POWER WORKERS' UNION

January 18, 2021

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Via online submission to ero.ontario.ca

Re: Ontario Low-Carbon Hydrogen Strategy - discussion paper (ERO 019-2709)

The PWU represents the majority of the highly skilled workers in Ontario's electricity generation, and delivery sector. Attached please find a list of PWU employers.

The PWU appreciates the opportunity to submit comments and make recommendations to the Ministry of Environment, Conservation, and Parks in support of the Ontario Low-Carbon Hydrogen Strategy discussion paper.

We hope you will find the PWU's comments useful.

Yours very truly,

Jeff Parnell
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List of PWU Employers

Abraflex (2004) Ltd.
Alectra Utilities
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Aptum
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Atlantic Power Corporation - Kapuskasing Power Plant
Atlantic Power Corporation - Nipigon Power Plant
Atura - Halton Hills Generating Station
Atura - Napanee Generating Station
Atura - Portlands Energy Centre
Atura – Brighton Beach Generating Station
Bracebridge Generation
Brookfield Power Wind Operations
Brookfield Renewable Power - Mississagi Power Trust
Bruce Power Inc.
Canadian Nuclear Laboratories
Cochrane Telecom Services
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Elexicon Energy Inc.
Enwave Windsor
EPCOR Electricity Distribution Ontario Inc.
Erth Power Corporation
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Great Lakes Power (Generation)
Greenfield South Power Corporation
Grimsby Power Incorporated
Halton Hills Hydro Inc.
Hydro One Inc.
Hydro One CSO
Hydro One Sault Ste. Marie
Independent Electricity System Operator
Inergi LP
InnPower
Kinectrics Inc.
Kitchener-Wilmot Hydro Inc.
Lakeland Power Distribution
Laurentis Energy Partners
London Hydro Corporation
Milton Hydro Distribution Inc.
New Horizon System Solutions
Newmarket -Tay/Midland Hydro Ltd.
Nuclear Waste Management Organization
Ontario Power Generation Inc.
Orangeville Hydro Limited
PUC Services
Quality Tree Service
Rogers Communications (Kincardine Cable TV Ltd.)
Sioux Lookout Hydro Inc.
SouthWestern Energy
Synergy North Corporation
Tillsonburg Hydro Inc.
Toronto Hydro
TransAlta Generation Partnership O.H.S.C.
Westario Power

Ontario Low-Carbon Hydrogen Strategy – Discussion Paper
PWU Comments to the MoECP, January 18, 2021

The Power Workers' Union (PWU) is pleased to submit comments and make recommendations to the Ministry of the Environment, Conservation and Parks regarding the development of a hydrogen strategy for the province. 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 energy solutions to enhance the competitiveness of Ontario's economy.

The PWU appreciates the province's invitation to participate in the Ontario Low-Carbon Hydrogen Strategy consultations and believes that inclusive, transparent consultations will enhance the development of a provincial hydrogen strategy.

PWU's Hydrogen Vision and Recommendations

Hydrogen is crucial for Ontario to achieve its climate policy objectives. In particular, hydrogen can help decarbonize challenging sectors of the provincial economy, including large-scale transportation, industry, heating, and electricity generation. The Ontario and federal hydrogen strategies recognize the need for jurisdiction-specific hydrogen approaches and the critical role nuclear energy can play producing low-carbon energy.

The PWU provides the following recommendations to Ontario's hydrogen strategy:

1. Plan for the low-emission baseload generation that produces the clean electricity required to support the province's hydrogen strategy;
2. Integrate and co-ordinate energy and electricity planning;
3. Focus on the "low-hanging" and near-term opportunities to help build a hydrogen economy;
4. The Provincial Government should participate in the development of business models that monetize the public benefits of early investments in hydrogen initiatives;
5. Explore the export opportunities for hydrogen-enabled products; and,
6. Adopt timelines to reflect the elements noted.

Recommendation 1: Plan for the low-emission baseload generation that produces the clean electricity required to support the province's hydrogen strategy.

Ontario's electricity supply mix is recognized for it low-carbon content, a critical element for enabling a low-carbon hydrogen economy in this province. However, the Pickering Nuclear Generating Station (PNGS) is scheduled to close at the end of 2025[1]. This will remove 3000 megawatts (MW) of clean, low-cost baseload electricity that would have been used for the production of low-carbon hydrogen.

Ontario's IESO intends to replace this low-carbon supply with natural gas-fired electricity generation that will effectively increase the emissions from Ontario's electricity system.[2] The material impact of the loss of PNGS's low-emission baseload, based on the IESO's current approach, is that natural gas will be put on the margin during most hours of the year, as illustrated

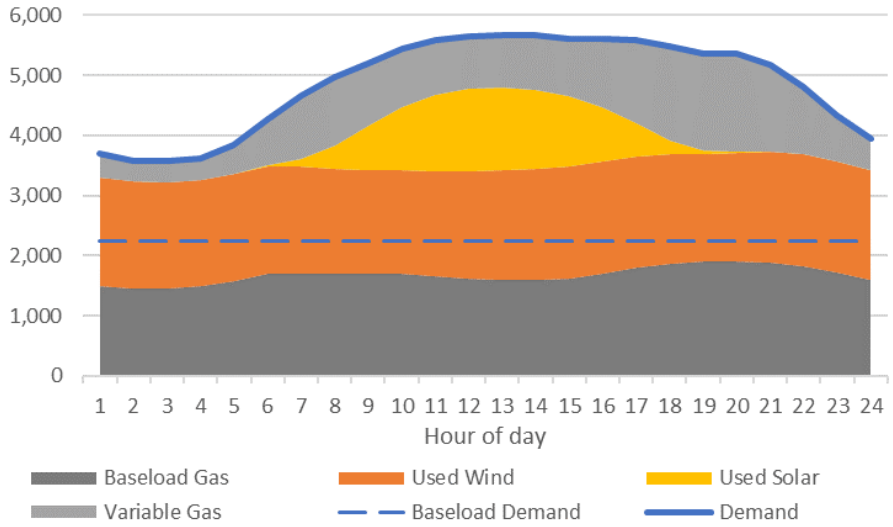
[1] Subject to regulatory approvals
[2] IESO, Annual Planning Outlook, 2020.

in Figure 1.[3] As such, natural-gas fired electricity will be a primary source for hydrogen production in Ontario.

Regrettably, over the long-term, the use of natural-gas generated electricity to create electrolytic hydrogen produces more emissions than existing steam methane reforming production methods. Steam methane reforming generates 11 kg CO_2 per kg hydrogen produced.[4] Future electrolysis technologies are expected to require ~39 kWh of electricity per kg of hydrogen, with current technologies using upwards of 50 kWh/kg.[5] Under future energy efficiency levels, electrolysis using natural gas-fired electricity would produce 16 kg CO_2 per kg of hydrogen, nearly 50% more than steam methane reforming.[6] Neither of these production methods meet the federal threshold for low-carbon hydrogen.

The development of a viable, Ontario electrolysis-based hydrogen strategy must include a plan for a clean baseload electricity system that includes hydroelectric and nuclear generation.

Figure 1 – Ontario's Electricity Supply Beyond Available Nuclear and Hydro
(Average annual supply & demand in 2026; MW per hour)



Source: Strapolec, Electricity Markets in Ontario: An Examination of Mismatched Conditions and Options for Future Competitive Procurements, 2020

Recommendation 2: Integrate and co-ordinate energy and electricity planning.

Hydrogen planning must be integrated and coordinated with electricity system planning, since electricity is the primary enabler of hydrogen. Analyses indicate that large amounts of low-carbon electricity will be required to produce the quantities of hydrogen that will be required to reduce emissions from a range of economic sectors. Estimates from the Green Ribbon Panel suggest upwards of 106 TWh of electricity will be required to produce the more than 2 billion kg of hydrogen that could be required annually.[7] This represents 60% more electricity than is produced in Ontario today. Yet, Ontario's current electricity planning forecasts do not include this

[3] The baseload gas illustrated is 24x7, 365 days per year
[4] NRCan, A Hydrogen Strategy for Canada, 2020.
[5] Green Ribbon Panel, Part 2 – Investing in Made-in-Ontario Solutions: Policy Enabled Competitive Advantages Tuned for Growth, 2020.
[6] U.S. EIA, How much carbon dioxide is produced per kilowatthour of U.S. electricity generation?, 2020. Source: https://www.eia.gov/tools/faqs/faq.php?id=74&t=11
[7] Green Ribbon Panel, Part 2 – Investing in Made-in-Ontario Solutions: Policy Enabled Competitive Advantages Tuned for Growth, 2020.

significant growth in electricity demand. In fact, the IESO's forecasts ignore the anticipated growth in electricity demand from electrification of the economy in general.[8] This underscores the risk that Ontario will have insufficient electricity to meet its needs in the near future.

For Ontario to achieve global competitiveness in hydrogen, electricity planning should be conducted in tandem with the planning required to accommodate hydrogen investment opportunities. Ontario's existing hydrogen technology developments would benefit from leveraging the province's current clean electricity advantage, while concurrently providing benefits to the electricity system.

Hydrogen production presents two synergistic opportunities and benefits for the electricity system. Firstly, such production will generate a greater need for low-cost, low-emission baseload generation and reduce requirements for costly, high-emitting peaking plant capacity. The need for baseload increases because hydrogen production is most economic when the facilities run at high-capacity factors.[9] Secondly, hydrogen production facilities can provide several valuable low-carbon services to the electricity grid e.g., ancillary services, load flattening, demand response, and seasonal energy storage.

Facilitating early electrolyzer application adoption, particularly in the timeframe before the retirement of PNGS, would inform Ontario's IESO of the new resource needs required to meet the different forms of electricity demand. Recognizing that Ontario's current plan will result in a period of higher-carbon electricity supply, providing such information in the planning process should accelerate the replacement of the PNGS with new low emitting supply options.

For these reasons, Ontario's hydrogen strategy must be integrated and coordinated with the province's energy and electricity planning processes.

Recommendation 3: Focus on the "low-hanging" and near-term opportunities to help build a hydrogen economy.

Ontario's hydrogen strategy discussion paper outlines a number of opportunities to advance hydrogen projects within the province. Some of these projects can be advanced to kickstart the hydrogen economy. Examples include:

- Ontario's petroleum refining and chemical manufacturing sectors produce hydrogen using the steam methane reforming of natural gas. Favourable conditions exist in Ontario to transition these to electrolyzer-based production of low emission hydrogen.
- The Highway 401 trucking corridor between Quebec and Windsor is one of the world's busiest trucking corridors. Electrolyzers producing hydrogen from grid-supplied electricity could nurture a hydrogen trucking sector center of excellence in the province.
- Blending hydrogen into Ontario's vast natural gas storage caverns could produce a less emissions-intensive product that given existing infrastructure could easily be distributed around the province, and even exported to the U.S.

Ontario's favourable conditions—low-carbon, baseload electricity supply and policy framework—mean these early adoption hydrogen investment opportunities can be implemented in the near term.

[8] IESO, Annual Planning Outlook, 2020.
[9] IRENA, Green hydrogen cost reduction, 2020.

- Ontario's extensive electrical transmission system typically has spare capacity that would enable electricity to be delivered to wherever it is needed for hydrogen electrolysis. This spare capacity could kickstart investments in Ontario's viable hydrogen investment opportunities without the need for new transmission system infrastructure, allowing these applications to create a first mover advantage.
- Locating projects along the transmission line from the Bruce electricity zone would provide hydrogen project developers with long-term, identifiable, and direct access to low-emission electricity. This could help mitigate the risks of high-carbon emitting electricity being used for hydrogen production post retirement of the PNGS.
- In addition to the above-mentioned applications, two existing policies – the Ontario Industrial Conservation Initiative (ICI) and the federal Clean Fuel Standard (CFS) – could make these near-term project opportunities economic today. The ICI program allows large industrial facilities to significantly reduce their electricity cost by cutting power usage during periods of peak demand. ICI participants with hydrogen production on site could produce hydrogen for very low electricity cost by pausing their electrolysers at times of peak demand. The CFS offers additional economic benefits in the form of emission credits for fuel-switching off of diesel. Using hydrogen for trucking would allow fleets to qualify for these credits. Taking advantage of these policies can make hydrogen applications viable now.

Recommendation 4: The Provincial Government should participate in the development of business models that monetize the public benefits of early investments in hydrogen initiatives

The increased use of hydrogen as a "clean" fuel offers significant public, environmental and economic benefits such as the health benefits of reduced air pollution from diesel trucks, reduced GHG emissions from the oil and gas sector, a more efficient electricity system, and economic benefits from new clean tech sectors.[10]

Government involvement may become part of the value propositions necessary to attract investments into hydrogen in Ontario – and therefore make the benefits real for the public. Pricing-in air quality benefits can help close the price gap between hydrogen and fossil fuels like diesel, and investments in emerging clean tech applications could benefit from tax treatments. Capturing the value of these benefits may be more difficult to monetize without government involvement.

Recommendation 5: Explore the export opportunities for hydrogen-enabled products.

The current hydrogen strategy discussion paper recognizes Ontario's opportunity to become a lead exporter of hydrogen technologies. However, "clean" hydrogen as an embedded element of other product exports has not been addressed. Research suggests that clean hydrogen can add value to export products that use it as an input.[11] Such hydrogen-enabled products include ammonia and related fertilizers and petrochemicals, all of which are currently produced in Ontario using carbon-intensive hydrogen.

[10] Green Ribbon Panel, Part 1 – Clean Air, Climate Change and Practical, Innovation Solutions to Grow the Economy and Reduce GHG Emissions in Ontario, 2020.
[11] Green Ribbon Panel, Part 1 – Clean Air, Climate Change and Practical, Innovation Solutions to Grow the Economy and Reduce GHG Emissions in Ontario, 2020.

Current hydrogen-enabled product exports can be made lower-carbon by using low-carbon hydrogen in their production. This could increase the competitiveness and value of these exports to jurisdictions that have public support for less emission intensive products.

Ontario has the opportunity to "capture" this advantage in a "green brand" for Ontario. Export products recognized as "green" may be able to capture a premium in certain markets, increasing sales and facilitating further exports.

Recommendation 6: The provincial strategy should include timelines that reflect all of the key factors

The business case for hydrogen is dependent upon the availability of "clean" or low-carbon electricity. The presence of hydrogen boosts the economic value of clean electricity. As well, developing energy infrastructure can take a long time. Experience indicates that it may take many years to acquire siting and regulatory approval before construction can begin.

To achieve Ontario's medium and long-term hydrogen goals, innovation and investment must occur early. However, Ontario has no framework under which investors can develop opportunities.

Achieving Ontario's emission targets will require matching the build out of the province's electricity system and hydrogen capacities with its emission reduction timelines. This will ensure that when hydrogen is expected to play a bigger role in meeting Ontario's energy needs, the low-carbon, baseload electricity supply will be in place to produce it. In the meantime, investments in hydrogen produced using emitting methods could be justified given the emissions reductions they promise down the line.

The long-run buildout of hydrogen and electricity capacity can create a large number of jobs in the province including in such positions as the manufacturing of hydrogen production equipment, electricity system upgrades, and plant operation jobs in new hydro and nuclear generation facilities. Meeting these requirements will not occur in a vacuum as Ontario is clearly in a "clean economy" competition with other provinces and countries. If the province fails to meet these challenges in a timely fashion, these jobs may be developed elsewhere. [12] With early, smart, and strategic planning, many of these jobs can be created sooner, in turn creating additional competitive advantages for Ontario in the global marketplace.

The federal hydrogen strategy has recognized that leading Canadian hydrogen companies have already begun moving out of the country due to a lack of government investment and more favorable policies elsewhere. [13] Jurisdictions that are able to institutionalize climate change mitigation sooner can be expected to secure more economic and environmental benefits.

Closing

The PWU has a successful track record of working with others in collaborative partnerships. We look forward to working with the Ministry of the Environment, Conservation and Parks and other

[12] Nuclear Innovation Institute, Seizing Ontario's opportunity to spark a national hydrogen economy, 2020.
[13] NRCan, A Hydrogen Strategy for Canada, 2020.

stakeholders to advance innovation, develop Ontario's hydrogen strategy, and strengthen and modernize Ontario's electricity system.

We believe these recommendations are consistent with, and supportive of, the province's objectives for developing a clean hydrogen economy and a competitive advantage for Ontario.

The PWU is committed to the following principles: Create opportunities for sustainable, high-pay, high-skill jobs; ensure reliable, affordable electricity; build economic growth for Ontario's communities; and, promote intelligent reform of Ontario's energy policy. The PWU is available to discuss these comments in greater detail at the Province's convenience.