ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

January 18, 2021

Michael Bishop
Climate Change Program Development
6th Flr, 135 St Clair Ave W, Toronto, ON M4V 1P5

Also submitted online via the Environmental Registry of Ontario

ERO 019-2709: Ontario Low Carbon Hydrogen Strategy

The Ontario Society of Professional Engineers (OSPE) is the advocacy body and voice of the engineering profession. Ontario currently has over 85,000 professional engineers, 250,000 engineering graduates, 6,600 engineering post-graduate students and 37,000 engineering undergraduate students. OSPE is pleased to provide input towards Ontario's Low-Carbon Hydrogen Strategy.

Introduction

OSPE believes that, in general, the discussion paper is well drafted and researched. The major issues are clearly outlined, with a good understanding of the value of this resource for Ontario's energy system and how this can impact the adoption of a hydrogen energy eco-system.

The world is adopting hydrogen as an alternative energy carrier and Ontario is well positioned to become a major hydrogen economy hub.

- OSPE has been advocating for changes to the Ontario Electricity Retail Pricing for some time and supports the use of clean surplus electricity to the benefit of Ontario residents and businesses.
- Making clean-green hydrogen from the clean surplus electricity is a valuable use of that power, however, it needs to be done with full analysis of other possible options, coordination amongst the various Ministries involved, pilot programs and realistic targets. The last 20 years of electricity policy in Ontario has had some unforeseen results from a lack of coordination and analysis.
- It is critical when technologies, like the battery electric vehicle (BEV) and battery storage are rapidly changing in cost and effectiveness, that thorough engineering and business case analysis be done by both professional engineers as well as other qualified professionals to determine the most effective use of valuable surplus electricity.
- Extensive electrification including the use of significant amounts of residential and commercial battery storage, both behind the meter (BTM) and in front of the meter (FTM), will have an impact on our surplus electricity. This could impact clean hydrogen production in the long term.
- OSPE supports the government procuring a techno-economic analysis for the prioritization of the use of the clean surplus electricity in Ontario and has identified hydrogen production as one of those potential uses. OSPE is supportive of a hydrogen economy grown in Ontario that could bring in benefits, such as good engineering, trades and manufacturing jobs.

Vision

Ontario has an opportunity to maximize the value of the abundant surplus electricity available in the province through electricity price reform. Ontario also has the ingredients to become a North American, and even global, hub for hydrogen integration into the energy matrix. Government support and ***commitment*** to the use of low-cost surplus clean electricity for the production of hydrogen could create the foundation of a supply structure that could bring the full hydrogen eco-system to Ontario. Success will be defined by the establishment of regional hubs for production, distribution to industrial and commercial operators, and the establishment of hydrogen economy manufacturers in the province. ***Goals, such as the 23,000 possible engineering, trades and manufacturing jobs predicted by the 2020 Green Ribbon Panel Report, based on an 80% heavy duty truck fleet operating on hydrogen (fuel cell/battery), could be possible if thorough analysis shows the appropriate financial, economy, emissions reductions and technical benefits.***

GHG Emissions Reduction

The greatest reduction in emissions through the use of hydrogen is in the transportation sector, displacing diesel fuel. The emissions reduction values below illustrate the relative amounts by application:

- *H_2 in fuel cell vehicles: ~ 350 grams/kWh emission reduction*
- *H_2 for oil upgrading: ~ 210 grams/kWh emission reduction*
- *H_2 for combustion turbine electricity generation: ~ 110 grams/kWh emission reduction*
- *H_2 for combustion for space and water heating: ~ 110 grams/kWh emission reduction*

With the surplus in clean electricity and Ontario-based companies such as Cummins and Next Hydrogen able to take advantage of a stable supply of low-cost surplus electricity, the technology and regulatory issues are within reach. ***The business opportunities will be driven by the stability and commitment to low-cost hydrogen based on the commitment to low-cost surplus electricity supply***. The business growth areas, as identified in the discussion paper, include significant electrolysis facilities located regionally to supply transportation/distribution hubs (i.e. Pearson-GTAA area), refineries (i.e. Sarnia), iron and steel facilities (i.e. Hamilton, Sault Ste. Marie). Any surplus can be fed into the natural gas distribution network to provide a broad-based reduction in commercial and residential heating emissions.

The foundation of supply will then further support the establishment of fuel cell hybrid drive research & development (R&D) and manufacturing facilities, and ultimately commercial vehicle assembly. In addition, in northern Ontario, H_2 by electrolysis supply hubs can service the mining and forestry industries with the displacement of diesel trucks.

Assuming that the predominant use of the low-carbon hydrogen is for transportation, then in refineries/steel making and finally mixed with natural gas for heating loads, the potential for emissions reduction and contribution to Ontario's 2030 GHG reduction targets is directly proportional to the amount of hydrogen produced, consistency of supply and the mix of the uses for the hydrogen as outlined above. For example, if 1 giga watt (GW) of electrolysis was deployed, producing about 86,000 tonnes/yr of H_2 for the displacement of diesel fuel in fuel cell (FC) trucks, the GHG emissions savings would be approximately 1,700,000 tonnes/yr of CO_2 emissions. In comparison, by 2030, Europe is looking at the development of 40GW of electrolysis.

Economic growth and job creation

Surplus power generation, when combined with hydrogen electrolysis, has the potential to create regional hydrogen economic hubs, co-located near hydroelectric facilities (Niagara, northern Ontario), nuclear facilities (Darlington, Bruce) and wind and solar Direct Energy Regulated Services (DERS) across the province. These hubs can also be located near major transportation routes (400 series highways), to facilitate the focus on goods transportation and manufacturing.

In conjunction with the hydrogen generation, significant R&D and training is required through universities and colleges. The development of Hydrogen Centre(s) for Research (i.e. Waterloo, Oshawa, Windsor) and technical training would be complemented by the attraction of interest from major automotive and truck parts manufacturers, and possibly truck assembly, bus assembly (New Flyer), and train locomotive. The significant potential to increase the efficiency and reduce the capital cost of electrolysis and fuel cell technology is a recommended priority target for R&D funding.

All of this economic activity will be driven by the province's commitment to low-cost surplus electricity and support of hydrogen procurement on a regional basis***. Supportive financing or tax policy combined with this electricity pricing program, based on a plan towards 2030, will provide the foundation needed***. A zero-emission vehicle (ZEV) program for forklifts and heavy-duty trucks, for example, much like the ZEV programs in Quebec and BC for light duty vehicles, would be a significant driver of the hydrogen eco-system.

Ontario should also encourage communication with the California Hydrogen Business Council and the Canadian Hydrogen and Fuel Cell Association to help promote information sharing, and take advantage of the experience these regions have gained in the development of their hydrogen programs. As outlined in the discussion paper, many other countries and regions such as Australia, Germany, Japan, Spain and the European Union are embarking on significant hydrogen strategies as part of their overall GHG plans to address climate change. ***Ontario is uniquely positioned to outperform in the world because of our surpluses of clean electricity, extraordinary educational institutions, strong industrial and manufacturing base and transportation density.***

ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

Energy Resilience

As outlined in the discussion paper, electrolysis can easily be integrated into the Ontario grid to assist with grid management, while maximizing the value of the surplus electricity by making hydrogen. This creates value for the ratepayer and taxpayer by putting hydrogen to work as an energy storage method, or directly into fueling systems for transportation. The latter has the added benefit of contributing to reduced GHG and pollutant emissions, improving the health of Ontarians.

Hydrogen storage further benefits resilience by offsetting the seasonal variance in wind and solar surplus production, so that these surpluses can be fully captured and the energy put to high value work.

Barriers and Action

Commitment to low-cost surplus electricity is the best way to support all commercial aspects of the hydrogen eco-system. Accompanying this should be a commitment to support R&D and training at universities and colleges. High value engineering, trades and manufacturing jobs will flow from this commitment.

The production of hydrogen from "wasted" clean electricity is one of the highest value uses, and fully supports the ratepayers and taxpayers past, present and future by creating real value from surplus. Ontario's historical leadership in hydroelectricity, nuclear and renewable energy has a significant legacy cost, but also has created a tremendous asset for the future with a 95% low-carbon energy supply that can be built upon to create the jobs, technology excellence and environmental benefits the taxpayers deserve.

However, the Ontario government and the Ontario Energy Board (OEB) would need to make policy changes on how surplus clean electricity is sold to fuel producers. Currently the OEB requires all energy extracted from the power system to share the fixed costs of the system, even if that energy is only extracted during low load periods. While that policy works fine for a high emitting power system, it is not an appropriate pricing policy for a clean power system like the one we now have in Ontario. Clean power systems by their nature produce a lot of surplus clean electricity when normal electrical demand is low or when renewables are producing too much energy even during peak load demand periods. If we allow hydrogen producers to purchase surplus clean electricity whenever it is available, on an interruptible basis, at only its marginal cost of production (the Independent Electricity System Operator (IESO) wholesale market price) without any additional markups for the fixed costs of transmission, distribution and regulatory charges, then green hydrogen could be produced at a large scale economically when compared to the costs of steam methane reformed hydrogen (grey hydrogen).

Additionally, the marginal cost of production (the IESO wholesale market price) for surplus clean electricity could be made to drop close to zero $/MWh if the Ontario government changed its policy for hydroelectric gross revenue charges from a production tax on energy output to a fixed annual site rental tax. That would drop the marginal cost of production from dispatchable (flexible) hydroelectric plants like Beck and Saunders to close to zero $/MWh. Currently, hydroelectric production taxes are creating an artificially high marginal cost of

production when there is surplus clean electricity. However, the gross revenue charge policy change should not take place until energy demand from the hydrogen electrolysis or other loads like electric vehicle charging are sufficient to be able to use most of the surplus electricity. The reason for this is that the export price received for surplus clean electricity would also drop to close to zero under current electricity trading rules for interruptible electricity. Provincial policy should also require that domestic demand receive priority access to surplus clean electricity before it is exported, since domestic consumers have paid for the enabling installed capacity.

Another priority challenge will be convincing the investment community that financing of hydrogen infrastructure projects can be done at acceptable risks compared to alternatives.

Hydrogen – Where and When

The surplus clean electricity advantage can lead Ontario towards large scale electrolysis that will create clean hydrogen for Ontario's industrial sector and hydrogen powered vehicles. There are Ontario based companies that are world leaders in electrolysis technology, so the Province is well positioned to maximize this opportunity. ***The temporal challenge for the use of this low-carbon hydrogen is that the development of the distribution hubs and the deployment of FC trucks will take time, as the technical skills, R&D effort and manufacturing and assembly facilities come online. The initial stage of hydrogen volume growth, should see it put to use where the direct replacement of fossil fuels with hydrogen is the only feasible solution (i.e. upgrading hydrocarbons to displace steam-methane reformation) and/or distributed through the natural gas (NG) pipeline system for heating use***. ***These applications warrant higher priority in the hydrogen allocation mix, if, for example, the GHG emissions offset is greater than other uses***. In parallel, as the fuel cell transportation usage ramps up, the province should be encouraging the deployment of ground and air source heat pumps and other energy conservation programs to accelerate the electrification of commercial and residential building space and water heating so that the hydrogen blended into natural gas is diverted to greater value in transportation. This 10+ year transition would serve to reduce emissions not only in transportation, but also the residential & commercial building sector.

We look forward to working with you to further develop these recommendations. If you have any additional questions, please contact Stuart Atkinson, OSPE Policy and Government Relations Lead, at satkinson@ospe.on.ca or 416-223-9961 ext. 225.

Sincerely,

Réjeanne Aimey, P.Eng.
Chair and President
Ontario Society of Professional Engineers

Sandro Perruzza
Chief Executive Officer
Ontario Society of Professional Engineers

2021002