution that allows the province to act both early and prudently to satisfy its future energy requirements.

The IESO's forecasts clearly demonstrate that Ontario will need to renew or replace 50% of its required capacity to meet future demands, even without considering the impacts of decarbonization.[82]

A procurement process that is focused on the specific needs of the province can be more quickly developed than one focused on "unbundling" the assets for individual procurement. The IESO's future procurement approach should encourage bundled solutions through technology agnostic specifications of the demand that needs to be met. Resource requirement parameters could include: the flexibility to respond to daytime fluctuations ramping; location; transmission implications; etc.

Analyses show that future low-emitting electricity system solutions will be provided by a range of technologies such as renewables, storage, nuclear, and natural gas.[83] Selecting "technology" winners from emerging resources presents significant uncertainties and risks. A more cost-effective and lower-risk approach would encourage proponents to bid a mix of gas, biomass, renewables, storage, nuclear, small hydro, DERs, and aggregations as complex integrated hybrid solutions. This approach could also encourage a mix of existing and new resources in a hybrid solution.

Developing a competitive procurement mechanism that enables cost-effective, integrated hybrid solutions is consistent with Ontario's desire to attract investors in innovation and meet its economic and environmental objectives.

Recommendation I3 - The IESO should create near-term dates to kick start the paradigm shift for procuring Ontario's energy needs by 2022.

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[76] New England saw average natural gas and electricity prices in January 2014 go up by over 5 times than in the preceding months. (ISO Newswire, 2014)
[77] In PJM, natural gas prices reached over $100/MMBTU in January 2014, while average wholesale electricity prices reached over $600/MWh. (Glazer, 2014)
[78] Go Energy, 2018
[79] Intelligence, 2021
[80] IESO, Verbal Communication during Enabling Resources April Engagement Session, 2021
[81] Strategic Policy Economics, 2020
[82] IESO, 2020
[83] Brouillette, 2019

The IESO should begin now to develop an RFP procurement approach that will provide long-term, cost-effective solutions to meet Ontario's emerging electricity needs. This year's IESO consultation process should explore how Ontario's demand needs could be met by bundled solutions, facilitated by information that is mostly available from the IESO's Planning Outlooks.

Targets should be established to define a selected set of needs for soliciting expressions of interest by the middle of 2021, followed by a formal procurement launch in early 2022. Initially, optimization of this process could be advanced by focusing on the clearly identified needs – for both baseload (to start replacing lost Pickering capacity as early as possible) and variable supply solutions.

This approach could advance the IESO's plans by 5 years and by extension, the availability of low-carbon energy supplies to support Ontario's 2030 emission targets and the economic benefits from the infrastructure investments.

Closing

There is evident urgency to resolving Ontario's energy planning framework. The contracting/RFP process should begin much earlier than the IESO's planned 2025 process design completion date.

The PWU has a successful track record of working with others in collaborative partnerships. We look forward to continuing to work with the MENDM and other energy stakeholders to strengthen and modernize Ontario's electricity system. The PWU is committed to the following principles: Create opportunities for sustainable, high-pay, high-skill jobs; ensure reliable, affordable, environmentally responsible electricity; build economic growth for Ontario's communities; and, promote intelligent reform of Ontario's energy policy.

We believe these recommendations are consistent with, and supportive of Ontario's objectives to supply low-cost and reliable electricity for all Ontarians. The PWU looks forward to discussing these comments in greater detail with the MENDM and participating in the ongoing stakeholder engagements.

Appendices

1. References
2. List of Recommendations
3. Summary of Responses to Posed Questions
4. Detailed Background on Broad Policy Priorities and Business Models

Appendix 1 - References

Bloch, C., Newcomb, J., Shiledar, S., & Tyson, M. (2019). *Breakthrough Batteries.* RMI.

Brouillette, M. (2014). *Rethinking Ontario's Long-Term Energy Plan.* CCRE.

Brouillette, M. (2019). *Renewables-based Distributed Energy Resources in Ontario: A Three-Part Series of Unfortunate Truths.* CCRE.

Bruce Power. (2020). *Ontario Energy Report.*

Canadian Institute for Climate Choices. (2021). *Canada's Net Zero Future: Finding our way in the global transition.*

City of Toronto. (2021, March 11). Special Meeting City Council.

Daimler . (n.d.). Retrieved from Ambition 2039: Our path to CO_2-neutrality,=: https://www.daimler.com/sustainability/climate/ambition-2039-our-path-to-co2-neutrality.html

Electricity Act, 1998, S.O. 1998, c. 15, Sched. A. (1998).

Enbridge Gas Inc. (2020, November 18). *Enbridge Gas announces a $5.2M Hydrogen Blending Pilot Project to further explore greening of the natural gas grid*. Retrieved from Cision: https://www.newswire.ca/news-releases/enbridge-gas-announces-a-5-2m-hydrogen-blending-pilot-project-to-further-explore-greening-of-the-natural-gas-grid-849137548.html#:~:text=18%2C%202020%20%2FCNW%2F%20%2D,existing%20natural%20gas%20network%20serving

Glazer, C. (2014). *Operational Events and Market Impacts January 2014 Cold Weather.* PJM.

GoEnergy. (2018, January 12). *How cold weather extremes affect Ontario energy markets*. Retrieved from GoEnergy: https://goenergy.ca/cold-weather-extremes-affect-ontario-energy-markets/

Hyundai. (n.d.). *Hyundai Motor to further extend lead in zero-emission mobility*. Retrieved from https://www.hyundai.news/uk/brand/hyundai-motor-to-further-extend-lead-in-zero-emission-mobility/

IESO. (2019). *Incremental Capacity Auction - High Level Design.*

IESO. (2020). *Annual Planning Outlook.*

IESO. (2021, March 22). Resource Adequacy Engagement .

Intelligence, N. G. (2021). *NGI's Dawn Daily Natural Gas Price Snapshot.*

ISO Newswire. (2014, April 4). *Oil inventory was key in maintaining power system reliability through colder-than-normal weather during winter 2013/2014*. Retrieved from https://isonewswire.com/2014/04/04/oil-inventory-was-key-in-maintaining-power-system-reliability-through-colder-than-normal-weather-during-winter-2013-2014/

Jaratt, E. (2020, November 16). *Quebec to ban sale of new gas vehicles by 2035*. Retrieved from Electric Autonomy Canada: https://electricautonomy.ca/2020/11/16/quebec-ban-new-gas-vehicles-2035/

Ministry of Energy, Northern Development and Mines. (2019, April 1). *Consultation on industrial electricity prices*. Retrieved from Ontario: https://www.ontario.ca/page/consultation-industrial-electricity-prices

Ministry of Energy, Northern Development and Mines. (2021, January 5). Letter to stakeholders.

Ministry of Energy, Northern Deveopment and Mines. (2020, October 8). *Changes to Ontario's Net Metering Regulation to Support Community-Based Energy Systems*. Retrieved from Ontario: https://ero.ontario.ca/notice/019-2531

NRCan. (2021, March 24). *Zero Emission Vehicle Infrastructure Program*. Retrieved from Government of Canada: https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876

OEA. (2021, April 7). OEA Symposium on MENDM Energy Planning Reform.

OECD. (2007). Governace. *OECD Glossary of Statistical Terms*.

Office of the Auditor General of Ontario. (2015). *2015 Annual Report.*

Ontario. (2013). *Achieving Balance: Ontario's Long Term Energy Plan.*

Ontario. (2017). *Delivering Fairness and Choice: Ontario's Long Term Energy Plan 2017.*

Ontario Clean Air Alliance. (2021, March 11). *Mayor Tory & Toronto City Council call for phase-out of Ontario's gas plants*. Retrieved from Ontario Clean Air Alliance: https://www.cleanairalliance.org/mayor-tory-toronto-city-council-call-for-phase-out-of-ontarios-gas-plants/

Ontario Clean Air Alliance. (2021). *Mayor Tory & Toronto City Council call for phase-out of Ontario's gas plants.*

Ontario Energy Board Act, 1998, S.O. 1998, c. 15, Sched. B. (1998).

PWU. (2019, May 13). 20-Year Planning Outlook Stakeholder Engagement Meeting 2 Feedback.

PWU. (2019, May 17). IESO Incremental Capacity Auction High Level Design Submission.

PWU. (2019, March 18). PWU Response to the Non-Emitting Resources Subcommittee's Draft Report, "Participation in Ontario's Future Electricity Markets".

PWU. (2020, March 11). PWU Submission on IESO Technical Planning Conference Materials.

PWU. (2020, October 20). PWU Submission on Resource Adequacy Engagement.

PWU. (2021, February 22). PWU Submission on the IESO's January 2021 Annual Planning Outlook Engagement.

PWU. (2021, February 22). PWU Submission on the IESO's January 2021 Resource Adequacy Engagement.

PWU. (2021, April 14). PWU Submission to the IESO's March 2021 Resource Adequacy Engagement.

Strategic Policy Economics. (2015). *Impact of Extending Pickering Nuclear Generating Station Operations to 2024.*

Strategic Policy Economics. (2016). *Ontario's Emissions and the Long-Term Energy Plan: Phase 1: Understanding the Challenge.*

Strategic Policy Economics. (2016). *Renewables and Ontario/Quebec Transmission Interties.*

Strategic Policy Economics. (2018). *Distributed Energy Resources in Ontario: A Cost and Implications Assessment.*

Strategic Policy Economics. (2020). *Electricity Markets in Ontario: An Examination of Mismatched Conditions and Options for Future Competitive Processes.*

Strategic Policy Economics. (2021). *Advancing Ontario's Energy Transition: Leveraging Policy Tools.*

Strategic Policy Economics. (2021). *Advancing Ontario's Energy Transition: Reforming Energy Planning.*

Strategic Policy Economics. (2021). *Advancing Ontario's Energy Transition: Electrification Pathways for Ontario.*

Vegh, G. (2016). *Learning from Mistakes: Improving Governance in the Ontario Energy Sector.* C.D. Howe Institute.

Vegh, G. (2017). *Report on Energy Governance in Ontario to the Ontario Energy Association and the Association of Power Producers of Ontario.* McCarthy Tetrault. OEA and APPrO.

Vegh, G. (2020). *Electricity Procurements in Ontario: Time for a New Approach.* Ontario 360.

Warren, R. B. (2015). *The Governance of Energy Agencies: A Case Study of the Ontario Energy Board.* CCRE.

Wayland, M. (2021, January 28). *General Motors plans to exclusively offer electric vehicles by 2035*. Retrieved from https://www.cnbc.com/2021/01/28/general-motors-plans-to-exclusively-offer-electric-vehicles-by-2035.html

White, A. (2021, February 20). *Here Are All the Promises Automakers Have Made about Electric Cars*. Retrieved from https://www.caranddriver.com/news/g35562831/ev-plans-automakers-timeline/

Appendix 2 - List of Recommendations

Governance recommendations

Recommendation ES-1: The energy planning framework should mitigate government risks by ensuring transparency and accountability in the processes and roles.

Recommendation ES-2: Ontario needs a transparent, accountable and effective long-term energy planning framework to develop reliable and affordable energy infrastructure.

Recommendation ES-5: Using an IESO "Living Plan" approach, supported by the OEB's participation and annual reporting against the Government's Policy Priorities could require minimal change to existing roles, create negligible burden to planning timelines, and provide the accountability required to bolster the process.

Policy priority recommendations

Recommendation ES-4: Policy Priorities should establish goals and objectives for such areas as: total cost to ratepayers; emission reductions; job creation; GDP; energy security; and other government policy objectives such as roles for indigenous peoples.

Recommendation P1: Planners require a clear mandate to independently identify and explore emerging risks and their implications for Ontario's energy system and government established Policy Priorities.

Recommendation P2: Policy Priorities must recognize that climate action is driving an indisputable and significant need for electrification that must be included in Ontario's energy plan.

Recommendation P3: Policy Priorities should recognize the need for integrated planning across electricity, natural gas, hydrogen and biomass economies as emerging technology innovations could affect the need for capacity buildout.

Recommendation P4: Sustaining system reliability through the energy transition warrants planning now for the future.

- ***Recommendation P4-1:*** Long-term procurement planning should place a policy priority on acquiring non-emitting resources.
- ***Recommendation P4-2:*** Policy Priorities should consider carbon pricing under the EPS be applied to natural gas fired generation in a manner similar to the OBPS, including any future contractual arrangements with existing assets that arise from IESOs resource acquisition strategy.
- ***Recommendation P4-3:*** System planning should be based on a strategically-driven timeline to 2050 in order to minimize the system reliability risks of a capacity shortfall.

Recommendation P5: A new resource acquisition planning framework should prioritize a "low system cost" approach while concurrently addressing the evolving nature of demand, including regional needs.

- ***Recommendation P5-1:*** Planning for new resource acquisitions must consider the cost implications and benefits of integrated bulk, regional, and local solutions.

Recommendation P6: Optimizing the economic benefits of leveraging infrastructure investments should be included in Policy Priorities and applied to the IESO's procurement process.

- ***Recommendation P6-1:*** The energy planning framework should consider using infrastructure development tools for public-private partnerships to minimize and share costs and risks in new low carbon infrastructure like nuclear generation.

Recommendation ES-3: Government should provide clear, transparent, non-prescriptive Policy Priorities than can be planned for and are sufficiently measurable to support accountability.

Implementation Recommendations

Recommendation ES-6: Procurements for low emission baseload should start now.

Recommendation I1 – Ontario should not be unnecessarily exposed to the risk of having inadequate electricity resources as it should not take the IESO four years to prepare a procurement process.

Recommendation I2 – Specifying Ontario's demand needs—baseload and intermediate—is the solution that allows the province to act both early and prudently to satisfy its future energy requirements.

Recommendation I3 – The IESO should create near-term dates to kick start the paradigm shift for procuring Ontario's energy needs by 2022.

Appendix 3 - Summary of Responses to Posed Questions

1. *"How can we promote transparency, accountability and effectiveness of energy planning and decision-making under a new planning framework?"*

   A *living plan* approach will promote transparency, accountability, and effectiveness through the provision of Policy Priorities of government, stakeholder engagement, and IESO and OEB annual reporting. OEB inputs to this process will promote accountability of planning to ratepayer interests, and reports to government of planning efficacy will increase transparency and increase the likelihood of effective and evidence-based planning in the broader interests of Ontarians.

2. *"What overarching goals and objectives should be recognized in a renewed planning framework?"*
   Assuring adherence to the principles of transparency, accountability and agency independence should be at the core of the new framework in order for it to be effective. The new planning framework must recognize and seek to mitigate the numerous novel risks facing the energy system and ultimately government: the pressure to address climate change; the complex energy transition; electricity supply reliability challenges including energy security; higher costs to ratepayers; and the emerging fiscal challenges post-COVID-19. These goals should be captured by whole of government Policy Priorities for energy planning and may include others.

3. *What respective roles should each of the Government, IESO, and the OEB hold in energy decision-making and long-term planning?*
   Government should set broad Policy Priorities for planning. IESO should create a *living plan* to meet these priorities in consultation with stakeholders, including the OEB. The OEB should provide inputs to the planning process, and report on the efficacy of IESO's proposed plans in light of the Policy Priorities as well as on the implications of those plans on ratepayers, taxpayers, and sector viability.

4. *"What kinds of decisions should be made by technical planners at the IESO and the OEB as regulators?*
   The IESO should lay out the process and criteria for defining and procuring adequate supply. OEB to not have decision-making powers over planning but should be accountable for advising on the compliance of the IESO's plans with regards to the relevant Policy Priorities.

5. *"What types of decisions should require government direction or approval?"*
   Government must set the Policy Priorities that will define the parameters and objectives for planning that the IESO and OEB can then use to guide their respective mandated activities. The approval signing authority for procurements that commit the province to expenditures above a set threshold best resides with the government.

6. *"Are there gaps in the IESO and the OEB's mandates and objectives that limit their ability to effectively lead long-term planning?"*

   The use of non-transparent or overly prescriptive Government Directives, limit the IESO's ability to utilize its independent expertise and provide effective planning.

   The overall planning process has no mechanism that links accountability to the interests of ratepayers and the financial viability of the sector. The OEB provides an accountability measure, only "after" implementation plans are proposed by regulated entities. This creates economic/business

uncertainty for utilities/generators that need stability and certainty in the regulatory environment to support their own planning exercises. The delayed review also impacts on the OEB mandate to balance ratepayer interests against the need to ensure the viability of the sector.

Bulk system resource acquisitions outside of the OEB regulated entities lack mechanisms linking decision accountability to ratepayer interests and investor risks.

Rate-setting is performed by both the OEB and the government. Rates set by government, such as the ICI and Net Metering programs, currently have no accountability links to the OEB for assessing ratepayer interests. The Electricity Act does not require the IESO to consider consumer impacts, including the possible transfer of risks between categories of ratepayers or between ratepayers and taxpayers.

After-the-fact accountability: Existing accountability measures do not address outcomes until public awareness has grown, usually several years after the decisions are made.

7. *"Should certain planning processes or decisions by the IESO, the OEB, or the government receive additional scrutiny, for example through legislative oversight or review by an expert committee?"*
   The planning process is well suited to be formulated under a *living plan* model. Participation of the OEB and publicly released annual reports by both the IESO and the OEB should remove the need for any legislative oversight or review by expert committees. With overall performance benchmarks determined by suitably expressed Policy Priorities, existing governance frameworks should suffice.

8. *"How often and in what form should government provide policy guidance and direction to facilitate effective long-term energy planning?"*
   The government should provide policy guidance to IESO in terms of broad, measurable Policy Priorities informed by discussions with all areas of government, and encompassing the public good objectives of energy planning. This is best done early in the term of a new government to provide as stable an environment for planners and investors as possible. Updates can follow whenever the outcomes of the annual OEB and IESO reports warrant the government to consider revisions of is Policy Priorities. With the publicly formalized expression of Policy Priorities in a document such as "The Long-Term Energy Planning Policy Priorities", there may be no need for a separate government authored LTEP beyond ongoing approvals of the APO.

9. *"How do we ensure effective and meaningful Indigenous participation in energy sector decision-making?"*
   Objectives regarding indigenous engagement should be included in the government's Policy Priorities and affirmatively enabling their participation in the *living plan*.

Appendix 4 - Detailed Background on Broad Policy Priorities and Business Models

The following is extracted with minor updates from previous submission to the MENDM.

When looking to the long term, any actions that are taken in the electricity sector should look to maximize the benefit to Ontario of the resulting energy infrastructure initiatives. Options should seek to enable opportunities that leverage creative funding solutions and Federal funding support, thereby minimizing the outlay from the province or rate payers. Recommended areas for consideration include optimizing the economic outcomes from plans to meet Ontario's energy needs; and, seeking leverage of federal program funding where synergistic policy objectives may exist.

1) Optimize the implementation benefits when preparing to meet Ontario's longer-term future electricity demand
   Current investment decisions in Ontario's electricity sector are driven by the cost of purchasing the required resource with a focus on the cheapest option. While this is an important criterion, it presents a significant risk for Ontario's long-term energy cost and security and its climate objectives. Several factors critical to mitigating this risk are not currently being considered by the IESO. For example, the IESO's Market Renewal Program is currently focused on procuring natural gas generation to meet Ontario's electricity needs at the expense of important jobs in the province and tax revenues.

   Expenditures in Ontario's electricity infrastructure have significant impacts on all sectors of the economy and should not be undertaken without considering the driving economic factors such as domestic content, job creation, energy security and the environmental well-being of citizens.

   i) Domestic Content should be a Critical Element of any Provincial Electricity Plan
      According to an independent report by the Conference Board of Canada, Ontario Power Generation's $12.8 billion refurbishment of four reactors at the Darlington Nuclear Generating Station and subsequent 30 more years of operation are expected to generate a total of $89.9 billion in economic benefits to Ontario. Ninety-six percent of the project costs will be spent in Ontario and the project will rely heavily on Ontario-based contractors. This investment will also create 14,200 jobs per year and boost personal income by an average of $1.6 B annually.

      By comparison, studies have shown that natural gas-fired generation sends significant dollars out of Ontario and the jobs with it. About seventy percent of the natural gas Ontario consumes for electricity generation is currently supplied from shale reserves in the United States. This significant outflow of dollars, amounting to billions of dollars per year, would be better spent on investments in domestic electricity projects that keep the benefits in Ontario and help speed up the province's recovery from the Covid-19 pandemic.

   ii) Low-carbon, Energy Security is a competitive advantage for Ontario's Economic Future
      Significant finds of shale in the United States have lowered the cost of natural gas which in turn has driven up demand. As a result, more of this fossil fuel is being consumed by homes, electricity generators and industries in the U.S. The U.S. also has become a net exporter of this commodity to other parts of the world besides Canada. The upsurge in U.S. consumption has resulted in

delivery constraints due to pipeline infrastructure limitations in some parts of the country e.g. northeast region.

Natural gas consumption in the U.S. is forecast to continue to increase as their coal plants are shut down and these generators switch to this lower carbon emitting fossil fuel. System planners around the Great Lakes region, including Ontario's IESO, have identified this increasing reliance on natural gas as a reliability risk given existing pipeline constraints, especially during extreme cold weather events. As an example, Ontario ran out of natural gas during the last Polar Vortex.

Natural gas is a commodity that Ontario competes for in a North American market with multiple jurisdictions in the U.S where consumption has been increasing significantly. This presents two risks: availability and price volatility. The recent extreme weather event in Texas saw gas prices rise on Ontario. In an extreme, widespread weather event Ontario's electricity sector could expect to see its natural gas supply curtailed. Furthermore, the State of Michigan is currently considering closing the pipeline that provide Ontario and Quebec with its oil for refining gasoline.

The price volatility of natural gas is a risk Ontario's IESO has been tracking over the past two decades.

iii) More natural gas generation means more carbon emissions

The IESOs emissions forecast shows that 30% of the emission savings Ontario has achieved from shuttering the coal plants will be lost when the Pickering Nuclear Generating Station is retired, and its capacity is replaced by natural gas. The 6 Mt increase in emissions by 2025 will make it significantly more challenging for the province to meet its Made-in-Ontario 2030 climate targets.

This makes re-evaluating the ongoing investments in new natural gas-fired generation infrastructure even more relevant. As previously noted, imports of U.S. shale gas send economic wealth out of the province and negatively impact Ontario's energy security, trade balance, jobs and emission levels. For these reasons, Ontario should transparently assess the costs and benefits of building new gas-fired generation and delivery infrastructure.

2) Work with the federal government to re-direct resources to energy infrastructure projects that improve Ontario's economic competitiveness.
New nuclear and biomass are two opportunities that could provide substantial economic and environmental benefits to Ontario, including thousands of new jobs, more low-carbon electricity and greater energy security.

a) Build new nuclear
There is a clear need for Ontario to secure 2000 MW of new baseload supply which could be met by a new nuclear facility when the current gas generation contracts expire in 2029. Ontario Power Generation has a CNSC approved site at Darlington that can accommodate a new nuclear investment with minimal site preparation delays.

The PWU recognizes the funding constraints that governments are facing and the views of ratepayers regarding any further rate increases. The PWU has advocated for the development of new and creative business models to support future investments in nuclear energy. Some new models suggest that a new CANDU plant at OPG's Darlington site could be delivered with private

funding thereby reducing risk to government and ratepayers. As the Conference Board of Canada's assessment of the Darlington refurbishment program has shown, this retains domestic content and secures low-cost, low carbon electricity for the long-term. Analyses also show that it is a cost-effective and reliable way to reduce emissions compared to other options. It would also build international confidence in Canada's nuclear technologies in support of export opportunities to other countries. Building new nuclear can also be accomplished in time to meet Ontario's electricity needs when the existing contracts for gas generation expire and without negatively impacting the refurbishment programs at the Darlington and Bruce Nuclear Stations.

Several studies of Ontario's future supply mix options point to a nuclear enabled solution as the low-cost option that will provide Ontario with electricity rates that will represent a competitive advantage for the province in the Great Lakes region. With expanded use of natural gas for baseload, Ontario will be more expensive.

b) Ontario's Biomass Resources in Northwestern Ontario.
Several independent analyses confirm the availability of significant supplies of renewable, carbon-neutral biomass—wastes from forestry harvesting and processing—are available in Northwestern Ontario. The 200 MW Atikokan Generating Station is fueled by these processed wastes in the form of wood pellets that are manufactured nearby. The plant provides dispatchable power to the grid and is potentially capable of supplying heat for residential and commercial consumers. These would include food production, e.g. greenhouses, and wood pellet production for local use and for export.

Investments that expand existing biomass supply infrastructure in the region would enhance energy security in the area and effectively eliminate the need to import natural gas generated electricity from Southern Ontario. Most importantly these kinds of investments would secure existing and create new employment and business opportunities for local, Indigenous and Metis communities.

Appendix 2 - Ontario Needs Better Planning to Avoid an Electricity System Crisis

Power Workers' Union, March 2024

The PWU is launching a series of papers to prompt discussion on better ways for Ontario to meet its growing electricity demand in a lower cost, lower carbon, and more reliable, affordable and timely manner.

Introduction

The evident, worsening consequences of climate change is creating a global consensus on the urgent need to achieve a net zero economy by 2050. Electrification of the economy, including the creation of a low-carbon electricity grid, is universally considered to be a critical prerequisite for achieving net zero. The Power Workers' Union (PWU) believes that Ontario's current planning approach to the province's electricity system is one of the major barriers that must be addressed. Ontario's current approach focuses on the near-term with "just in time" solutions that are based on flawed modelling, incomplete forecast analyses, and that require overly complex and costly system integration. As a result, Ontarians will be unnecessarily exposed to both significant reliability threats, i.e., increasing likelihood of brownouts and affordability risks.[84]

A Recognized Need for More Low-Carbon Electricity

Ontario's *Powering Ontario's Growth (POG)* report laid out a pathway to ensure Ontario has the energy needed to power economic growth and electrification over the next three decades while maintaining its clean electricity advantage. Ontarians are increasingly recognizing that the transition to an affordable and reliable net zero energy system is a significant undertaking and that achieving this outcome has become more urgent. For example, the 2023 theme at the Ontario Energy Association/Association of Power Producers of Ontario's (OEA/APPrO) conference was *Taking Action: Driving Ontario's Energy Transition*. There was an evident consensus among the attendees that Ontario has enough information to start deciding on known technologies given the rapidly emerging supply gap. Also evident was the shared consensus that it will be better for Ontario to overshoot its capacity needs rather than face reliability risks caused by supply shortages.

The Growing Risk of Brownouts

However, these shared concerns directly clash with the more conservative approach recently expressed by Ontario's Independent Electricity System Operator (IESO) to keep Ontario's "*options open without getting ahead of demand*". [85] The PWU believes that this conservative view has resulted in the IESO under-forecasting demand, underestimating the required infrastructure build and the lead time that it would require, and not procuring enough supply. With this approach, several independent analyses suggest that Ontario will experience brownouts before the end of this decade.[86]

Ontario urgently needs to accelerate building the scale of low-carbon infrastructure on a timeline that meets the province's long-term resource requirements. The POG and the recent Electrification and Energy Transition Panel (EETP) report lay out strategic imperatives for proactively planning Ontario's

[84] PWU submissions to the MENDM, 2021, IESO Preliminary APO Jan 2024, and IESO LT2 RFP Jan 2024.
[85] Keynote address by L. Gallinger, CEO of the IESO, at the Ontario Energy Network (OEN) February 2024.
[86] Strategic Policy Economics, Electrification Pathways for Ontario, 2021.

electricity system which are not being adequately addressed by the IESO's annual planning and resource acquisition approach.

The Government has Directed Actions to Power Ontario's Growth

In 2021, the IESO, at the direction of the government, developed its *Pathways to Decarbonization Report (P2D), the findings of which were embraced by* Ontario's *POG* report. The *POG* report emphasized the need for Ontario to address an anticipated greater than doubling of Ontario's electricity demand by 2050 amidst the concurrent retirement of 20 GW of supply. The Minister of Energy stated that the POG "*lays out the plan to provide … the reliable, low-cost, and clean power we need to power Ontario's growth*." The Minister further stated that "*in the near-term natural gas generation will continue to … to maintain system reliability and support electrification across our economy.*"

The *POG* outlined several actions to secure Ontario's energy future including many to enable and advance long-lead time, low-carbon, long-life electricity system assets, which the Ministry directed the IESO to act on:[87]

Ministry of Energy Directed Actions in Powering Ontario's Growth Report	
Long Lead Asset Development	**Initiatives for Reliability Risk Mitigation**
Advance new nuclear • Pre-development work on SMRs at Darlington, large scale nuclear at Bruce, and of refurbishing Pickering • Assess potential future nuclear generation facilities to meet P2D forecast demand Designing future competitive procurements for: • Resources with long lead times and long lifespans, such as long-duration storage, and hydroelectric generation; • Commercial options for new nuclear generation Planning for the transmission required to support the POG-identified generation projects, including new nuclear and hydroelectric opportunities; Addressing known transmission bottlenecks between northern and southern Ontario and within the Greater Toronto Area to unlock opportunities for new nuclear and hydroelectric.	Designing future competitive procurements for new clean resources including wind, solar, hydroelectric, storage and bioenergy. Supporting the development of local markets for distributed energy resources (DERs) Support a future energy efficiency framework and path forward for Conservation and Demand Management (CDM) programming post-2024. Accelerating the development of new transmission infrastructure in Northern Ontario, the Ottawa Region and Eastern Ontario

The PWU contends that the IESO's approach to resource adequacy will not facilitate these options without additional proactive government direction and, in fact, impedes making these infrastructure decisions.

The EETP Recommended a More Proactive and Accountable Approach to Energy Transition Planning

The EETP laid out a context and qualitative narrative for Ontario's decision-makers emphasizing the need for proactive actions necessary to achieve a NZ economy. Much of the EETP's narrative aligns with PWU

[87] Minister of Energy Letter to the IESO, Jul 10, 2023.

recommendations provided in 2021 to the Ontario Ministry of Energy and Northern Development and Mines (MENDM).[88]

The EETP characterized the challenge as a "*multi-decade social, economic, and political process*" that requires "*Establishing a government-wide commitment to develop a clean energy economy by 2050*." To this end, the EETP report not only identified the need for integrated energy planning but that a: "*transformed planning process will deliver certainty and predictability to align actors across the energy sector*" and not stray from the *"imperative to ensure an affordable and reliable supply of energy."*

The EETP also suggested that "*when planning and making decisions, government and all sector entities should justify how current decisions align with the long-term commitment to a clean energy economy by 2050*." The EETP report additionally states that*: "government must put in place robust governance and accountability mechanisms that encourage iterative planning, measurement, verification and tracking of progress*." To this point, the PWU has repeatedly noted the absence of cost accountability in Ontario's energy planning process. As such, the PWU applauds the EETP's recommendation that the OEB provide a regular procedural review of IESO-led planning and procurement as an additional accountability mechanism.

The EETP report advised that navigating the energy transition *"requires strategic foresight"* and *"perhaps most importantly, a long-term perspective to maximize policy clarity in line with long-term investment cycles*."

Most importantly, the EETP report stated that: "*the risk-return balance between proactive build-out of energy infrastructure and reactive energy planning has shifted. Energy planning must work proactively to ensure that adequate, affordable, and reliable supply is available in a timely manner ….*" The EETP emphasizes the importance of shifting to a more proactive planning regime as *"A key factor in attracting investment and enabling economic development is access to energy where and when it is needed*." This shift towards proactive planning is consistent with the themes of the OEA/APPrO conference discussions mentioned earlier and is in stark contrast to the IESO's approach.

Unfortunately, the EETP report does not specifically define the:

- Steps and reforms that could enable the urgent action that the EETP calls for;
- Criteria to guide decision-making during the process; nor,
- Demand growth and inherent risks presented by the pace of electrification and guidance for securing reliability and affordability.

The PWU contends that the short-term planning horizon inherent in the IESO's Resource Adequacy Framework[89] and conservative demand forecasting not only puts Ontario at risk of losing its status as a low carbon electricity system, but even more importantly, at risk of sustained energy shortages.

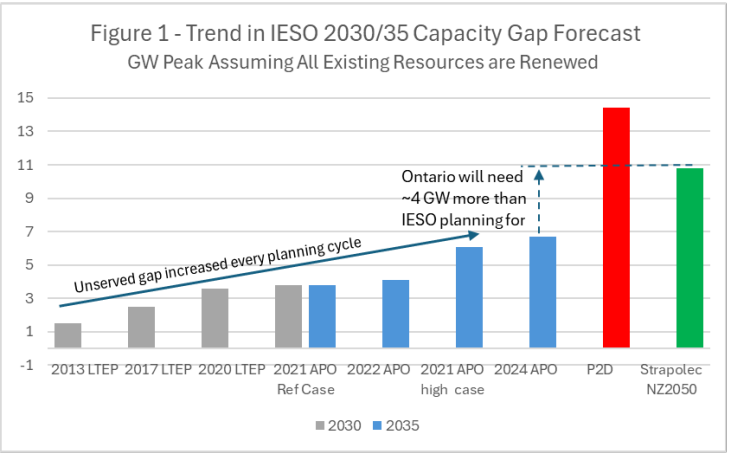
At Odds with the POG/EETP, IESO's Conservative and Legacy Practices are Exposing Ontario to Risk

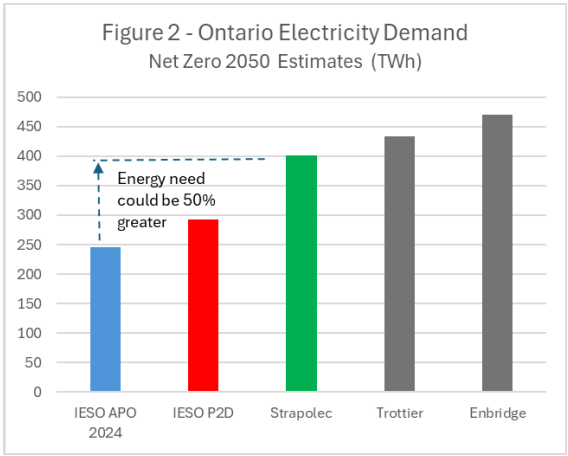
[88] PWU submission to the MENDM, May, 2021; Green Ribbon Panel, 2021.
[89] Comments made during the March 21 IESO Strategic Advisory Committee (SAC) meeting.

The IESO's conservative, not proactive, approach to planning and its focus on making use of its ill-matched administered markets mechanisms are introducing reliability, affordability and deliverability risks.

Reliability Risks

Even though its *P2D* report has informed the *POG* report, the IESO insists it was just an analysis and is not using it to inform its electricity planning efforts. In contrast, the IESO's 2024 Annual Power Outlook (APO) provides a conservatively low demand forecast for Ontario. In fact, since 2013 the IESO's conservative approach to demand forecasting has led it to successively realize greater and greater capacity risks for the 2030-2035 timeframe, while losing time to develop the necessary assets, as shown in Figure 1. This trend can be expected to continue as the IESO's demand forecast remains below the consensus opinion of the needs resulting from decarbonizing the economy as shown in Figure 2. [90] For example, the IESO's 2024 APO, which underpins its current planned procurement activities, does not consider the large impact of heating electrification. Ignoring such factors complicates and delays the procurement of the resources Ontario needs. In several submissions to the IESO, the PWU has recommended that the IESO undertake a risk informed forecast and resource planning and procurement approach that will consider higher electricity demand drivers. This would better address the recent findings of Ontario's EETP and, more specifically, its recommendation regarding "timely, available supply".





The PWU has also noted that the IESO's procurement approach inadequately matches supply to demand and will under-procure in meeting its own forecast.[91] These observed risks are now acknowledged in the IESO's 2024 APO which further indicates that the mitigation may be the life extension of Ontario's cost-regulated Lennox thermal generating station. The PWU agrees with this contingency but further notes

[90] Sources for Ontario demand in a Net Zero economy include: Strategic Policy Economics (Strapolec), "Electrification Pathways for Ontario", 2021; Institute de L'energie Trottier, "Horizon 2060, Canadian Energy Outlook", 2021 (Trottier); and, Guidehouse for Enbridge Gas, "Pathways To Net Zero Emissions For Ontario", 2022 (Enbridge). These differ primarily with hydrogen assumptions. The P2D report assumed no electrolytic hydrogen production in Ontario.

[91] PWU submission to IESO on its LT2 RFP, Jan 2024. IESO published expedited LT RFP results, Sept 2024.

that it acknowledges how the IESO's market-based procurement approach has not and will not meet Ontario's needs and will require government directives to compensate for that failure.[92]

Affordability Risks

The IESO's current procurement approach creates several unmitigated affordability risks.

Many key Ontario energy stakeholders have advised the IESO that its markets-based approach for the procurement of long-term, low-carbon energy resources presents unnecessary risks and includes poorly designed cost evaluation criteria.[93] In spite of these valid criticisms, the IESO has asked the Ontario government to approve its approach. Multiple PWU submissions to the IESO have consistently advised that procuring intermittent supplies based on levelized costs absent market impacts could result in supply mix outcomes at three times the costs, including unanticipated stranded costs. Additionally, the IESO's proposed procurement criteria do not capture the significant socio-economic and energy security implications for taxpayers. This ignores the EETP's recommendation regarding the need to balance the roles of ratepayers and taxpayers.

Many stakeholders, such as municipal councils, have also expressed concerns about other risks associated with the IESO's procurement approach, particularly as it relates to new gas-fired generation and even the storage alternative. The IESO may be overly relying on developers to advance public engagement while the EETP has recommended improved integrated planning.

Deliverability Risks

Meeting Ontario's electricity needs requires decision-making and investments from multiple players – government, local community, indigenous people and the electricity sector, including distributors, transmitters and generators. The IESO's regional planning process has been bringing these players together. However, the IESO's regional and bulk system planning processes are several years out of synch with their own APO demand forecasts. This misalignment creates risks that are evidenced in the IESO's recurring annual upward adjustments to its long-term demand forecast. These misalignments predictably undermine the multi-year bulk system studies that must address Ontario's delivery development challenge and the policy imperative to manage Ontario's "transition off natural gas". The consequence is inadequate guidance for the development of the delivery infrastructure needed to power Ontario's growth and the alternatives to mitigate the associated risks.

***A Preventable Supply Crisis* - Advancing Ontario's Policy and Planning Gaps to Achieve NZ by 2050**

Ontario's current approach to planning and procuring critical long-term, low-carbon electricity resources needs significant changes and additional policy direction. The above noted risks are evident and pressing. The PWU will be releasing three papers in the coming months to broaden the discussion of the improvements required to Ontario's approach to system planning and to shed light on alternatives to risk

[92] An assessment of Ontario's electricity market structure and how they are ill-suited to procuring the non-emitting resources the provinces needs is provided in the Strategic Policy Economics 2019 report, "Electricity Markets in Ontario".
[93] IESO LT2 RFP webinar, Feb 2024.

mitigation and the accelerated decision-making required to secure new reliable and affordable, low-carbon, long-life energy assets.

The first paper in the series of three will further explore the identified reliability risks and mitigation options, including: high fidelity temporal modeling for identifying viable supply mix options; implications of interjurisdictional interconnections; available processes to optimize resource development timelines; and, acceleration of the development of reliable long-lived low-carbon assets.

The second paper will explore the aforenoted affordability risks and explore others associated with accountability gaps, the efficacy of Ontario's IESO administered electricity markets, the IESO's timeline for procuring medium and long-term low-carbon resources, and the effectiveness of regional planning.

The final paper will examine the deliverability risks facing the above-mentioned Ontario's transmission and distribution systems development challenges, including the integrated delivery of electricity, natural gas and hydrogen. This will include the mitigation options for building out distribution and transmission system capacity required to meet the pace of electrification technology adoption, such as moderating demand growth and leveraging the value of behind the meter distributed energy resources (DERs) and rate programs.

Closing

For over seventy years, the men and women of the PWU have been critical to keeping the province's lights on. The PWU remains a strong supporter and advocate for the prudent and rational reform of Ontario's electricity sector and recognizes the importance of planning for low-cost, low-carbon energy solutions to enhance the competitiveness of Ontario's economy. The PWU has a successful track record working with other energy stakeholders to strengthen and modernize Ontario's electricity system. The PWU is committed to the following principles: Create opportunities for sustainable, high-pay, high-skill jobs; ensure reliable, affordable, environmentally responsible electricity; build economic growth for Ontario's communities; and, promote intelligent reform of Ontario's energy policy.

Appendix 3 - Mitigating Ontario's Electricity System Reliability Risks Requires A New Planning Approach

Power Workers' Union, May 2024

This is the second in a series of four papers by the PWU that is intended to prompt discussion about better ways for Ontario to meet its growing electricity demand at a lower cost, with lower carbon emissions and in a more reliable, affordable and timely manner.

The PWU's first paper described how Ontario's current planning approach for its electricity system is a major barrier to reliably and affordably electrifying the province's economy. Additionally, a better planning approach is a critical prerequisite for achieving net zero (NZ). This paper focuses on the inherent reliability risks associated with Ontario's current planning approach including: the underpinning conservative demand forecasts; inadequate consideration of the true needs of the province's electricity system; and, the challenges associated with ensuring the timely development of the needed supply directed by the Ministry of Energy. Mitigating these risks requires a radical rethink of Ontario's current electricity system planning approach.

Ontario's Electricity Policy Guidance Provides Clear Direction

The province's "*Powering Ontario's Growth (POG) Report*" laid out a pathway for securing the energy needed to power economic growth and electrification over the next three decades while maintaining its clean electricity advantage. The Minister of Energy continues to emphasise the need to double Ontario's electricity supply by 2050 while ensuring that the system will "*meet demand at any time*".

The recent "*Electrification and Energy Transition Panel (EETP) Report*" states that*: "Ontario's energy governance entities must show thought leadership and embrace the challenges and opportunities of electrification and the energy transition"* ... with ... *"reasonable risk-taking"* ... to ... *"enable private actors to make innovative investments that are aligned with the clean energy economy objective, while protecting consumers, maintaining affordability and bolstering reliability."*

The POG Report also states the need for the government to make better evidence-based and informed decisions. However, this requires transparent and full guidance to developers on the electricity demand to be met. While IESO staff verbally acknowledge the need to address electrification and the 2050 NZ objective [94], the IESO's primary planning guidance material, the *2024 Annual Planning Outlook (APO)*, fails to do so.

There are material consequences associated with underestimating demand growth from Ontario's energy transition. A lack of adequate power resources in other jurisdictions is deterring economic investments.[95] Ontario's supply risks are as real and severe. This paper highlights the failure of Ontario's current planning process to realistically convey an accurate forecast of the province's electricity needs to decision makers.

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[94] IESO remarks at Toronto Regional Plan webinar, Apr 16, 2024.

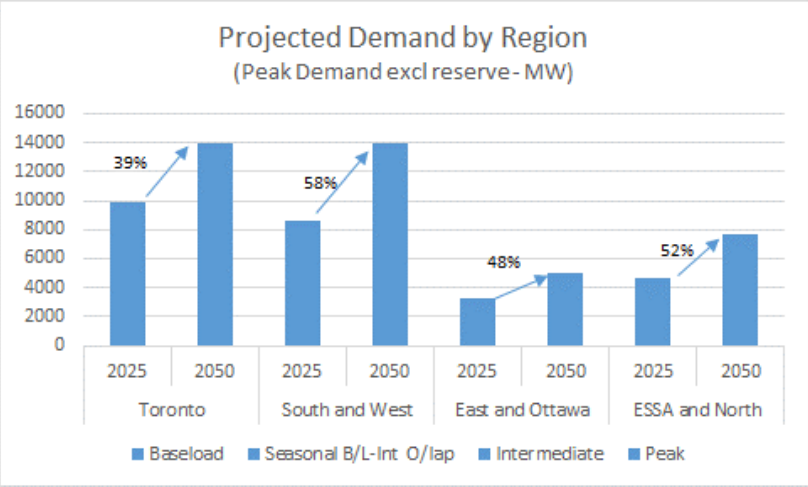
[95] British Columba and Quebec have been declining data centre and other connection requests due to anticipated supply shortage risks. https://www.nationalobserver.com/2024/02/06/news/bc-hydro-power-crypto-mining-company, https://news.gov.bc.ca/releases/2024EMLI0018-000470. Quebec is prioritizing connection opportunities that are the most economically beneficial. Quebec authorizes nearly 1,000 megawatts of electricity for 11 industrial projects, November 11, 2023 - CTV News.

1 – Emerging risks are concealed in the IESO's 2024 APO conservatively, low demand forecast

The IESO's "*Annual Planning Outlook (APO)"* is the guiding planning document for its bulk system development and procurement activities. The PWU's first paper contrasted the substantially lower 2024 APO demand forecast to consensus opinion of other widely supported forecasts for achieving a NZ Ontario economy. Specifically, the APO's projected 60% energy growth and 40% capacity growth is less than half the respective growth identified by other stakeholder developed Net Zero forecasts for the province. This stems from the IESO basing its 2024 APO demand development on "*all firm/known policies, industrial projects, the Industrial Conservation Initiative and federal EV targets for 2035 at the time of development*".[96] Additional electrification trends were not included in developing the forecast. A notable example is the demand from data centres, which is based on year-old March 2023 information.[97] Since the 2024 APO reflects much higher demand than was considered for the near term in the Pathways to Decarbonization Study (P2D) and approximately the same demand as the P2D summer forecast may suggest to readers that the APO has considered fuller electrification of the economy. However, this could be misleading to decision makers. While the 2024 APO has adequately modelled the electrification implications from light duty transportation vehicles,[98] it has omitted several significant factors. For example, the 2024 APO considers only about 22% of the electrification of Ontario's heavy-duty transportation fleet, ignores most of the electrification of heating, and excludes all but token amounts of electrolytic hydrogen production – all critical elements of achieving a NZ economy.

Finally, the comparative results to the P2D are almost exclusively due to approximately 3 GW of industrial demand growth in the Southwest and Northern regions of Ontario. This industrial growth would need to be added to the P2D forecast to allow a fair comparison. Figure 1 shows how growth in peak demand (e.g. capacity needs) in the West and North regions exceeds 50%, where industrial growth is predicted, and is less than 40% in Toronto where industrial growth is absent.

Figure 1 – Regional Demand Growth Highlights Absence of APO Electrification Assumptions



[96] IESO 2024 APO Webinar, April 2024.
[97] Stated during the IESO April 23, 2024, APO webinar.
[98] The 2024 APO demand projections for transportation align closely with the Green Ribbon Panel 2021 report assumptions for light duty vehicles and 20% of heavy-duty vehicles.

By comparison, the IESO has adopted a demand forecast by the City of Toronto in the IESO's regional plan, that projects almost 60% summer capacity growth and over 65% winter capacity growth. It is laudable that these demand forecasts by the City of Toronto have taken a risk-informed approach. This provides a base case that reflects a probabilistic estimate of demand scenarios and also a further high case demand scenario for additional guidance. The IESO openly acknowledged that it anticipates its demand forecast will rise over the next year as they "*gain learnings*".[99] This reinforces the likely continuation of the trend of increasing capacity shortfalls in the IESO's annual planning efforts that the PWU introduced in the first paper of this series. To mitigate this trend, a risk-informed approach to resource adequacy has been previously recommended.[100]

The PWU has consistently advised the IESO to align its demand assumptions for regional planning with its APO.[101] Over the last few years, there has been a notable lag between the regional planning assumptions and the increasing demand forecast of each APO release. This increases the risks that regional plans may be significantly underestimating the infrastructure requirements of Ontario's bulk electricity system. The assumptions in the City of Toronto's regional plan are now out of sync with the APO by reflecting the more appropriate higher implications of electrification on the demand forecast, underscoring the risks that the APO represents to the bulk system transmission planning efforts that the Ministry has directed the IESO to undertake. **The PWU recommends that the IESO better align its assumptions for its internal planning activities and more fully consider the implications of electrifying Ontario's economy in its plans underway in 2024**.

2 - The risks in Ontario's near-term resource acquisition approach are amplified by the conservative APO demand forecast.

The reliability of Ontario's electricity system is also dependent upon the province's approach for securing the necessary supply. The IESO has a four-pronged resource adequacy framework (RAF): three mechanisms managed by the IESO; and, a government-directed bilateral negotiated contracts mechanism.[102] The IESO's three mechanisms include: Capacity Auctions that offer 1 year supply commitments; Medium Term (MT) procurements consisting of a Request for Proposal (RFP) process for re-securing existing resources with 5 year operating commitments; and Long-Term (LT) procurements addressing needs 5 years out with 20+ year commitments. It is notable that most of Ontario's supply has been secured under government directed bilateral contracts and this will continue given the POG-based nuclear and hydro directives. The IESO has currently completed its procurement mechanisms for the periods up to 2029, although the results of its LT1 RFP process have not yet been made public.

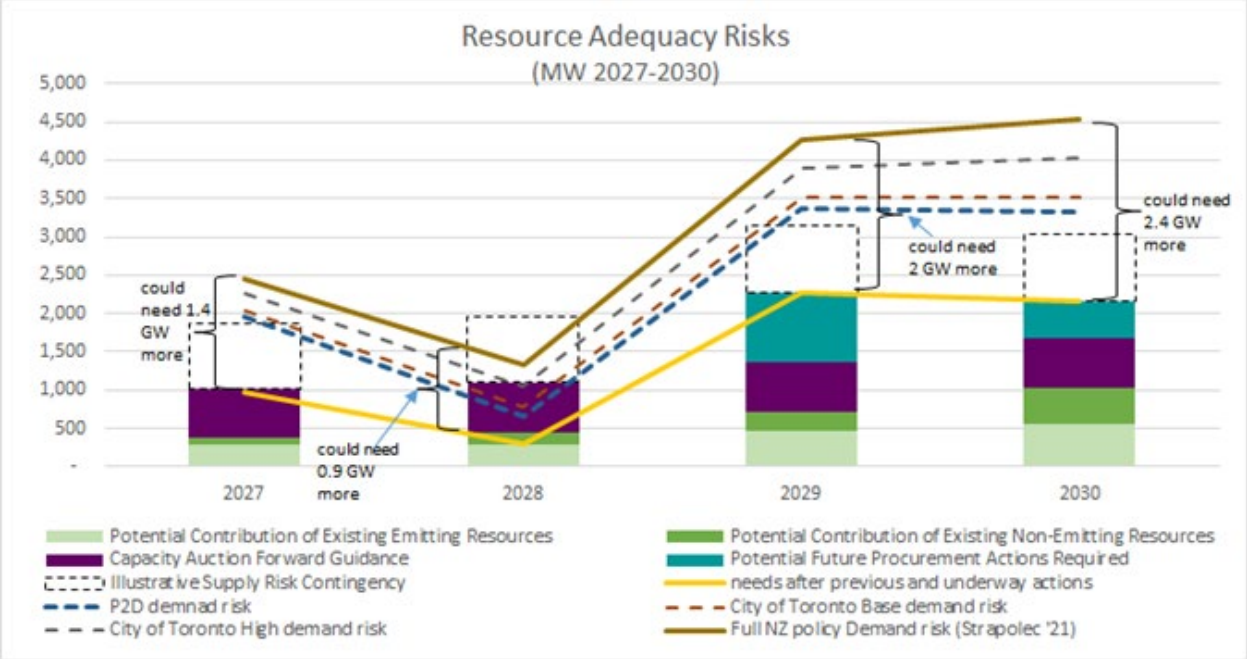
In comparison to its overall conservative demand forecasting approach, the IESO's APO reflects some aggressive assumptions on resource availability. The APO assumes continued participation growth in the Industrial Conservation Initiative (ICI) and the Capacity Auction. The ICI is more likely

[99] IESO remarks during the 2024 APO Webinar held Apr 23, 2024.
[100] PWU submissions to the IESO's Resource Adequacy consultations, 2019-2021; GRP, 2021; Strapolec, 2021.
[101] PWU submissions to the IESO regional and bulk system planning efforts from 2021 to 2023.
[102] IESO RAF is summarized in IESO Update to Government, Dec, 2023, "Evaluating Procurement Options for Supply Adequacy." RAF also includes programs not explicitly addressed by this paper.

to see declines as the projected Hourly Ontario Electricity Price (HOEP) will devalue the benefit to ICI participants. While recent Capacity Auctions have achieved the projected outcomes, they rely on gas-fired generation and imports from the U.S. and Quebec. These resources may not be available in the future as the IESO converts resources to longer term frameworks and demand in neighboring jurisdictions grows, limiting their export capability.

The combined consequences of the near-term demand and supply risks are illustrated in Figure 2 showing that Ontario could face a near-term reliability risk of a 3 GW resource shortfall by 2030.[103] If this shortfall occurs, Ontario could face brownouts in the late 2020s. In its 2024 APO the IESO indicated that extending the operation of the aging, 2 GW Lennox facility could provide a possible future risk mitigation. This would still leave a 1 GW shortfall that can be exacerbated by new demand, e.g., a new Honda battery plant in Alliston.[104] The IESO has likely run out of time to begin procuring to mitigate the risks of this shortage.

Figure 2 – Potential Risk Consequences of the APO's Demand/Supply Assumptions



Recommendation 23 in the EETP's Report stated that: … "*the ministry should: Reflect in planning, policy-making and direction to the IESO and the OEB that in the rapid shift to electrification and the transformation toward a clean energy economy the risk-return balance between proactive build-out of energy infrastructure and reactive planning has shifted*." **The PWU recommends that the IESO conduct a risk-informed demand and supply forecast and that the OEB's new planning oversight role recommended by the EETP include an assessment of the appropriateness of any chosen risk-informed approach.**

[103] Solid bars from 2024 APO, lines and notes reflect Strapolec analysis. The 3 GW includes the shown 2.4 addition and the 600 MW of Potential Future Procurement Actions identified in the 2024 APO.
[104] https://news.ontario.ca/en/release/1004485/honda-to-build-canadas-first-comprehensive-electric-vehicle-supply-chain-creating-thousands-of-new-jobs-in-ontario.

3 - The current long-term procurement focuses on energy supply post 2030; however, its misaligned performance criteria will not mitigate Ontario's risk of an energy shortfall.

The APO identifies three LT procurements under development: LT2 for 2030 supply; LT3 for 2032 supply; and LT4 for 2034 supply. The IESO is currently developing the LT2 RFP with the stated objective of addressing a 5 TWh unserved energy need.

The approach to the LT2 RFP has several weaknesses that will inhibit the acquisition of the supply needed to address Ontario's energy shortfall:[105]

- While the stated purpose of the LT2 RFP is to address "unserved energy", no explicit definition of that term is provided in the LT2 RFP materials. As well, the conditions under which the energy is to be supplied by the generation being procured is not provided;
- The LT2 RFP is seeking to procure 2000 MW of installed capacity to provide the 5 TWh of energy required, with a strong bias to securing renewables. The subsequent LT3 and LT4 RFPs are currently defined to target an additional 1.5 GW each. Together, these measures will not meet the stated needs; and,
- The LT2 RFP's five-year development time and rated non-curtailed cost of energy criteria favours independent wind and solar solutions, which cannot meet the unserved energy requirement.

The energy shortfall is defined in the 2024 APO as shown in the extracted figures below. It is noteworthy that the energy shortfall is expected to be present only 45% of the time by 2035, even less frequently in 2030. The estimated unserved energy in 2030 by Time of Use (TOU) periods shows a significant energy shortfall in winter and for the On- and Mid-peak periods in summer. Solar cannot contribute to the winter shortfall, even though the LT2 RFP criteria heavily favours solar solutions. Wind cannot supply the on-peak energy in summer. Furthermore, the 2030 peak needs of 6771 MW are much higher than the 2000 MW being procured.

Figure 3 – APO Exhibits for Unserved Energy

Figure 20 | Unserved Energy Duration Curve (As Is Case)

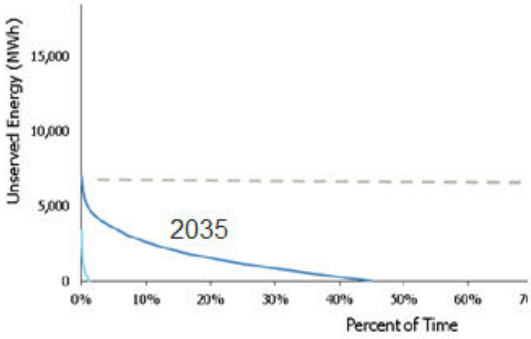


Figure 13| Total GWh Unserved Energy by TOU periods (High Nuclear Case)

	Winter			Summer			Shoulder		Annual
Year	On-Peak	Mid-Peak	Off-Peak	On-Peak	Mid-Peak	Off-Peak	Mid-Peak	Off-Peak	Total
2025	2	2	2	1	2	5	45	16	74
2030	1,016	1,025	987	856	1,106	289	585	118	5,981

Figure 17 | Max MWh Unserved Energy by TOU periods (High Nuclear Case)

	Winter			Summer			Shoulder		Annual
Year	On-Peak	Mid-Peak	Off-Peak	On-Peak	Mid-Peak	Off-Peak	Mid-Peak	Off-Peak	Max
2025	809	935	407	405	537	2,087	3,358	3,098	3,358
2030	5,348	5,587	5,359	6,771	6,684	3,751	4,535	3,747	6,771

Most importantly, analyses show that the wind resources required to supply the 5 TWh of unserved energy at the times of the energy shortfall would require closer to 10 GW of wind resources, plus additional solar resources for summer which would still be unable to address the peak needs. The APO acknowledges the risk of misalignment between renewables resources and the stated energy shortfall but offers no solutions other than an extension of the operating life of the Lennox facility

[105] PWU submissions to the IESO on its LT2 RFP design, January and February, 2024.

and to revisit any shortfalls in future APOs [at the cost of a one-year delay]. There is no alignment between stated objective for the RFP to address the unserved energy and the LT2 RFP approach for securing renewables solutions. The PWU believes that this misalignment results in decision-makers, investors and the public being mis-informed about the true procurement objectives.

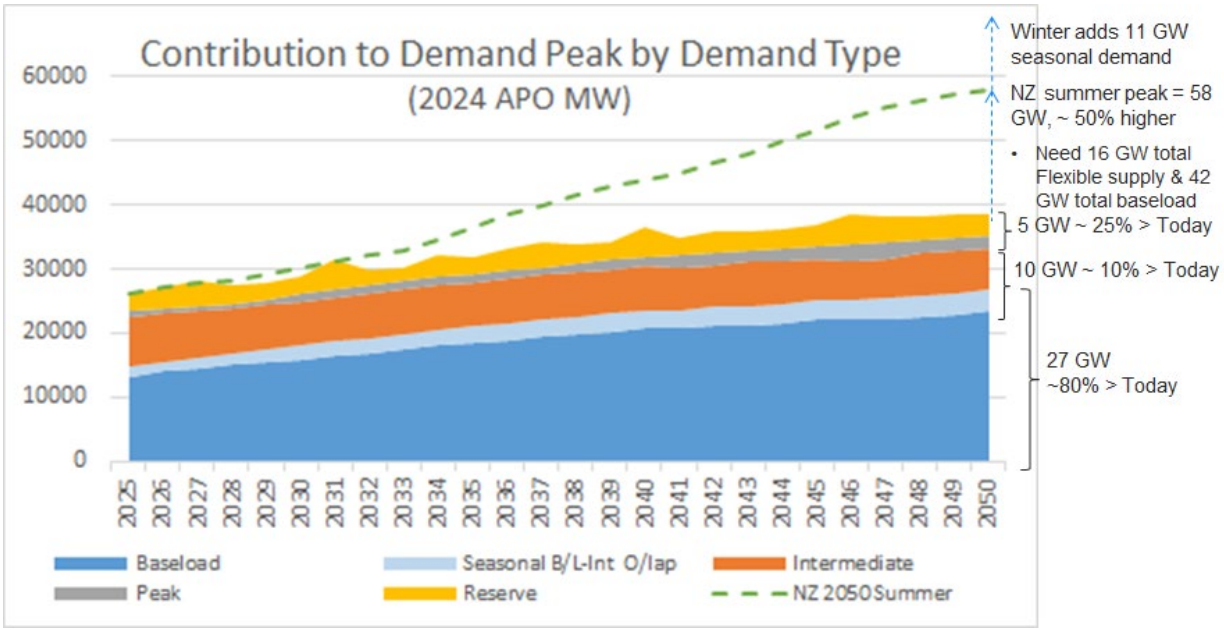
Proper specifications of the emerging system needs and the rating criteria for compliance is required in the IESO's procurement materials to ensure the reliability of the system.

Part of the IESO's challenge in developing these RFPs is due to its bias for using administered markets in procuring Ontario's needed energy resources. Numerous analyses show that electricity markets are ill-suited for procuring the non-emitting resources required to meet Ontario's supply mix requirements and that a different approach is warranted.[106] Ontario's resource adequacy needs would be better met by resource procurements that align with the province's growing baseload demand.

4 - The resource adequacy framework for procuring resources does not align with the needs of Ontario's electricity system, notwithstanding the POG directives.

Demand will be growing faster than the APO has planned and creating both supply gap risks and a "dirtier" electricity system. Ontario's electricity demand includes baseload, intermediate, and peak/reserve characteristics [See Appendix A for definitions]. Demand is best not viewed by capacity and energy terms. Based on a detailed hourly forecast by year from the 2024 APO, Figure 4 illustrates the evolving needs of Ontario's electricity system by the aforenoted types of demand.

Figure 4 – Evolving Nature of Demand Reflected in the 2024 APO



[106] Strategic Policy Economics, "Electricity Markets in Ontario", 2019.

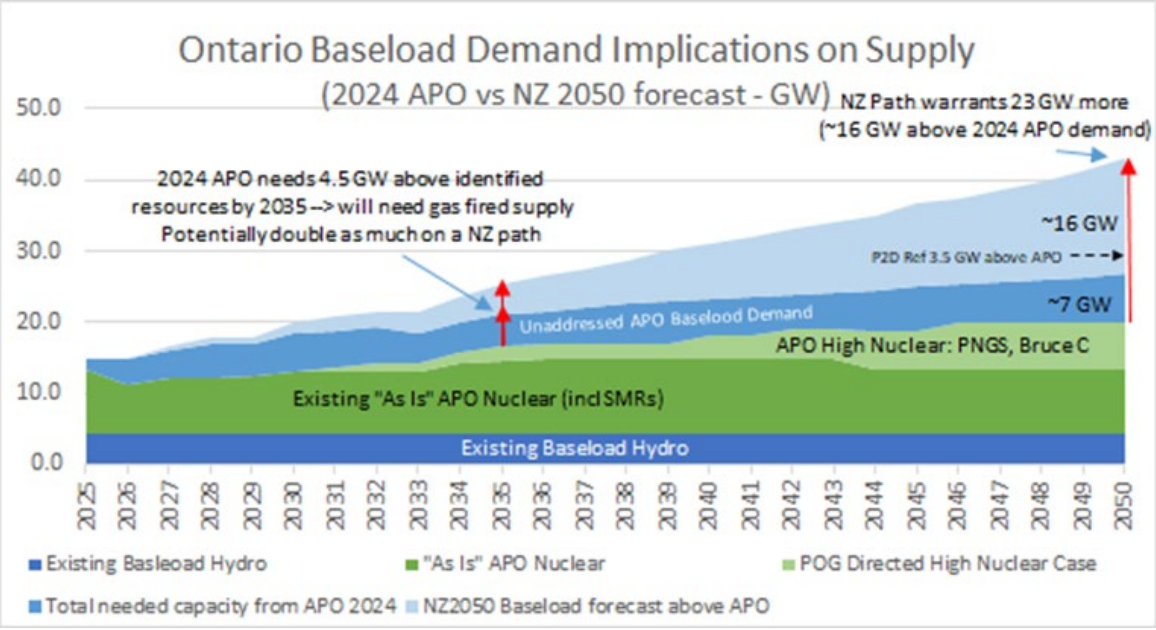
Most of the growth is for new baseload demand with only modest growth for intermediate and peaking/reserve supplies. The APO assumption of substantial demand side management (DSM), such as managed EV charging profiles that move demand from peak hours into off-peak hours, provides one reason for this growth in demand for baseload supplies. It is worth noting that Ontario already has ~ 13.5 GW of flexible supply. Renewing the existing natural gas, bioenergy, hydropower and battery resources would almost be sufficient to meet the intermediate, peak and reserve capacity needs in 2050, according to the 2024 APO. Furthermore, the LT1 RFP objectives to secure 2500 MW of new capacity may close any remaining gap, even for the NZ 2050 forecast.

As a result, Ontario's most urgent need is to secure baseload resources as Ontario's existing gas-fired fleet is best suited to meet on-going system intermediate and peak/reserve needs. The IESO's current approach to procure capacity and unserved energy on the margin relies upon the existing fossil fleet to provide the required baseload energy – this increases emissions from Ontario's electricity sector. **The IESO should be procuring for baseload supply not additional flexible resources, beginning now with the LT2 RFP.**

The P2D report recognized the importance of new baseload supplies and identified a need for over 18 GW of new baseload supply by 2050[107] and a "no-regrets" recommendation that hydroelectric and nuclear options be evaluated. As a result, the POG has directed procuring additional SMRs, the refurbishment of Pickering and an assessment of the need for additional units at Bruce Nuclear Complex — all of which are now reflected in the 2024 APO high nuclear scenario.

Figure 5 illustrates the outcome of these directives in the context of the baseload demand defined by the APO, a Net Zero scenario and the P2D identified potential for new nuclear and hydropower.

Figure 5 – Ontario's Growing Need for New Baseload Supply



[107] Including both new nuclear and new hydro.

According to the APO forecast, by 2035 Ontario needs 4.5 GW additional baseload over the APO's high nuclear supply case and 7 GW by 2050. Given the lengthy nuclear and hydroelectric baseload resource development timelines, the near-term emergence of a sustained 4.5 GW of new baseload demand can only be supplied with gas-fired facilities - a challenge given recent public objections. This is more challenging for the NZ forecast as there may be insufficient time to develop even gas-fired generation. Additionally, relying on baseload natural gas generation to support Ontario's new storage fleet will increase both emissions and cost. **Ontario requires a transparent transition strategy for non-emitting baseload resources required to displace the use of gas-fired generation, while mitigating the risks of stranding assets acquired to address near term risks.**

While renewables solutions to the baseload challenge could reduce the emissions from a full natural gas-fired option, analyses show it would require, for example, an integrated solution of 12 GW of wind, 3 GW of natural gas-fired generation and 3 GW of 24 hour storage – four times as much new capacity to be sited and an additional incremental amount of transmission.[108] Even then, 30% of the emissions would still remain.

Given the forecast baseload needs associated with a NZ scenario, the viability of developing 23 GW of new hydro and nuclear facilities by 2050 will be challenging to say the least. It is clearly evident that Ontario will need to continue operating a significant natural gas-fired fleet at high operating factors well past 2050. This problem will persist as the IESO has not reframed its procurement approach and / or demand forecasting methodologies despite the substantial advice it has received beginning in 2019.[109] **Ontario is best served by accelerating the procurement of non-emitting, long-economic life resources, e.g. nuclear, for reliable and affordable baseload.**

As well, the IESO's response to the Environment and Climate Change Canada (ECCC) draft Clean Electricity Regulation (CER) understates Ontario's continued reliance on natural gas-fired generation.[110] The IESO's recommended 30-year end of life provision will see most gas facilities retired by 2045, 10 years later than the ECCC's preference, but potentially 10 years sooner than Ontario will need. The IESO's conservative demand forecasting approach effectively misinforms policy makers on the urgency needed to address Ontario's NZ electrification challenge.

The IESO should develop a reliability-risk-informed, long-term demand forecast with horizons that encompass anticipated development timelines for the large-scale bulk system resources e.g., nuclear. Two key criteria would include: IESO compliance with the North American Electricity Reliability Corporation's (NERC) Loss of Load Expectation (LOLE) requirement of no more than 0.1 days per year; and, full and appropriate consideration of the future demand risks associated with electrification as identified by the consensus opinions of aforenoted reports. The recent Cost-Effective Energy Pathways Study received by the Ministry of Energy in December 2023, but not yet publicly disclosed, may be a valuable reference.

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[108] High fidelity system models are required to analyse these implications as described in the PWU's November 2023 submission to the ECCC on the CER.

[109] PWU submissions to the IESO's Resource Adequacy consultations, 2019-2021; PWU submission to the MENDM, May 2021; GRP, 2021; Strategic Policy Economics: "Electrification Pathways for Ontario", 2021 and "Electricity Markets in Ontario", 2019.

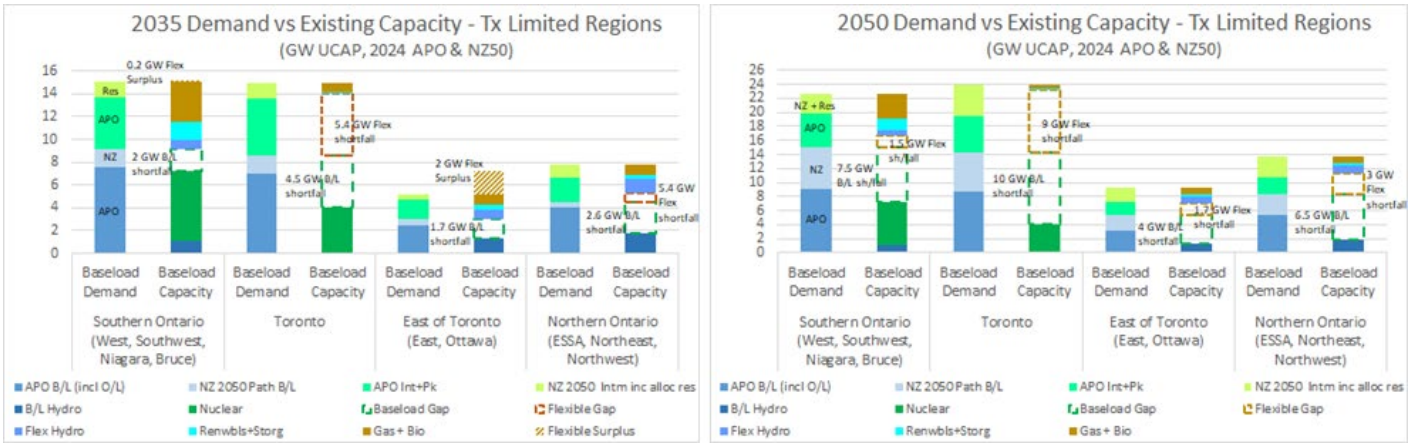
[110] P2D Report, 2022, Section Gas Moratorium, IESO submission to the ECCC on the CER, Nov 2023; IESO submission to the ECCC, March 2024.

5 - Zonal transmission interconnection constraints warrant consideration of regional reliability needs.

Ontario has been segmented into zones based on constraints in the transmission system that have evolved over time. The zonal demand implications for 2035 and 2050 are illustrated in Figure 6 in contrast to existing supply capacities.[111] This figure highlights the emerging regional needs for both flexible and baseload supply. A lack of flexible supply options is apparent, particularly for Toronto, in both the 2035 and 2050 forecasts, with flexible supply shortfalls identified in all zones by 2050.[112]

The apparent gaps in anticipated baseload supply across all zones in both 2035 and 2050 underscore the need for an Ontario baseload procurement strategy. There are no known options for supplying the regional baseload gaps in 2035. Even after including the 2 GW of refurbished Pickering nuclear reflected in the APO's high nuclear case, Toronto could face a baseload supply shortfall of 2.5 GW in 2035. With all zones forecast to have shortfalls and considering transmission system uncertainty, planning, development and timeline implications, new generation resources may best be prioritized for local supply within each region. Meeting Toronto's need requires the development of new generation resources, either within Toronto or in neighbouring zones that will already be baseload-supply-challenged. Transmission capacity around Toronto could be as high as 12 GW suggesting that there may be no limitation to supply options by 2035,[113] however there may be material restrictions by 2050 that could impact bulk system generation choices.

Figure 6 – Ontario Major Zonal Demand and Supply Balance Forecast



By 2050, even including the high nuclear case [not shown], Southern Ontario is forecast to be 3 GW short of baseload supply, Toronto 8 GW short and the expected 10.5 GW in the East and North are

[111] Based on APO zonal demand data and generating resource database. The generation resource database has been corrected for missing hydro data including Mattagami, some small hydro and an overall 5% gap scaled across all regions. The 2035 illustrated surplus east of Toronto is almost entirely due to the Lennox GS which is unlikely to be operating by 2035, given its age. For existing nuclear, Pickering excluded, SMRs included per IESO As Is case. High nuclear case not shown. Supply options do not reflect the unannounced outcomes of the LT1 RFP.

[112] Note that most flexible supplies will have come off contract by 2035 and so the illustrated flexible supply shortfalls underrepresent the procurement needs.

[113] IESO, Transmission System energy flow charts, 2018, which the IESO is no longer publishing; APO 2024: Ontario's Transmission Interfaces and Interties.

not addressed. These supply shortages present significant implications for the planning of the future bulk system. Given the transmission bottleneck in and around Toronto, the needs of the North could be best addressed by resources located in the North. Toronto's needs and those in the East may best be addressed by new baseload resources sited in the East. And finally, the needs of Southwest Ontario could require much more than the POG-identified Bruce C additions. Despite how location of new supply options will impact the long-term development of the bulk transmission system, the APO defers discussion on these matters.

Ontario needs a long-term baseload supply strategy in order to characterize the timing and resource location options and to better identify and inform the provincial bulk transmission system requirements definition.

Ontario's electricity system and its reliability are interconnected with neighbouring jurisdictions. Historically, Ontario has imported from Quebec in the summer and exported to Quebec in the winter. Recently, on average Ontario has exported electricity to the U.S. from the Southwest. However, forecasts indicate that all neighboring jurisdictions are experiencing their own supply challenges. Ontario should not be assuming electricity imports will be available to meet the province's needs before and beyond 2035. Alternatively, these shortfalls in neighboring jurisdictions could represent an economic opportunity for Ontario generators. **A more prudent electricity plan would address the downside risks and upside opportunities including how the emerging need in the U.S. may provide a risk mitigation against unintended generation surpluses in Ontario.**

Closing – *Ontario should identify and procure reasonably available, low carbon, cost-effective supply options by region*

This paper described the urgent need for Ontario to revise its electricity planning approach that better considers: the emerging demand from electrification; the associated risks of supply shortfalls; the significant growth in baseload demand; and, the integration of regional baseload needs into a provincial baseload resource plan. **There is minimal risk for Ontario to aggressively build out non-emitting baseload supply which may instead enable upside opportunities.**

The next discussion paper will explore the affordability risks presented by this new demand given Ontario's current procurement approach, including: gaps in accountability; the efficacy of Ontario's IESO administered electricity markets; the IESO's timeline for procuring medium and long-term low-carbon resources; and, the effectiveness of regional planning.

For over seventy years, the men and women of the PWU have played a critical role helping to keep the province's lights on. The PWU remains a strong supporter and advocate for the prudent and rational reform of Ontario's electricity sector and recognizes the importance of planning for low-cost, low-carbon energy solutions to enhance the competitiveness of Ontario's economy. The PWU has a successful track record working with other energy stakeholders to strengthen and modernize Ontario's electricity system. The PWU is committed to the following principles: Create opportunities for sustainable, high-pay, high-skill jobs; ensure reliable, affordable, environmentally responsible electricity; build economic growth for Ontario's communities; and, promote intelligent reform of Ontario's energy policy.

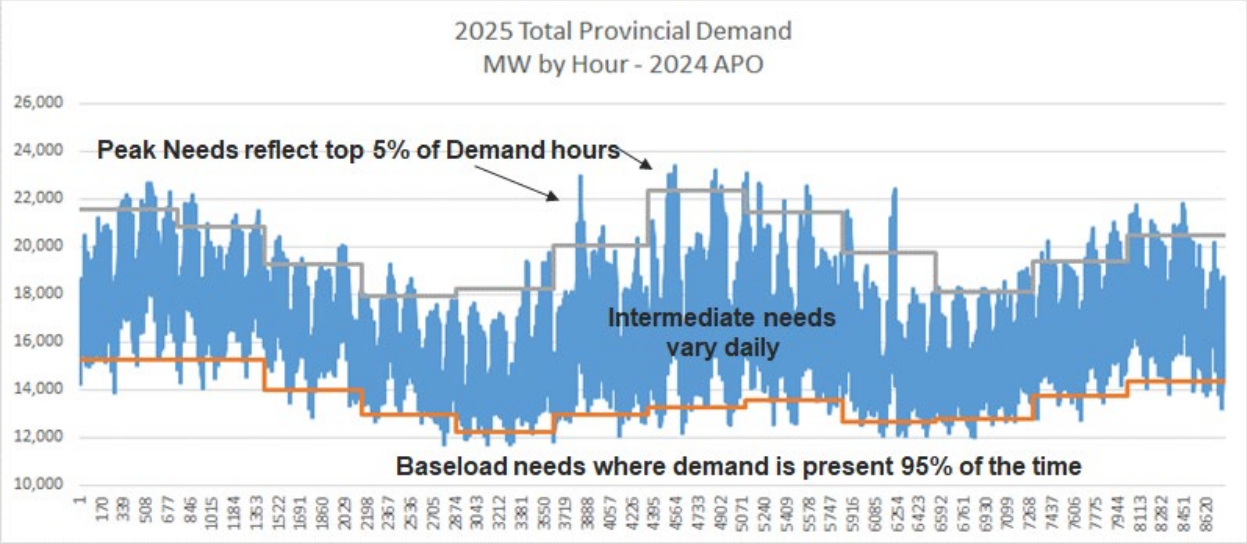
Appendix A – Definition of Demand Types

Demand consists of three types:

- Baseload demand is present 24x7, 365 days per year and in Ontario have been typically supplied by nuclear and hydro.
- Peak/Reserve demand arises rarely, substantially less than 5% of the time and is best served by classic peaking supplies e.g., natural gas, but now evolving to use more storage.
- Intermediate demand is the demand that varies on a daily, weekly and seasonal basis and has typically been served by flexible supplies such as hydro, storage and gas-fired generation. Demand Side Management (DSM) resources, such as bidirectional EV charging and building energy management systems help moderate the volatility associated with intermediate demand. The use of renewables requires integrated solutions that include all of the above resources to provide backup and help optimize output.

As part of the APO background materials, the IESO has provided the hourly demand forecast for every year up to 2050 and also by region.

The figure below illustrates the above definitions using the APO provided data for its 2025 forecast. **The PWU recommends that the IESO's procurement approach be based on detailed specifications and characteristics for procuring each demand type instead of using the abstract concepts of capacity and energy**.



Appendix 4 - Mitigating Affordability Risks to Ontario's Electricity System Requires Accountability

Power Workers' Union, May 2024

This is the third in a series of four papers by the PWU that is intended to prompt discussion about better ways for Ontario to meet its growing electricity demand at a lower cost, with lower carbon emissions and in a more reliable, affordable and timely manner.

The PWU's second paper described how systemic reliability risks require a radical rethink of Ontario's electricity system planning approach given its: conservative demand forecasts; low clarity on electricity system's needs; and unrealistic timelines for developing new supply. This paper focuses on how the lack of accountability for over-all affordability in Ontario's electricity system planning and procurement approach is driving up rate payer and taxpayer costs, neglects total system costs, ignores critical socio-economic impacts, and under values regional engagement.

Accountability for Affordability – a "top of mind priority for Ontarians" – is not reflected in Ontario's current electricity system planning approach.

The *Electrification and Energy Transition Panel (EETP)* Report devoted considerable attention to the subject of energy affordability, an important priority on the minds of consumers in this period of high inflation. The Panel's report noted that about half of Canadians (48 percent) are willing to pay more to fund the energy transition, but that number declines as the costs rise. The report also notes that "*Keeping costs low and any increases predictable will be crucial* ..." and that "*For large industrial consumers in particular, long-term certainty on electricity supply and pricing can be a key component in investment decision-making* ..." However, the EETP report did not address the critical issue of "accountability" for the "affordability" of addressing Ontario's energy needs. Furthermore, Ontario's Independent Electricity System Operator's (IESO) *2024 Annual Planning Outlook* is silent on the cost impacts of its demand forecast.[114] The PWU's 2021 government submission described the cost accountability gaps within the electricity sector.[115]

Prudent procurement of Ontario's needed electricity assets should transparently reflect the consequential impacts of cost, including total system cost, economic and social development, and regional needs.

1. The IESO's Markets-biased procurement approach and conservative demand forecasting are needlessly increasing Ontario's electricity costs.

Most of Ontario's supply mix continues to be procured in response to government directives as described in the PWU's first discussion paper. It could be argued that this is necessary given how inflexible and ill-suited IESO Resource Adequacy Framework (RAF) is for securing such assets. Effectively, the significant government role limits the IESO's accountabilities to a small, but critical share of new resource procurements. The IESO relies exclusively on its administered market mechanisms for securing these supply resources.

[114] The 2024 APO, page 15, states: "This document does not speculate on future supply mixes ... the diversity of [which] will directly impact ... marginal costs and emissions of the electricity system. As such, these system outcomes are not forecasted in this APO."

[115] PWU submission to the MENDM on Ontario's Long Term Planning Framework, 2021.

Besides flexible thermal plants e.g., gas-fired generation, analyses show that market-based procurement mechanisms for "capacity" and "energy" become vague concepts ill-suited for procuring the fixed cost, clean electricity generation relevant today. [116] In fact, the IESO's market-biased procurements negatively impact affordability and emissions.

The following section discusses three related topics:

- Recent procurements have driven up costs and will result in higher emissions;
- Affordability risks are arising with the development of IESO's LT2 RFP; and,
- IESO's go-forward approach will further propagate these risks.

1.1. Recent IESO procurements have driven up costs and will result in higher emissions

a) Rate payer costs are higher due to the IESO administered capacity style procurements.

Capacity-style procurements to serve Ontario's baseload demand needs, unnecessarily increase costs and the use of gas-fired generation. While the IESO's 2024 APO did not comment on the future trajectory of the Hourly Ontario Electricity Price (HOEP), the 2022 APO provided a schedule reflecting the influences of a rising carbon tax while natural gas generation is increasing on the margin. The IESO's 2022 APO forecasts the HOEP of $23/MWh in 2023 to triple to $69/MWh in 2043. **For the approximate 25 TWh increase in natural gas baseload production,[117] the higher HOEP could add $1B to Ontario's electricity system costs**. Analyses show that under supply constraints, the HOEP could increase significantly more. [118] The impact on Ontario's industrial competitiveness would be severe given the value erosion in the Industrial Conservation Initiative (ICI) program. This could potentially triple the industrial cost of electricity.

b) *IESO's inadequate demand forecasting resulted in much higher capacity costs*.

The IESO initially estimated that the capacity cost for the LT1 RFP would be $622/MW-business day. The RFP realized instead $1680/MW-business day for gas-fired generators. This compares to $425/MW-business day implied by the IESO in its costing assumptions for its 2024 APO.[119]

The IESO attributes the high LT1 RFP results to the shorter assumed operating life which was limited to 2040 due to assumptions about the Environment and Climate Change Canada (ECCC) Clean Electricity Regulation (CER). This shorter life assumption of 12 years instead of 20 stems from the IESO's under-forecasting of Ontario's supply needs. In its CER response to the provincial and federal governments, the IESO suggested that most gas plants could be retried before 2040.[120] This 40% shorter life means that rate payers will pay over 60% more for that

[116] Strategic Policy Economics, Electricity Markets in Ontario, 2019. Note market mechanisms could be relevant to the cost structures of biomass, hydrogen fueled generation and perhaps gas plants with CCS, but the vast difference in their costs and in other benefits that may arise due to new specified needs (e.g. emissions) undermine the efficacy and intent of the energy markets.
[117] Extrapolated from the emission projection provided by the IESO, Resource Adequacy Update, May 9, 2024.
[118] Dunsky, DER Potential Study, 2022; Strategic Policy Economics, Electricity Options Comparison, 2013.
[119] IESO, 2024 APO Resource Costs and Trends Module, which uses US NREL 2023 ATB benchmarks.
[120] IESO submission to the ECCC, March 15, 2024, requested a 30-year operating life gas-fired generation to avoid a 2035 unmitigable resource shortfall as most of Ontario's gas assets were built in the late 2000s.

capacity than they otherwise should in that time frame. Expecting rate payers to pay in the near term for future long term stranded costs is a comparable circumstance to the provincial government's recent override of the OEB's ruling on Enbridge's rate application.

Properly informing Ontario policy makers regarding the future demand risk may have enabled them to take a firmer position on the CER to enable a more affordable transition – the policy direction currently adopted by Ontario.[121] Other analysis suggests that there are no jurisdictions in Canada that can comply with the draft CER 2035 target date for a net zero electricity system.[122]

c) *The IESO's RFPs for storage capacity will lead to higher cost of energy and emissions*.

Storage is an example of a technological change where the benefits are undermined by market structures. Despite the false assertions that storage facilities can be charged during off-peak hours to benefit from Ontario's clean electricity supply mix,[123] the 2022 APO forecast gas-fired generation to be on the margin virtually all the time, even in off-peak hours. With the higher 2024 APO demand forecast and the additional demand risks, the second paper in this series described how gas-fired generation will remain on the margin well beyond 2050.

Given the minimum 15% losses involved in a battery/storage charge/discharge cycle, the cost of the energy output from a battery will be higher than the cost of the gas-fired generation used to charge it. This presents two consequences for dispatching battery output:

- Batteries will only be dispatched when any lower marginal cost generation is unavailable. This could relegate batteries to acting as reserve margin resources only, which does not materially help reduce the use of gas-fired generation.
- When dispatched, energy markets will award the 15% higher cost as an energy price premium to operating generation that is HOEP-reliant, directly providing an unearned financial benefit. For example, if batteries are operated 4 hours/day and 5 days a week, the 15% premium could add $75M/year of unplanned margins to gas-fired generators, a cost borne by rate payers. With energy markets subject to gaming over capacity availability, such a premium could provide a strong incentive to game.[124]

To the extent that storage is called upon frequently, the 15% premium increase in HOEP could further materially erode the benefits of the ICI and negatively impact Ontario's industrial electricity cost competitiveness with other jurisdictions.

d) *These costs will be incurred while emissions rise*.

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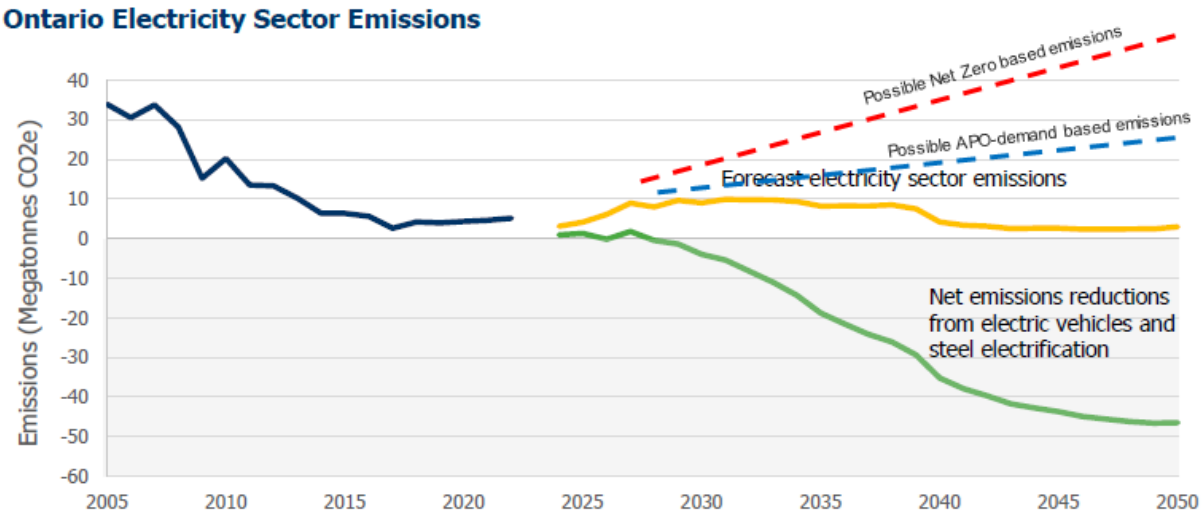
[121] Ontario's Powering Ontario's Growth report states: "*As a result, for the first time since 2005 Ontario's electricity demand is rising, and we know that to support this type of growth we need to ensure the continued availability of reliable, affordable, and clean energy. While we build the next phase of Ontario's electricity grid to reliably meet peak demand, in the near-term natural gas generation will continue to provide our province with an insurance policy to maintain system reliability and support electrification across our economy.*"
[122] PWU submission to the ECCC on the CER, November 2023.
[123] Ontario Newsroom, Ontario Completes Largest Battery Storage Procurement, Quick Facts, May 9, 2024.
[124] Alberta's big natural gas generators drive up electricity prices. The government is quietly changing that, The Narwhal, May 2, 2024.

Charging batteries with gas-fired generation will also result in 15% higher emissions compared to the direct use of that gas-fired generation. While the 2024 APO declined to discuss projected emissions implications, the IESO has since claimed that emissions from Ontario's future electricity system will decline to negligible levels by 2050 as shown below.[125]



In developing this forecast, the IESO assumed that the CER would prohibit gas-fired generation post 2040 and, as a result, other new resources will be secured as needed to meet system demands between now and 2050.[126] The IESO has not identified what these resources may be. The PWU's last discussion paper showed that with the 2024 APO demand, even under the high nuclear scenario, gas fired generation will remain on the margin for many decades and cause electricity system emissions to potentially approach 27 Mt.[127] Under a higher demand Net Zero forecast Ontario's emissions could triple.[128]

1.2. Further affordability risks arise with the IESO's LT2 RFP development

While the LT2 RFP purports to address a 5 TWh energy shortfall, the IESO's criteria suggest it is simply a renewables procurement disguised by market mechanism terms that only serve to increase costs to rate payers. Unnecessary costs to rate payers are manifesting in three ways:

a) The constrained timelines that the IESO is specifying limit available options and increase costs.

The IESO is planning a series of long-term procurements for new facilities with a requirement for commercial operation within 5 years of an RFP release. Only limited supply options may be viable with these development windows, e.g., wind, solar and storage, assuming siting is approved. The IESO has not provided justification for these timelines. These timelines

[125] IESO, Resource Adequacy Update, May 9, 2024.
[126] IESO submission to the ECCC regarding the CER updates, March 2024.
[127] At best, emissions would be no lower than 9 Mt assuming an extensive build out of renewables with a considerably higher overall electricity system cost.
[128] Strategic Policy Economics, Electrification Pathways for Ontario, 2021.

effectively eliminate large scale and long-lived bulk assets such as hydro and nuclear. Note that the IESO is now planning a separate longer lead time RFP for in service dates of 2034/35. [129]

b) IESO's newly developed Enhanced Power Purchase Agreement (E-PPA) revenue model is a higher cost solution without other benefits.

The IESO's E-PPA was not well received by many stakeholders as this new untried approach involved significant complexity, lack of clarity and unquantifiable risks.[130] Two examples of the risks are noteworthy: curtailments and settlements.

In response to stakeholder feedback, the IESO shifted the curtailment risk to rate payers by modifying the E-PPA design to guarantee that developers receive their revenue requirement. Rate payers will absorb the cost of any excess generation.

The same guarantee has been offered to address the uncertainties about the market price settlements process. Further appeasing developers, the E-PPA provides an upside should the hourly market revenues exceed their quoted price. This upside premium will come at a cost to rate payers. **The E-PPA design is a high-cost patch because the IESO's energy market mechanism is simply not suited for these types of resources.**

Yet, even with these modifications, the IESO's E-PPA design did not resolve stakeholder concerns prior to submitting its recommendation to government.[131]

Subsequently, the IESO stated that the *"E-PPA revenue model has been designed to facilitate (and incentivize) hybridization."* [132] This appears incongruous with current objectives given that during the LT2 RFP process, the IESO indicated that it was not seeking hybrid facilities and advised proponents that co-located generation and storage capabilities should be separately bid. At the IESO's May 23 Webinar, the IESO introduced yet another revision to its revenue model, the Protected E-PPA, to address the settlement risk, adding another layer of complexity – a patch on a patch.

c) Cost selection criteria do not reflect what rate payers will pay.

The RFP cost selection criteria will be based on the proponents proposed Levelized Cost of Electricity (LCOE). This is important for developers given their lack of control over the output from intermittent solar and wind resources being procured and precludes hybrid solutions for low-cost bids.

However, LCOEs do not reflect curtailment costs or the rate premium and therefore is not an appropriate mechanism for comparing different bids. Both of these factors can vary depending on the technology (e.g., wind vs solar) as well as geographical location.

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[129] IEO, Resource Adequacy Update, May 9, 2024; IESO LT2 RFP Webinar, May 23, 2024.
[130] Stakeholder feedback on the LT2 RFP design is available on the IESO's website.
[131] The IESO was obligated by a December 7, 2023 letter to provide a report to the Minister in February, 2024. The IESO informed stakeholders on March 19, 2024, that it was submitting its approach to government for approval, albeit recognizing that concerns remained.
[132] IESO Enhanced PPA Revenue Model Update Memorandum – March 28, 2024.

It is not clear how curtailments will impact on final costs. The second paper of this series showed that the forecast unserved energy in 2035 will be present for less than 43% of the time. This means that the output of any procured resources can only address that need for at most 43% of the time with much of that served with only at a small percentage of its capacity. The resulting cost to rate payers of supplying this unserved energy could potentially be more than 150% higher than the rated LCOE.

Furthermore, the PWU's LT2 RFP submission to the IESO noted that the procurement design could not address the stated unserved energy need and that there will be a capacity shortfall.[133] The IESO indicated on May 9, 2024, that it will now be seeking 500 to 1000 MW of new capacity by 2031 as well.[134]

The assumed operational profile of new resources and their alignment with other system supply and demand profiles warrants disclosure. **The IESO must be clear about how it will be using the procured resources and the reasonableness of the costs that will be incurred for rate payers.**[135] As it stands, the PWU sees no evidence supporting the cost effectiveness of the anticipated outcomes of the IESO's procurement approach.

All of these cost risks arise because the IESO's administered market procurement mechanism is not suitable for meeting Ontario's emerging baseload-heavy, non-emitting, fixed cost resource needs. A straight-forward procurement with a PPA would be less costly, entail no additional curtailment risks and allow for dispatch based on local electricity system needs, much like how most of Ontario's generation is operated today. **Ontario requires a cost-effective procurement approach that considers how electricity system needs and available technologies evolved.**

1.3. IESO's go-forward approach will further propagate these risks

Unfortunately, the IESO recently affirmed its intent to *"use this new model* [the E-PPA - NB] *as the foundation for other future energy procurements, alongside the capacity contract utilized in the LT1 RFP."*[136] The PWU reiterates shared-stakeholder concerns that this is an unproven model that attempts to shoehorn fixed cost assets into a capacity and energy markets framework.

Ontario needs a better planning and procurement approach to create a low-cost, low-carbon electricity system, including:

- **An accountability mechanism that requires the IESO to provide transparency and disclosure, in a manner that can be validated, on: how the system is expected to operate new resources; real system needs; and, the expected cost for meeting them**.
- **A procurement process for securing dispatchable power to provide either 24x7 baseload or intermediate flexible supply capable of supplying variable daily demand patterns**. This would make the costs of hybridization and other dispatchability needs explicit and transparent for RFP evaluation purposes.

[133] PWU submission to the IESO on the LT2 RFP design, Jan 2024.
[134] IESO, Resource Adequacy Update, May 9, 2024.
[135] PWU submission to the IESO on the LT2 RFP design, Jan 2024.
[136] IESO Enhanced PPA Revenue Model Update Memorandum – March 28, 2024.

2. The most affordable supply mix requires explicit consideration of total system cost

The challenges and cost risks identified emerge from inadequate specification of system needs. The PWU's previous paper argued that system needs should be specified in terms of baseload, intermediate and peak/reserve demand. This would provide a level playing field against which the total system cost of options can be compared.

The EETP report identified … "*a critical need for Ontario to develop a comprehensive energy transition policy vision"* and *"consider the generation, transmission, distribution, … that prioritizes affordability, reliability and economic development."*

Addressing affordability across this broad scope requires a procurement approach that considers two factors: (1) RFP rated criteria for all costs that will be borne by rate payers; and, (2) Planning for infrastructure to minimize the long-term costs.

2.1 Rated Criteria should Capture Full Costs to Rate Payers

The full costs of generation options include four material factors:

a) Component costs and their effective LCOE under Ontario operating conditions;
b) The total cost of the integrated system solution to supply the system demand;
c) Transmission system implications for connecting the resources; and,
d) Liabilities associated with decommissioning and waste management.

a) Given system conditions, it is inappropriate to compare options on component costs alone

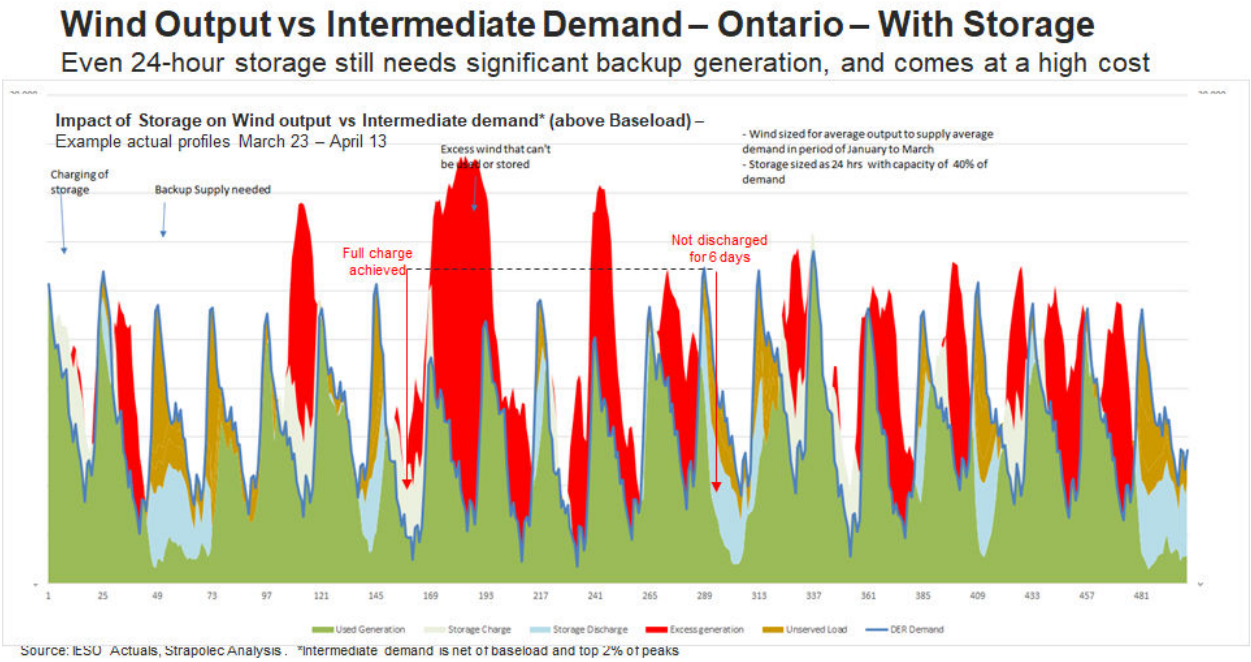
Assessing the fundamental costs of the technology options using LCOE alone as proposed in the LT2 RFP presumes an operating profile that does not impede or curtail other fixed cost assets, such as nuclear or hydro. For example, to incur no curtailment consequences from using the full output of wind resources, the output must only displace the potential use of less economic or otherwise desirable, variable generation e.g., gas-fired generation. For example, for this to be true in a baseload supply scenario: the installed wind capacity could not exceed the expected gas-fired generation used for baseload; the marginal wind cost would need to be less than the marginal gas costs; these economics would need to net out positive over the wind assets' entire economic life of 25-30 years; and the backup natural gas (or an equivalent) would need to be present until 2060. This is unrealistic, real system operations will have curtailments.

b) Solutions must be assessed on a total system cost basis, taking into consideration the lifetime operation profiles of the integrated energy resources required to meet demand.

The need to consider the total system costs is illustrated by the Figure below that compares the profile of actual wind generation in Ontario against a profile of intermediate demand.[137] Wind can be absent for several days, even at night. Wind can also generate significant output for substantial periods of time when generation is not needed, both during times of high and low

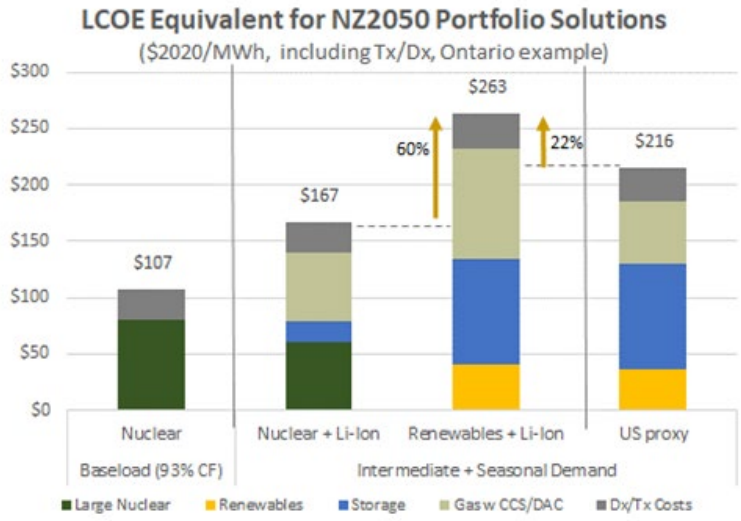
[137] Details provided in the PWU submission to the IESO on the LT2 RFP design, Jan 2024. Wind sized to match total output to total demand. Model includes substantial 24 hours of storage, capable of supplying 40% of the modeled peak demand. Even with this storage, substantial periods occur (indicated by the brown color), when unserved energy exists that must be supplied by flexible generation, presumable gas-fired.

demand. The effects can be moderated by storage, but even 24 hours of storage does not eliminate the need for gas-fired generation.[138]



When different technology options are assessed against the specified demand, e.g., baseload and/or intermediate, the full cost to rate payers becomes transparent. Ontario modeling results in the figure below show that integrated renewables solutions could be 60% more costly than nuclear based solutions even for meeting intermediate demand, not a traditional function for nuclear. Furthermore, intermittent renewables increase the need for flexible resources.

The IESO should use such modeling to inform decision makers and procurement plans.



[138] Note that the IESO has typically procured for 4 hours of storage capacity.

c) Transmission costs are impacted by the location and number of resources

Ontario's high voltage transmission network was initially developed to connect the province's population centers to its fossil, hydro, and nuclear generation. Similarly, the future expansion of this system is dependent upon the siting of new generation. Locating generation as close as possible to demand centers lowers transmission costs. With new supply connections, several factors materially impact on total costs.

- *Transmission is costly, approximating* $60/MWh for line lengths of 1500 km operated at full capacity.[139] While wind resources may have capacity factors of 40%,[140] much higher than today, for wind resources north of the Great Lakes that figured prominently in the IESO's Pathways to Decarbonization (P2D) report, the transmission costs to connect them could be $150/MWh – over three times the cost of the actual generation – significantly altering their economics.
- *Backup for renewables increases transmission circuit capability needs.* Renewable solutions require thermal/flexible backup and storage. If not co-located as hybrid solutions, three separate transmission circuits may be necessary, which increases costs. Furthermore, each of these resources and the transmission system will be operating at very low capacity factors as the resources take turns meeting demand. This drives up the cost of transmission assets.
- *Line losses.* Distances between the generation components may involve possible intervening Tx system constraints and line losses.

To optimize the affordability of Ontario's electricity system, the significant impacts of the cost of the transmission system must be reflected in the RFP rated criteria.

d) Cost liabilities for end-of-life decommissioning and waste management should be considered

The eventual cost of decommissioning should be considered. The liabilities associated with decommissioning and waste management are provided for nuclear generation, however, not for other resources. The unfunded decommissioning and waste management liabilities for wind, solar and batteries are becoming critical issues globally. Rate payers and taxpayers will ultimately be burdened with these currently unquantified and non-transparent costs.

2.2 Planning Infrastructure development to minimize long-term costs

Ontario's procurement approach to optimize affordability should include two considerations: The pace of development to minimize stranded assets; and, maximizing alternative supply options.

a) Optimizing the pace and scale of long-term infrastructure development

The EETP report identified that: "*... the necessary build-out of the electricity system is a highly complex undertaking that will need to be paced and balanced ...*" The PWU believes that the pace of infrastructure development should: be driven to optimize affordability in the long term;

[139] DeSantis et al., iScience 24, 103495, December 17, 2021.
[140] IESO, 2024 APO, Resource Costs and Trends.

consider long-term demand; and identify the lowest cost long-term infrastructure options that will meet it, particularly for the new, needed baseload supplies.

Consistent with this view, Ontario's Minister of Energy requested that the IESO develop long-term hydro and nuclear options and the associated transmission infrastructure supporting it. Achieving this requires the IESO to consider the higher demand case of a full Net Zero economy given the long timelines for developing these assets.

The PWU recommends that the most practical accelerated timelines for asset development be identified first and then establish the transition requirements for other resources based on those timelines. **The IESO role within its RAF should be to: cost effectively fill in the resource and infrastructure gaps while minimizing reliability and stranded asset risks; and, maximize leveraging of the existing bulk transmission system infrastructure as it is expanded to support the long term baseload resources**.

b) Enabling Maximum Supply Mix Diversity

Clearer specification of system requirements would surface procurement options for many diverse generation solutions, including geothermal, biomass, DERs, hydrogen and new emerging innovations, e.g., space based solar.[141] All of these options are presently precluded by the IESO's procurement approach. For example, the government recently authorized the renewal of operations at Atikokan, a facility that, despite being a flexible thermal generating station, is sufficiently dissimilar in cost structure and benefits to the IESO's markets-based procurement approach. Analyses have shown that ongoing Atikokan operations are an economic solution for the north, particularly when considering transmission costs.[142]

3. Socio-economic impacts should be included in new resource decisions

The PWU maintains that given the significant infrastructure investments required to develop the future electricity system, the selection criteria should not exclusively focus on the lowest total cost of supply, but also include the socioeconomic impacts of investment decisions.[143] The EETP report echoes these priorities:

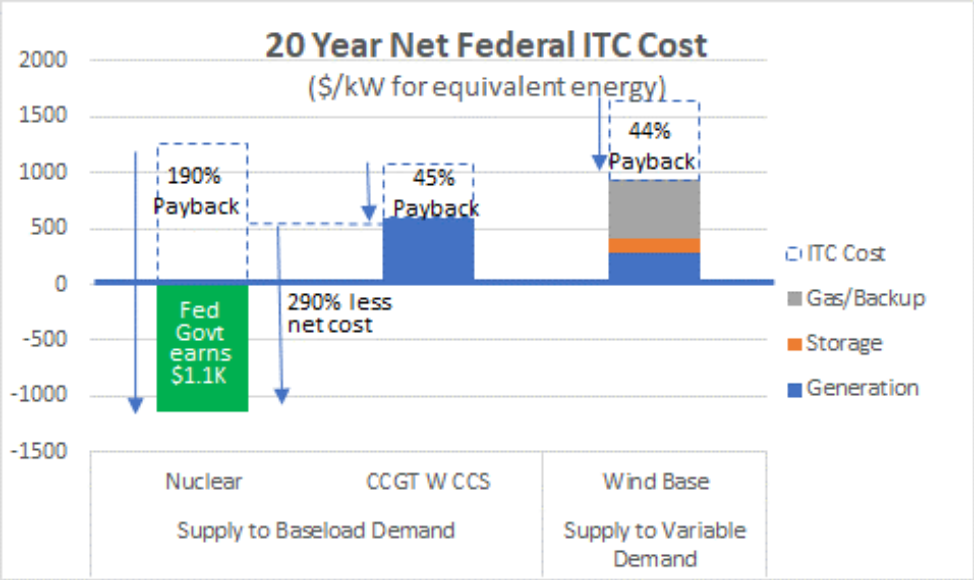
- Ratepayers cannot and should not be expected to be the sole funders of the transition;
- The province should consider shifting some of the cost to the tax base;
- Energy regulators are increasingly being asked to address a broader range of outcomes beyond price, cost, reliability, and quality of service;
- Focus on areas in which the province enjoys long-term competitive advantages relative to other jurisdictions, such as nuclear technology.

Besides enabling economic growth, electricity infrastructure investments generate increased tax revenues for government. These tax revenues could be considered as an opportunity to share costs

[141] Strategic Policy Economics, Electrification Pathways for Ontario , 2021, explores hydrogen innovations and optimal use of behind the meter DERs; DERs will be discussed further in the final PWU discussion paper, https://cleantechnica.com/2024/04/25/space-solar-power-is-happening-sooner-rather-than-later/.
[142] Strategic Policy Economics, Extending Atikokan Operations, 2021.
[143] PWU submission to the MEDNDM in Ontario's long term energy planning, 2021.

between taxpayers and rate payer. For example, the PWU's submission to Finance Canada showed that nuclear generation, due to its high GDP impact, best optimizes the net lifetime economic benefits of government financial supports for clean energy.[144] The incremental tax revenues over the life cycle represent a "payback" for financial supports like investment tax credits (ITCs). The Figure below shows that federal tax revenues from new nuclear generation more than cover the cost of ITCs. This is in contrast to alternative integrated solutions that pay back less than half. Different technology options could have significantly different and material economic benefits that directly affect the net combined cost to rate payers and taxpayers.

Procurement criteria should include the economic benefits from government tax revenues.



4. Reform Regional Planning to minimize costs of community awareness and engagement.

The government's mandating of local and indigenous support on all projects has helped advance needed resource procurements. Developers have worked responsibly and cooperatively to help the IESO identify ~3000 MW of new capacity at over 30 sites during three procurements. However, not all municipalities have been supportive of the types of projects being proposed by some developers e.g., municipal objections to new gas-fired generation and storage facilities. The IESO's E-LT1 RFP missed its procurement targets by 323 MW (over 20%) of mostly gas-fired facilities. The LT1 RFP missed its 2500 MW target by 300 MW (12%), including a 55% or 500MW shortfall in procuring targeted gas-fired generation.

Experience in the last decade suggests that the siting in Ontario of any kind of electricity infrastructure — new wind, solar, nuclear, transmission and hydro –can expect to face robust public opposition. As Ontario's demand ramps up, so will the need to procure ever greater amounts of new capacity, possibly about 40,000 MW by 2050.[145] This will exacerbate the critical requirement for a better process that helps accelerate decision making. Equally important is the need to maximize

[144] PWU submission to Finance Canada on the Fall Economic Statement Clean Tech Investment Tax Credit, January 2023; PWU Submission on 2023 Budget Investment Tax Credits to Finance Canada, Sept 8, 2023.
[145] Strategic Policy Economics, Electrification Pathways for Ontario, 2021.

positive cost-effective outcomes. Relying on developers to initiate and lead municipal approvals for new projects could face significant obstacles going forward.

The EETP report noted that: "*local governments want to play their role in addressing climate change, energy affordability and, by developing local energy sources, build community commitment. Establishing a strong link between local and municipal planning with regional and distribution sector energy planning has been a long-standing challenge."* The EETP report went on to provide several related recommendations:

- *Recommendation 7:* To ensure municipalities, communities, and local businesses … participate in energy decision-making and take responsibility …, the Ministry of Energy should develop a strengthened framework for local energy planning and decision-making …
- *Recommendation 16:* The Ministry of Energy, working with the OEB, IESO, LDCs, municipalities and gas utilities, should develop a … framework … for enhanced planning co-ordination at the bulk, regional, and distribution levels in order to effectively pace and facilitate the fuel-switching, system optimization and enhanced levels of energy efficiency …
- *Recommendation 26:* The government, IESO, and OEB should … ensure transparent access to high-quality information and meaningful opportunities to participate in decision-making … The EETP report further elaborated on need for: Helping customers; Preparing the public; Strengthening community input; Education initiatives; and Fostering community-level engagement.

Currently, the IESO and LDCs have regional planning processes that could be better leveraged by adopting the EETP Panel's above noted recommendations. This would help optimize informed engagement and decision making by:

- Ensuring that regional and provincial demand forecasts are available, aligned and reflect the magnitude of the anticipated demand growth required to achieve Net Zero.
- Helping local communities understand their needs and the implications of their choices on their own reliability, as well as the rest of the province. Discussion can be facilitated by defining Ontario's demand in terms of baseload, intermediate or daily variations, as well as peak.
- Developing options that ensure local residents will have the electricity they need as demand grows and know the costs for them and the rest of Ontario. Options will typically involve localized solutions or bulk system transmission with generation elsewhere, each of which may have cost and risk advantages and disadvantages.
- Developing a cost accountability framework that allocates the development costs fairly across all customer classes in light of which levels of government drive the decisions, e.g., localize the cost of municipal actions for those residents.
- A Benefit-Cost Analysis (BCA) has been advanced by the OEB and provided direction for LDCs. The next phase of aligning the framework around total system costs and the IESO's approach remains.[146] The PWU has provide extensive inputs for an effective BCA framework.[147]
- Prioritizing developments in communities that help accelerate decisions. The inherent challenges of managing and aligning demand and infrastructure growth will be discussed in the PWU's next paper of this series.

[146] OEB, Letter to Stakeholders, Final Phase One Benefit-Cost Analysis Framework for Addressing Electricity System Needs, (OEB File No. EB-2023-0125), May 16, 2024.
[147] PWU submission to the OEB on the Benefit Cost Analysis recommendations of the FEI WG, Jan 2023.

Closing – *Ontario's procurement practices must be reformed to include accountability for better affordability*

This paper described the current absence of transparent mechanisms addressing cost accountability in Ontario's electricity system planning. This included: the consequential impacts of Ontario's procurement processes on Ontario's supply mix, total system cost, economic development, and engagement in regional planning activities. **Continuing to base Ontario's future supply mix procurements on capacity and energy markets unnecessarily exposes Ontario to significant affordability risks.**

The final discussion paper in this series of four will examine the deliverability risks in developing Ontario's transmission and distribution systems to meet the demand growth. This will include the integrated delivery of electricity, natural gas, and hydrogen. Mitigation options for building out distribution and transmission system capacity to meet the pace of electrification technology adoption will be outlined, e.g., moderating demand growth and leveraging the value of behind the meter distributed energy resources (DERs) and rate programs.

For over seventy years, the men and women of the PWU have played a critical role helping to keep the province's lights on. The PWU remains a strong supporter and advocate for the prudent and rational reform of Ontario's electricity sector and recognizes the importance of planning for low-cost, low-carbon energy solutions to enhance the competitiveness of Ontario's economy. The PWU has a successful track record working with other energy stakeholders to strengthen and modernize Ontario's electricity system. The PWU is committed to the following principles: Create opportunities for sustainable, high-pay, high-skill jobs; ensure reliable, affordable, environmentally responsible electricity; build economic growth for Ontario's communities; and, promote intelligent reform of Ontario's energy policy.

Appendix 5 - Ontario's Electricity System's Deliverability Risks Require Innovations in the Distribution System

Power Workers' Union (PWU), September 2024

This fourth and final paper outlines the PWU's views on better ways for Ontario to meet its growing electricity demand with lower carbon emissions and in a more reliable, affordable and timely manner.

The first three discussion papers described how systemic reliability risks in the face of growing demand require a radical rethink of Ontario's electricity system planning and procurement approach which necessitates an urgent focus on developing the long-lived baseload generation assets Ontario needs to power its growth. The papers also described how the lack of accountability for over-all affordability in Ontario's electricity system planning and procurement processes is unnecessarily driving up rate payer and taxpayer costs. This paper considers that the delivery system infrastructure will be equally challenged to meet the growing demand and advances policy ideas to support a reliable and cost-effective transition of Ontario's electricity system as demand grows and the baseload bulk system supplies are developed.

Executive Summary

A transition plan is required to identify an affordable and achievable pathway for improving the infrastructure of Ontario's electricity system to respond to demand growth and the province's increasing dependence on natural gas fired generation. Such a plan would maximize the use of the capacity of Ontario's existing distribution and transmission components while deferring the need to upgrade them. This would "buy time" to better optimize timing and development of the required delivery system infrastructure as well as the bulk system baseload generation assets.

This energy transition strategy would help optimize the use of existing delivery infrastructure by maximizing the transfer of baseload power from the grid to the distribution system by migrating the provision of variable demand smoothing and flexible supply solutions to the latter i.e., "as close to load as possible".

Instead of relying on IESO-advocated market-based mechanisms, the optimal approach would employ regulated-rate designs to incent consumer behind-the-meter (BTM) technology adoption choices that support grid performance and enabling AI-powered aggregated demand side management (DSM).

Embracing such innovations is critical given that the rapid growth in electricity demand exceeds the system's ability to build the necessary infrastructure, a fact recognized across North America.[148] This pace risk requires proactive and aggressive mitigation – and the opportunities for necessary mitigation exist in the distribution system.

The pace of demand growth is challenging the delivery system

The PWU's discussion paper on mitigating reliability risks drew on the IESO 2024 Annual Planning Outlook (APO), planning references from the Toronto Region, and available net zero studies for

[148] Canada Faces Crunch in Electrical Supply, Energy Now, Aug 17, 2024; New York encourages electrification with new grid planning process, affordability pilot, Utility Dive, Aug 21, 2024. "The rate at which consumers are electrifying buildings and vehicles has the potential to outpace the existing grid planning processes," the New York Public Service Commission said.

Ontario. This analysis showed that the planned growth and electrification of Ontario's economy will lead to approximately 150% increase in system capacity over the 25-year period from 2025 to 2050. These findings did not reflect the impact of the Honda factory announcement (over 300 MW) or the trend in requests for AI-driven data centers (could range from 350 MW to 3000 MW by 2030). These alone represent a 10% increase in the peak load in Ontario by 2030 that is not currently being addressed.[149]

The pace of electricity demand growth presents challenges not only for procuring required new generation resources but also for new infrastructure in the delivery system. The delivery system represents about 30% of the total cost of electricity or almost half of the cost of generation[150]. While generation can be located with a finite selection of sites, the delivery system is ubiquitously spread across the province and is managed by 60 local distribution companies (LDCs),[151] as well as the transmitters, including Hydro One which serves most of the province. Upgrading the transformer stations, wires and distribution transformers to meet demand growth represents a major challenge while maintaining reliability and meeting consumer demand.

The Electrification and Energy Transition Panel (EETP) report clearly described this critical challenge, stating: *"Importantly, increases in the demand for electricity must be paced in a way that aligns with the capabilities of the energy delivery system for power and gas."* This highlights the need for an energy transition strategy to achieve a NZ economy by 2050 – not everything can be built everywhere, all at once.

Innovations are emerging that can enable an achievable pace of development and reduce reliability risks. The average capacity usage of the delivery system is about 35%. If the daily peak demand variations from the LDCs can be reduced, in favor of relative increases in baseload, the utilization of the delivery system assets could be doubled to 70%, reducing the required growth in capacity. This strategy could buy time for building delivery capacity on the path to 2050, potentially deferring the risk of distribution and transmission system-induced bottlenecks and local blackouts for many years.

Ontario's bulk system grid → all roads lead to the distribution system

The previous papers explored the factors related to total system costs and the transmission system's contribution as well as the zonal structure of the bulk system and the localized emerging supply gaps. The papers argued for a transition plan that can optimize the pace of developing long-term infrastructure and the cost-effective development of required baseload generation by

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[149] Strapolec analysis: Honda estimated based on VW media reports, IESO representative verbal statement of 350 MW of AI connecting requests, analysis of 2024 EPRI study suggests Ontario demand form AI data centers could grow by 2.5 to 3 GW by 2030.

[150] 2019 statistics published by Ontario's Auditor General, quoted from https://www.lifebynumbers.ca/cost/electricity-service-costs/, stating: The total system service cost for providing electricity to Ontario consumers approaches $23 billion according to a 2019 audit of the Independent Electricity System Operator (IESO). The cost breakout is 68% for electricity, 17% for distribution, 7% for transmission, 4% for wholesale market charges, and 4% for regulatory and all others.

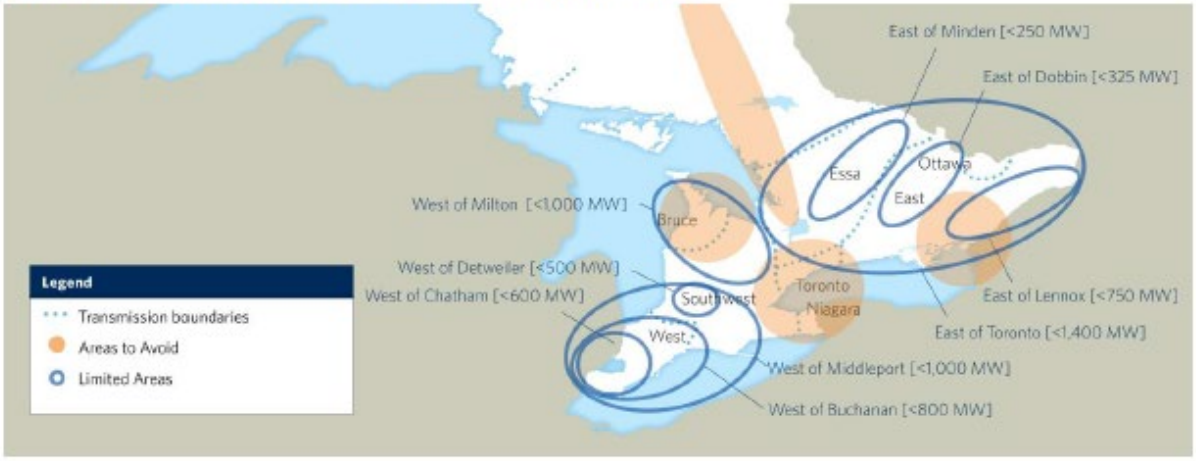
[151] https://www.eda-on.ca/FOR-CONSUMERS/Ontarios-Local-Hydro-Utilities#:~:text=LDCs%20distribute%20power%20from%20transmission,60%20LDCs%20operating%20across%20Ontario.

leveraging existing bulk system assets. The analysis concluded that locating new generation within each zone, where possible, would minimize the broader Ontario bulk system transmission development challenge.

The previous papers recognized that the IESO's 2024 APO forecast demand growth is primarily for baseload supply. However, there is a need to address Ontario's variable supply needs as well, in particular reducing the province's reliance on flexible natural gas generation. The IESO's procurement of flexible supplies continues to rely on outdated market mechanisms. Analyses have shown that procuring 3000 MW of new grid-connected storage could fully meet Ontario's need even in 2050 in the Net Zero scenario. However, the new storage and other resources are being acquired by the IESO in less-than-optimal locations, increasing transmission costs and exacerbating the need for the grid to accommodate peaking supply.

The IESO's preliminary guidance on new resource connections for its LT2 RFP,[152] shows that they should be connected away from the province's peak demand centers. This approach exacerbates the delivery system development challenge by continuing to place peaking generation outside of load centers. Many of these may become stranded when the more cost-effective baseload supplies are developed.

Figure 2 | Overall Southern Ontario Limitations Map



Optimizing the bulk system development and timeline costs requires understanding the drivers of demand: from large, baseload-drawing, directly connected industries; and, from the residential, industrial, and commercial loads within local distribution company (LDC) territories. In fact, the APO shows that most of the demand growth stems from loads within the distribution system. The solution to grid cost optimization is not to construct large scale grid-connected storage, but to smooth the demand variability with smaller distributed energy storage capacities as close to the loads as possible.[153] New grid connected storage would optimally be co-located with transmission system transformer stations at the bulk-system grid interface to the LDCs, specifically on the LDC side of the connection. This approach would smooth demand and minimize peaks at the

[152] IESO, Preliminary Connection Guidance for Long-Term 2 RFP, April 16, 2024.
[153] Strategic Policy Economics, Distributed Energy Resources in Ontario, 2018.

transformer stations permitting greater utilization of the bulk system assets and the deferral of their upgrades – an underpinning pretext for the value of demand side management (DSM) of distributed energy resources (DER).

The optimization of this cost-effective approach to the development and use of the bulk system transmission and baseload generation assets would critically rely on additional DSM implementation within the distribution system to minimize the operational challenges of grid scale storage and flexible supplies.

Importantly, state of the art distribution system DSM is sufficiently well advanced and should figure prominently in the IESO's resource adequacy framework, but it is not.

A Paradigm Shift is required to optimize deliverability through distribution system innovations

The nature of consumer demand and the tools available to manage it are conducive to a radical rethink of how the distribution system's costs and capacity could be optimized.

a) *The electricity system does not need to invest in empowering consumers with choice, but rather ensure that infrastructure can be cost effectively delivered as consumers make whatever choices they desire*.

The EETP report overstates the degree to which "e*mpowering customers with choices is integral"*. It is not established how important it is to cater to " '*prosumers' who can both produce and consume electricity and actively provide grid services, not just consume them*." There has been much hyperbole in the sector on the degree to which DERs have been adopted. However, this adoption has arisen from inadequately designed and overly generous incentives that shift DER costs to other rate payers (e.g. net metering and the Industrial Conservation Initiative).[154]

While the EETP report provided no quantified assessment of costs related to its recommendations, it did qualitatively emphasize the importance of understanding cost. It states that "*Any mechanisms adopted by the government should be rigorously analyzed for cost-effectiveness and must transparently consider both costs and benefits to individual customers and to the overall system, for example peak electricity demand impacts*."

To this end, the OEB has been advancing the important work of developing a benefit cost analyses (BCA) approach to fill this data gap for decision makers.[155]

While understanding the benefits and costs of DERs are critically important for decisions that allocate costs to rate payers, the OEB BCA framework does not address mitigating schedule constraints on resource development and other priority areas such as ensuring that Ontario's lights will not go dark.

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[154] PWU Submission to MENDM on "Changes to Ontario's Net Metering Regulation to Support Community-Based Energy Systems", November 2020.

[155] Ontario Energy Board, Framework For Energy Innovation: Setting a Path Forward for DER Integration, January 2023; Ontario Energy Board, Benefit-Cost Analysis Framework for Addressing Electricity System Needs, May 16, 2024.

b) Dogmatic reliance on market-based procurement mechanisms is a barrier to innovation.

The EETP report stated that: "*Well-regulated competitive markets can significantly advance customer choice and should be combined with convenient and accessible information about options, including up-front and operating costs*." While this is an important ambition, it is not an achievable reality with respect to procuring future non-emitting supply resources. Markets rely on innovators to leverage market price arbitrage-based schemes. In the absence of fossil-fuel-dominated electricity markets, the approach is not sustainable as there are no possible market-based signals that can capture the implication of full system cost and the greater imperative need to build out quickly.[156] The EETP report cautioned that "*new technical capabilities raise a myriad of challenges concerning not only the physical management of the energy system, but also pricing and the entry of non-traditional market participants.*" The EETP report also stated that "*market models and regulatory frameworks by which the distribution sector is managed, and the ways in which the bulk electricity system is planned and managed, will need to evolve.*"

Growing the distribution system is a physical/engineering management challenge, not a market price optimization challenge.

c) The potential for Distributed Energy Resources (DERs) to help address the system needs is not being clearly communicated and misinforms decision makers.

The EETP report states that "*Technology for the distributed generation and management of electricity is evolving quickly in maturity and cost-competitiveness, with the potential for disruptive change in the distribution sector in the near future.*"

However, the potential contribution of DER is optimistically conveyed in the EETP report that "*it would be possible to cost-effectively meet all incremental system needs with DER capacity*." This has not been confirmed by analyses. The EETP founded their conclusions on an IESO-funded study.[157] Analysis shows that the study conclusions, particularly around the role of solar that figured prominently in the findings, were based on contrived analyses and serve to misinform decision makers, like the EETP.[158]

As a result, the PWU found it appropriate that the EETP report "watered down" support for DER by stating: "*The assessment of the achievable potential of DER technologies therefore must be complemented with rigorous analysis to understand how evolving (utility) business models and design of the wholesale market can enable DERs*."

The PWU suggests that DERs cannot in fact help address the problem of accelerating capacity buildout except where DER technologies can improve distribution asset utilization. Specifically, this requires mitigating not only peak demand but demand variability in general.

The real strategic issue → Demand drivers and delivering the required supply

[156] Strategic Policy Economics, Electricity Markets in Ontario, 2019.
[157] Report to the IESO, Ontario's Distributed Energy Resources (DER) Potential Study, Sept 2022.
[158] PWU Submission to the IESO on the DER Potential Study, October 28, 2022.

Smoothing demand and thereby optimizing the utilization of existing distribution infrastructure is the critical strategic issue for buying time during the transition. The EETP report identified that "*There is an urgent need to advance the regulatory environment to enable effective participation of DERs and eliminate barriers. A delay will mean that potentially cost-competitive solutions located at the distribution level cannot effectively compete during a time when Ontario will be investing in the expansion of the electricity grid to satisfy increased demand from electrification*."

Much attention has been given to the promise of smart grid technologies, much of which is associated with enabling two-way flows across the distribution systems to accommodate DERs. While the technology innovations from smart grid initiatives hold promise, the answer is not market-based pricing signals and two-way flows across the grid. A smart grid in this sense is not what is needed, but rather smart energy consumption by the end users. The objective is to smooth demand on the distribution system connection points and ultimately to the transformer station supplying the feeder that connects a consumer. Enabling two-way flows represents a costly exercise that can be deferred and potentially obviated by the innovations discussed here. The answer lies in understanding the drivers of demand growth.

Demand growth is emerging from two sources: new economic growth/development; and the electrification of the economy. Economic growth impacts population and new business, both of which lead to distribution system expansion for new connection requests (e.g. new subdivisions or industry such as greenhouses or auto sector manufacturing). Electrification of the economy results in increasing demand from existing loads and is ubiquitous throughout the province's distribution systems. Planning for new loads, e.g., economic growth, is not new, albeit the pace of growth in Ontario may be higher than previously experienced. The electrification of the economy, however, is a new phenomenon that entails unprecedented growth for existing infrastructure.

The implications of electrification on demand from existing loads can be viewed from two perspectives:

a) *Industrial load growth*: Increased load from existing large consumers translates directly into requests for higher service levels from the distributor and/or transmitter. Related investment decisions are implemented within a planning framework with scheduled upgrades developed accordingly.
b) *Residential/commercial and other buildings*: Consumer adoption of non-emitting options to fuel switch away from gasoline and natural gas are occurring in many areas and are organic based on public opinion. The most commonly discussed innovations are electric vehicles and heat pumps for building heating and cooling. But electrification of appliances is also occurring. This ubiquitous growth across all LDCs impacts the existing distribution system infrastructure.

In all cases, the impacts will be felt through the need for distribution system feeder and transformer upgrades. Managing the development of existing feeders is the daunting problem – How can asset utilization be maximized and distribution system upgrades deferred? This is an important question as the required infrastructure cannot all be built across the entire distribution system at the same time.

Opportunity: Emerging Distribution level Demand Side Management tools

The EETP report states that: "*Ontario must explore ways that implementation can proceed quickly while other regulatory and market reforms are underway.*" The distribution system offers opportunities for balancing growth on and across feeders. The process starts with smoothing demand within a feeder, then across feeders from a common substation, then across substations connected to a transformer station, etc. Solutions in DER Management Systems (DERMS) are helping utilities meet their current needs and scale for the future by improving hosting capacity, reducing the need for grid upgrades, and delivering financial gains and grid support.[159] DERs that can be most effective at achieving this objective fall into two categories: LDC load management DERs; and, consumer adopted fuel switching technologies suitable for integrated load profiles management.

1. LDC load management innovation opportunities

LDCs have three load optimization options that could be leveraged by DERMS: Addition of community scale storage at transformer stations; working with large evening charging loads; and, optimizing the operations of electrolytic hydrogen production facilities. These options could provide MWs of flexible load.

- Distribution stations are an opportunity to locate Front of the Meter (FTM) community scale storage.

  Locating storage on the load side of distribution stations is the most direct mechanism for smoothing load originating on a feeder and minimizing the variability presented upstream to the rest of the grid. Studies have shown that using storage to smooth load is the most cost-effective use of storage capacity.[160] While community scale storage (1-5 MW) is almost double the cost of grid storage (100 MW),[161] it can provide delivery system load smoothing benefits. In contrast, the IESO has procured grid-scale transmission connected storage to mimic the flexible operations of gas-fired generation. Grid connected facilities offer no benefit for optimizing transmission infrastructure and in fact increase costs given the need to connect them and not co-locating them with demand which incurs losses. However, a direct cost comparison may not be the relevant consideration. The benefit of community scale storage is its potential to defer the distribution system capacity upgrades and support a more cost-effective transition plan.

- Commercial and Municipal transportation electrification offer overnight load balancing

  Loads arising from electrification of commercial delivery fleets and public bus and rail could represent increased overnight loads. This would help smooth overall diurnal distributions system load and, by utilizing utility DERMS, could smooth demand more locally and at further upstream transformer stations where feeders converge.

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[159] https://resources.industrydive.com/manage-ders-at-scale-and-unlock-more-value-for-customers?utm_source=UDLM&utm_medium=BlastMay24&utm_campaign=SmarterGridSolutions; It's time to stop fretting about load growth and get serious about demand-side solutions, Utility Dive, Aug 6, 2024.
[160] Strategic Policy Economics, Distributed Energy Resources in Ontario, 2018.
[161] Lazard, Levelized Cost Of Energy, June 2024.

- Electrolytic hydrogen offers distributed flexible load and demand response

  The potential for hydrogen as an alternative fuel for heavy-duty transportation and for blending into the natural gas system to reduce its emissions could be distributed across the province's distribution system. Electrolyzers have rapid flexible load control when producing hydrogen. Electrolytic hydrogen production could be incented for nighttime operations and/or used as demand response.[162]

2. Consumer technology adoption offers controllable load profiles

Residential and consumer adoption of heat pumps and EVs offers the ability to manage loads on a feeder. Unmanaged, large and coincident peaks could compromise the distribution system. Much work has been done to demonstrate that the smart charging of EVs, in response to rate programs for example, can help smooth new peak loads. The IESO assumed this benefit in its 2024 APO. Additional technology innovations offer greater benefits. Hybrid dual fuel heat pumps, bidirectional EV chargers and home storage (e.g. powerwalls) can provide tools to help smooth demand all year long, reduce peaks and increase the utilization of delivery system capacity.

Enbridge, with the support of Natural Resources Canada (NRCan), managed a Hybrid Home heating program from 2021 to 2024.[163] This program met with success.[164] Natural Resources Canada has been supporting DERMS pilots as part of its Smart Grid Funding.[165] Several pilot programs are seeing success using bidirectional EV chargers.[166] Finally, the value of home energy storage is growing. California recently reduced the guaranteed payments under net metering for solar PV owners.[167] The result has been an uptick in installed home storage for shifting solar output to more optimal times. It is important to note that using storage to smooth demand is far more cost effective and efficient in Ontario than in smoothing the output from intermittent renewables.

Optimizing the use of these technologies to support the development of electricity infrastructure requires a distribution system performance signal, not a market price signal. In fact, the optimal intent of load smoothing would be to have a constant load that would not have material price differences over the day. Strong wind on a cold winter day may provide a low HOEP on the grid, but it won't change the overloading of the distribution system wires when the heat pumps ramp up. NRCan describes the dual fuel heat pump controls as "*Wi-Fi–enabled smart switching controls that automatically send a signal to the system to switch to the furnace or the heat pump … The smart*

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[162] Green Ribbon Panel, Clean Air, Climate Change and Practical, Innovative Solutions Policy Enabled Competitive Advantages Tuned for Growth, 2020, identified how hydrogen can be used in a "Made In Ontario" Integrated solution as demand response to reduce system costs; Strategic Policy Economics, Electrification Pathways for Ontario, 2021, quantified those benefits.

[163] https://www.enbridgegas.com/sustainability/clean-heating/hybrid-heating.

[164] https://sustainabletechnologies.ca/home/heating-and-cooling/air-source-heat-pumps/smarter-home-heating/london/#:~:text=Overall%2C%20the%20analysis%20showed%20that,electricity%20demand%20of%20the%20homes.

[165] https://natural-resources.canada.ca/sites/nrcan/files/environment/Smart%20Grig_E_2021_accessible.pdf

[166] From Vehicle-to-Grid To DIY Home Powerwalls, Hackaday, Aug 18, 2024; In a first, electric Ford F-150 trucks are powering homes in Baltimore, Canary Media, Aug 1, 2024; Sunrun, BGE launch first US electric vehicle-to-home virtual power plant, Utility Dive, Jul 25, 2024.

[167] https://support.opensolar.com/hc/en-us/articles/6037827371919-Understanding-California-s-NEM-3-0-Latest-Modifications.

system takes into account various factors: natural gas and electricity prices, time of use, outdoor air temperatures, performance of the natural gas furnace and performance of the heat pump."[168] Crucially, it requires more information than just the electricity wholesale market price and could be configured to "understand" the load interaction with the distribution system.

3. *The advent of AI enables internet-based consumer load optimization*

Google hosted a National Electricity Roundtable in Montreal in June of 2024.[169] A key message was that Artificial Intelligence (AI) is far more mature than most people think and represents another industrial revolution. Google is already working actively with the IESO on its Save On Energy Peak Perks™ program and with Alectra on other projects.

The Peak Perks program has received North American attention with over 100,000 Ontario residents allowing their utility to adjust the homeowner's WiFi enabled smart thermostat up to two degrees to save power during events such as heat waves. This is described by the energy industry as a virtual power plant (VPP).[170] The IESO has partnered with the Energy Hub, a leading North American provider of DERMS. Several smart thermostats are supported, including Google's NEST. The Peak Perks program is currently focussed on avoiding the top peak demand hours during the summer air conditioning season.

Google has incorporated NEST functionality into Google Home. Expanding the notion of Peak Perks to incorporate bi-directional EV charging, dual fuel heat pumps and home energy storage on a 24x7 basis that can leverage such internet-based cloud services, such as Google Home, is not a technology "stretch".

The potential for VPPs hinges on the ability to aggregate consumer behaviour. AI is already able to identify and locate where EVs are just using meter data. Its readiness is illustrated by Maryland's regulations that will require utilities to integrate bidirectional EV charging with VPPs.[171] Key VPP players agree that advanced operational software, communications standards and customer compensation can scale VPP size and services, cut system and customer costs and enhance reliability.[172] Studies have shown that this approach could improve the cost effectiveness of Ontario's delivery system.[173]

The first step could be to enable energy management within buildings and then link buildings on a feeder etc. Aggressively adopting these passive low-cost solutions that require no delivery system infrastructure development could buy the time required to optimize the capacity utilization of the delivery system while its expansion and that of the bulk system baseload resources are being

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[168] https://natural-resources.canada.ca/simply-science/the-future-home-heating-hybrid-home-heating-systems-offer-energy-savings-and-reduce-g/22236.

[169] https://static1.squarespace.com/static/65c13565c669a1195a8adfef/t/6658ca1d9c2a3e6860bb420c/1717094942079/Agenda.pdf.

[170] What if you got paid to use less power during heat waves?, CBC News, Jul 28, 2024; EnergyHub Helps Ontario's IESO Build Canada's Largest Residential Virtual Power Plant in Just Six Months, February 1, 2024 - The Financial Post; How an Ontario virtual power plant enrolled 100,000 homes in just six months, Utility Dive, Feb 5, 2024.

[171] Bidirectional EV charging, VPP bill passes Maryland Assembly, heads to governor's desk, Utility Dive, Apr 8, 2024.

[172] Tackling 3 key issues can help scale virtual power plants and spur a wave of benefits, analysts say, Utility Dive, Apr 23, 2024.

[173] Strategic Policy Economics, Electrification Pathways for Ontario, 2021.

planned. The next step of advanced bi-directional power flows from buildings to the grid may be an unnecessary costly distraction. Many utilities are appropriately focusing their development efforts on capacity expansion, not risky bidirectional applications.

4. *Electricity rates designed for synergy with AI and aggregation can enable delivery system capacity enhancements*

The need for Conservation and Demand Management programs to evolve beyond peak reduction to demand smoothing cannot be achieved using market mechanisms. However, consumer electricity rate programs designed for synergy with AI and aggregation could.

Rate programs can be effective enablers of AI-based aggregator solutions given their predictability. Time of use rate programs provide incentives to shift demand away from system peaks to off peak times, every day. The recently introduced ultralow overnight rate might be sufficient to motivate overnight EV charging. Addressing whether aggregators can use it for more than just EV charging and how demand profiles evolve requires optimizing local peak demand on feeders. The IESO has recognized that moving away from simple time-bound frameworks may better leverage CDM as a resource that responds to evolving system, market and customer needs.[174]

Key features for new rate designs are that the offers must be clear and predictable. As home energy management system integration becomes more sophisticated, more sophisticated rate incentives could be developed that encourage the end objective. Rate programs can be designed to encourage a smooth demand profile to approximate as much as possible a constant load 24x7.[175] This could be presented as a challenge to aggregators to achieve smoothing over feeders etc. Enabling aggregators with aligned consumer incentives could accelerate adoption at a much lower cost by creating scale.

With such a rate program, AI-enabled aggregators will be able to achieve the performance objectives needed to ease Ontario's delivery infrastructure development challenge.

The Answer to Optimizing Distribution System Load: Policies to regulate consumers and incent the private sector support

Philippe Dunsky, the Chair of the recent Canada Electricity Advisory Committee (CEAC) suggested at the OEA/APPrO Sept 2023 conference that it may be time to not rely on markets but instead require customers to implement demand side management. This theme came through in the CEAC report that recommended federal support should prioritize demand management.[176] The report notes that these programs should address demand flexibility and related distribution grid modernization technologies; and, ensure that electricity-consuming entities and project aggregation entities are eligible proponents.

Ontario needs an energy transition strategy rooted in what is achievable where and when. That strategy should consider options for influencing demand growth, demand profile evolution and the

[174] IESO, Demand Side Management Update - Presentation for the Strategic Advisory Committee, June 26, 2024.
[175] Informal feedback provided to the OEB on Class B rate designs, February 2021.
[176] Canada Electricity Advisory Council Final Report, Powering Canada - a Blueprint For Success, May 2024.

need to expand the delivery system. The pace of demand growth can be influenced by policy that helps moderate the increase. While defining an appropriate pace of demand growth acceleration will be controversial, the path forward will in large part be determined by realistic development timelines and acceptable costs. The PWU offers the following policy recommendations that it believes can enable demand side management schemes to moderate demand growth and facilitate and accelerate the delivery system's ability to meet the growing demand cost effectively.

1. LDCs should be mandated to minimize load variability on Ontario's bulk electricity system

The EETP report strongly encouraged the OEB to enable LDC autonomy in support of innovations within the distribution system. The EETP report stated that: *Where private sector participation lags and markets fail to adopt or proliferate valuable innovations, LDCs should be empowered to step into the breach, in the interest of enabling the energy transition and protecting customers.* LDCs should be allowed to include storage facilities located at transformer stations as part of the rate-based infrastructure costs where those assets are needed to optimize station performance. An additional criterion the OEB should include in its BCA should be mitigation of risk associated with the schedules for the development of required distribution infrastructure given the rapid ubiquitous demand growth across the system. It may be appropriate to prioritize the delivery system development schedule as a criterion for procuring both bulk and distribution system assets.

2. Examine the need for the IESO's ongoing procurement of grid scale storage.

As previously noted, analysis has shown that if properly located, Ontario has already procured sufficient grid scale storage assuming the DSM approaches discussed in this paper are adopted. Ongoing procurement of grid scale storage should prioritize optimal locations, such as in transmission stations to moderate demand flows on the upstream grid. This need may be better addressed by transmitters not the IESO.

3. Provide the OEB with a new mandate and criteria for rate design.

The OEB should have the authority to design rates for options that will support innovation from aggregators of BTM consumer DERs. As mentioned earlier, there are rate design approaches to help optimize the smoothing consumer loads.

4. The government should prioritize fuel switching technology adoption incentives.

The EETP report recommended that*: "The provincial government should explore mechanisms to support broad adoption of fuel switching, decarbonization and supportive technologies such as electric vehicles, storage and heat pumps to support its clean energy economy objectives, foster change at the needed pace and scale.* The reference to "needed pace and scale" represents an important caveat.

Burdens on the system can be minimized while achieving emission reductions by managing adoption incentives that moderate local demand and encourage DSM. The government should incent:

- bidirectional EV chargers more than unidirectional chargers; and,
- dual fuel heat pumps or heating modes more than regular heat pumps, where consumers have existing natural gas connections.

The government should further incentivize aggregator program participation when consumers utilize the subsidies for purchasing heat pumps or EVs.

Based on California's experience, net metering requirements should mandate that any new PVs be paired with storage and must be managed to smooth the load on the feeder and not require bi-directional flows to the distribution or transmission systems (i.e. peak output should be less than the coincident peak demand of the building).

5. Transitioning off natural gas and accelerating a hydrogen strategy

EETP report recommended that*: "In order to provide clarity to utilities, investors and customers, the Ministry of Energy should provide policy direction on the role of natural gas in Ontario's future energy system … and consider the various roles natural gas plays across the energy system."* The EETP report further stated that "*The outcome should be to manage the system optimization and fuel switching necessary to achieve a clean energy economy at a pace that maintains affordable, reliable and resilient energy service*." The report suggested several approaches including renewable natural gas and clean hydrogen for the natural gas system.

Effective policy can help manage the synergies between the natural gas system and the hydrogen economy to create the infrastructure required to help mitigate system peaks while achieving emission reduction by incenting hydrogen fueled trucking and charging stations and gas system down blending with hydrogen.[177] Supporting the development of large-scale centralized hydrogen production in southwest Ontario and distributed electrolysis stations throughout province can provide demand side management services.

LDCs mandated to smooth demand as recommended above, could put constraints on new connection requests for EV fleet charging and hydrogen electrolysis installations, requiring that customers must participate in demand management services. Making connections conditional on participant behavior is being advanced by the OEB DER Connections Working Group.

Closing

Ontario can mitigate its delivery system development risks through regulated rate designs, incentivizing consumer behind-the-meter (BTM) technology adoption that support grid performance, and enabling AI-powered aggregated demand side management (DSM) of those capabilities.

This paper described the delivery system development challenges including the pace of demand and its drivers, the solutions that exist in the distribution system, the need for a paradigm shift in approach, and the opportunities presented by the emergence of DSM and AI. Supportive policy recommendations for government include expanding the mandates for the LDC, IESO and OEB and for optimal incentives that achievably accelerate the adoption of emission reducing technologies.

Without embracing these new innovations in Ontario's future supply mix, procurements, and delivery system planning, the province will be unnecessarily exposed to both the significant

[177] The IESO and Enbridge have been operating a successful hydrogen to natural gas pilot in Markham.

risk that its delivery system will be outpaced by demand growth as well as a greater need for transition bulk system assets that will get stranded.

For over seventy years, the men and women of the PWU have played a critical role helping to keep the province's lights on. The PWU remains a strong supporter and advocate for the prudent and rational reform of Ontario's electricity sector and recognizes the importance of planning for low-cost, low-carbon energy solutions to enhance the competitiveness of Ontario's economy. The PWU has a successful track record working with other energy stakeholders to strengthen and modernize Ontario's electricity system. The PWU is committed to the following principles: Create opportunities for sustainable, high-pay, high-skill jobs; ensure reliable, affordable, environmentally responsible electricity; build economic growth for Ontario's communities; and, promote intelligent reform of Ontario's energy policy.