TrueEnergy

Submission to Environmental Registry – Instrument Number – 019-2709

RE: Ontario's Low-Carbon Hydrogen Strategy

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ABOUT TRUE ENERGY INC

True Energy Inc. is a Canadian corporation, based in Ontario, founded by Dr. Douglas J. Hallett and Dave Willis in 2015 to advance their Hydrogen Reduction (HR) process. This transformational and patent pending technology can chemically deconstruct any organic compound, releasing embodied **Renewable or Recovered Natural Gas** (RNG) and pure **Hydrogen,** while freeing up inert materials for recycling.

Over the past 30 years, early variants of the HR process have destroyed complex hazardous wastes, such as PCBs, DDT, dioxins, and chemical warfare agents, rendering them inert while releasing their energy value. A new application, which is patent pending, focuses on deriving RNG and Hydrogen from wastes that are prevalent in society, such as sewage, municipal solid waste (MSW), mixed industrial plastics, auto shredder residue (ASR) and off-spec foods. Addressing these waste streams with the HR process effectively brings them into the circular economy, reducing our reliance on fossil fuels for transportation, energy, and manufacturing -- most economically.

The process uses gaseous hydrogen as a reducing agent to break up larger, more complex molecules. Reduction occurs from materials in either a solid, liquid, or gaseous state. Energy is released primarily in the form of hydrogen and methane. The **Renewable and/or Recovered Natural Gas and Hydrogen** can be produced **cost competitively compared with fossil fuel derived gases.** The process achieves upwards of 95% solids reduction of waste materials and provides for the recycling and recovery of metals, elemental carbon, and silica.

Ministry Discussion Questions

Vision

It is imperative that Ontario develops a Hydrogen Strategy as a road map to build on existing expertise and help transition Ontario to a low-carbon economy that we can showcase to the world. While electrification is a key component of a low-

carbon future, Hydrogen will play an increasingly important roll where clean electricity in of itself is not as practical for de-carbonization in sectors such as: heavy and long-distance transportation; energy intensive manufacturing, i.e., cement and steel production; and commercial/industrial building heating.

As written, the vision statement is very Ontario-centric and does not embody the international opportunities to export technology and expertise to the world. It also does not recognize the tangible health and societal benefits of a low-carbon economy. In addition to local jobs, environmental and investment opportunities, the vision statement should highlight the potential to bring Ontario technology, systems, and expertise to the world. Participating in the global emerging low-carbon economy is what makes developing low-carbon hydrogen strategy so very compelling.

Key outcomes of the Hydrogen Strategy should include:

- Development of a **Hydrogen Secretariat for the Province**, accountable to the Cabinet Table, that can monitor, measure, advise and recommend strategies to maximize the opportunities to utilize low carbon H2 in the province. The Secretariat would consult with an industry roundtable of experts in the various sectors to keep the Province on target to meet its low carbon objectives;
- Developing resilience in the electricity sector by directing the IESO to allow for the use of our surplus supply of green electricity to make Green H2, primarily as a fuel to displace fossil fuels. This **Power to Fuel** program should be implemented ASAP to get green hydrogen production on line;
- Directing the OEB to allow Renewable Natural Gas and Green, or low carbon H2, from processes such as Electrolyzers, Chemical Reduction, Waste to Energy and Anaerobic digestion to be fed into the existing natural gas pipeline system at reasonable market rates;
- Re-establishing a heavy equipment manufacturing/assembly sector for, trucks, trains and possibly ferries that utilizes Ontario's expertise in fuel cells, electrolyzers, and H2 deployment;
- Transitioning our petro-chemical production, especially around Sarnia and Hamilton, to use lower carbon H2 in refinery operations, weaning these processes from carbon intensive Grey hydrogen, thereby greening fossil transportation fuels;
- Deploying more green electricity generation from Small Modular Nuclear Reactors (SMRs), wind, water, and solar generation, knowing any surplus can be taken up by the Power to Fuel program. This is especially important

for when Pickering Nuclear Reactors come off-line to reduce our reliance on natural gas electricity generation;

- Creating greater demand for Green and low carbon H2 through government procurement programs and incentives for fleet deployment of Hydrogen Fuel Cell Vehicles, for people and goods transportation, including public transit buses, trains, marine, cement mixers, garbage trucks, forklift trucks and more;
- Putting meaningful and decreasing caps on CO2 emissions from energy-intensive industries, with penalties for non-compliance, incentivizing them to reduce their use of carbon intensive fuels and facilitating their switch to low carbon H2.
- Providing strategic investments through the Ontario Centre of Excellence or other agencies to showcase Ontario low-carbon Hydrogen technology, including production, utilization, and distribution.
- Working cooperatively with the Federal Government and local municipalities to develop projects, policies and standards that encourage the use of low-carbon hydrogen.

The success of these programs could be measured by progress made against aggressive targets for H2 deployment in Ontario. This could be by tonnes of H2 used in key sectors, such as material handling, goods transportation, heating, manufacturing, refining etc. It could also be measured in sector employment, export orders and dollars expended. Measuring this success would be a key role of the Hydrogen Secretariat.

Generating Economic Development and Jobs

Ontario once had a vibrant heavy-equipment manufacturing sector, especially with trucks, buses, and farm equipment. Internationally we are seeing more companies entering into this space with innovative technologies, including fuel cell deployment of hydrogen vehicles, as they rise to meet the challenges of a low carbon economy. Ontario should be leveraging its expertise in H2 components, clean electricity and start manufacturing, or at the very least finish the assembly of, H2 transportation and work vehicles, for local and international markets.

Ontario should be working with the Federal government and local municipalities to facilitate and support procurement of H2 buses, light rail transit (LRTs), and trains, as well as waste collection vehicles and other municipal fleets to transition from diesel to H2 propulsion. The procurement process should require Canadian and

Ontario content to encourage job development and manufacturing infrastructure in Ontario.

Cities like Mississauga, Brampton, Burlington, North Bay, and others are interested in pursuing H2 fleets for municipal purposes. The advantage of FCEV over BEV for heavy equipment is well documented and Ontario could become a leader in the manufacturing and use of these vehicles to help drive the demand for new low carbon H2 production.

Government procurement programs would act as a springboard for private sector manufacturing of other H2 equipment, such as cement trucks, transport trucks, material-handling equipment like forklifts and more. As noted in the discussion paper, some companies like Amazon, Canadian Tire and Walmart are committing to H2 for material handling equipment worldwide. If Ontario developed a large supply of green and low carbon H2 it would compliment local manufacturing and roll out of H2 equipment, and the province would be well positioned to export this expertise.

The H2 Strategy must go well beyond research and development, as the innovation currently exists to build the low-carbon vehicles and fuelling infrastructure of the future. The strategy should focus on implementation, incentivizing the purchase of low H2 equipment and creating demand for low carbon H2 as quickly as possible. For this reason, we will need to develop expertise for manufacturing, maintenance, and repair of H2 vehicles and energy systems. Our Community Colleges are well positioned to create the curricula needed to supply these new high paying jobs of the future.

Promoting Energy Resilience

By far the most important and the easiest to implement opportunity for green hydrogen deployment in Ontario would be establishing a robust **Power to Fuel** program. Essentially this program would allow green hydrogen generators, using electrolyzers, to have access to surplus power in the province at a competitively-driven surplus market price. This electricity should be available without transmission charges, global adjustment charges or any other charge, except the price H2 generators are prepared to pay for the watts consumed at that moment, when the power is otherwise unwanted.

This program would provide many benefits to electricity consumers in Ontario:

- It would establish a more competitive bidding process for using surplus power within the province, increasing the value of this power, lowering the Global Adjustment for other consumers.
- It would reduce the need to curtail wind, water, and solar power generation when demand is low, again providing more revenue to the system.
- And it would reduce the need to vent steam heat into the atmosphere from nuclear power stations to reduce the electricity they generate when it is not needed, so that this power could be used to make hydrogen, again providing more revenue into the system.

Electrolyzers are especially adept for grid stabilization because they can be turned up or down on a moment's notice. When demand is high for electricity, then they would generate little hydrogen, but when demand is low, they can generate a lot, i.e., to their capacity.

This opportunity is especially important because Pickering Nuclear station will be coming offline shortly. Under current demand profiles, Ontario's low carbon electricity grid, currently at around 95% carbon-free, will require upwards of 25% natural gas generation to meet demand, a major step backwards in carbon reduction. To avoid this outcome, more renewable generation, such as wind, water, solar and Small Modular Nuclear Reactors, will need to come online in Ontario. When that power is not needed, off-peak for instance, hydrogen can be made providing greater value for the generated power, lowering the Global Adjustment.

The Ontario Energy Board and/or the Independent Electricity Service Organization may need to be directed to implement the **Power to Fuel** program.

Energy resilience will also be enhanced if renewable natural gas and hydrogen is permitted to be injected into Ontario's gas pipeline system. One of the greatest barriers faced in developing renewable gas projects is finding off-take agreements for the gas produced. The simplest solution is to make it easier for this gas to be put into the distributed gas system, thereby making our natural gas system a bit greener.

Enbridge is currently doing this at their Markham project. They are making hydrogen from electricity using an electrolyzer and have finally obtained permission to add that hydrogen into the gas pipeline. However, it took years to get the OEB to permit this and even now there is reluctance from the OEB to allow others to do the same. It should be as of right to add pipeline grade renewable gas and H2 to the pipeline, and at a regulated price that is fair and reasonable.

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Tel: 613-549-8683

The same should apply to RNG from anaerobic digestion plants, landfill gas, and other sources of RNG, provided that the gas is cleaned to pipeline grade quality. If there is an outlet for the renewable gas and H2 generated, it will be easier to get these projects developed. The developer can then make a business decision around continuing to inject into the pipeline or use the gas for other purposes, such as local heating, transportation, or electrical generation.

Reducing Barriers and Enabling Action

The major barriers facing hydrogen deployment in Ontario are:

- Access to surplus electricity under a **Power to Fuel** program to make low-cost low-carbon hydrogen;
- Access to the gas distribution network for low carbon renewable natural gas and hydrogen at a fair and sustainable price;
- Insufficient current demand for low carbon H2 that is produced, to be used as transportation fuel for heavy trucks, public transit, marine and air travel, or industrial processes;
- An artificially low price for natural gas and steam reformed hydrogen that does not fully account for the depletion of a natural resource and the costs associated with the carbon emitted into the atmosphere.

Some of these barriers can be addressed by implementing a Clean Fuel Standard, such as has been proposed by the Federal Government, that recognizes the climate and other environmental benefits of low carbon hydrogen. Placing caps and penalties on carbon intensive fuels and/or providing credits for using greener hydrogen would send price signals to use less carbon intensive hydrogen. This would help with the development of more Green and Blue Hydrogen that typically are more expensive to produce as replacements for Grey/Brown hydrogen.

The Hydrogen Strategy also needs to better understand the carbon intensity of the various “colours” of hydrogen.

The discussion paper identifies three grades of hydrogen, listing them by colour. Ultimately the hydrogen grade should be determined by the carbon intensity of the H2 and this should be reflected in the caps, credits or offsets generated by the low carbon hydrogen.

Grey Hydrogen, for instance, can be made from steam reforming natural gas or coal, but its carbon intensity will change depending on whether the natural gas

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Tel: 613-549-8683

used comes from fracking or is oil well derived natural gas. A better understanding of the carbon intensity of each is needed to accurately assess their climate change impacts.

This is also true of **Blue Hydrogen** where the amount of carbon that is captured and sequestered can very significantly depending on the process that is used.

Green Hydrogen is generally associated only with hydrogen that is made from green electricity using electrolyzers. The amount of carbon emitted to generate the electricity is particularly important to determine carbon intensity, because of the amount of electricity required to make the hydrogen.

In Ontario, our 95% carbon free grid gives us a large advantage in green hydrogen generation. That might well change with the closure of Pickering, as some estimate that we will require up to 25% of generation from natural gas to meet our demand by 2025. This is why developing greater renewable generation and grid resilience with electrolyzers utilizing surplus power should be a key component of the Hydrogen Strategy.

Often overlooked is that **Green Hydrogen** can also be produced by steam reforming renewable natural gas (RNG). This RNG can be produced through anaerobic digestion of putrescible wastes, such as Source Separated Organics or sewage sludge. It can also be produced through chemical processes, such as the Hydrogen Reduction Process being advanced by True Energy, using all sources of biogenic wastes. Hydrogen generated from steam reformed RNG should qualify for all the benefits and credits associated with hydrogen generated using electrolyzers and renewable electricity.

We also suggest introducing a new category, **White Hydrogen,** that would apply to H2 generated from waste plastics and other fossil fuel based products that have reached their end of life. Typically, plastics that are not recycled end up as waste in our landfills and their energy value is lost. Thermal waste to energy processes, such as incineration, chemical reduction or pyrolysis, can capture that energy and hydrogen can be produced from the electricity and/or the syngas that they produce.

Waste materials such as unrecyclable plastics already have had their carbon content counted in their manufacture. If these materials are captured in a waste to energy facility, at worst their carbon intensity is neutral. If these materials, once thermally treated, create an energy source, such as steam, syngas and/or electricity that displaces fossil fuels, then it should be recognized as low carbon energy. If the

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Tel: 613-549-8683

electricity or syngas produced is used to make H2, this is far better than making hydrogen from coal or natural gas and should rate as having lower carbon intensity.

Consider also that municipal waste contains biogenic materials like paper, cardboard, and wood waste. This is renewable feedstock and the energy produced from these biogenic materials should be considered renewable, and any H2 made should also be considered **Green Hydrogen**.

The same principals should apply to the energy produced from chemical processes like Hydrogen Reduction, being proposed by True Energy. The breakdown or reduction of fossil-based molecules in plastics, for instance, will release embodied methane that can be captured and refined to pipeline grade natural gas quality. Steam reforming this gas will produce H2 that, while not from biogenic sources, still would have a much lower carbon intensity than steam reformed fossil natural gas.

Using Hydrogen Where and When it Makes Sense

The technology currently exists in Ontario to advance the deployment of low carbon hydrogen immediately. Low carbon supply will become available if a Power to Gas program is implemented and if the projects being developed had access to the natural gas pipeline for the gas they produced at a fair and competitive price. Putting these two policies in place will provide supply and an initial market to get the hydrogen economy rolling.

Displacing some of the Grey Hydrogen used in industrial processes, particularly refining, should also be a short-term target, as it would provide an immediate market for low carbon hydrogen that will both displace fossil fuels and at the same time, partially green the gasoline, diesel, propane and other fuels that they produce.

Developing the supply in tandem with these large users creates an opportunity to then develop fleets of Hydrogen Fuel Cell Electric Vehicles (HFCEV) that can be deployed close to these sources of Green Hydrogen production. Some believe that hydrogen-fuelling stations should be developed along highway corridors first, but we don't believe that is a priority. HFCEVs with predictable ranges, such as local delivery vehicles, taxi services, waste pick-up and transfer vehicles, public transit buses etc, do not need to be accommodated on major highways for re-fuelling. They just need to get back to their warehouse, garages or depots and be refilled

there. Rolling out re-fuelling infrastructure at hubs were H2 generation is practical is the most cost-effective way of getting HFCEV on the road.

Hydrogen deployment can also help address other issues, such as air quality, achieving additional immediate benefits. For instance, material handling equipment, such as forklifts operating inside a warehouse, are already being transitioned to H2 powered forklifts. Because of air quality concerns, many warehouses have moved away from propane lifts to battery electric forklift trucks. However, the charging infrastructure, time lost changing batteries, and other considerations have helped make the business case for the transition to H2. Incentive programs to enhance the economic case for moving to H2 forklifts would help workers across Ontario that still use propane-powered forklifts with the air quality where they work.

Similarly, the air quality in the Sarnia and Niagara border crossing regions is known to be among the worst in North America. Much of that pollution comes from idling diesel transport trucks waiting hours in line to get across the border. What if transport trailers could be shuttled across the border using green hydrogen powered tractors? Tractor-trailer yards could be established on either side of the border. Trailers could be dropped on one side and a local H2-powered truck could shuttle the trailers across and drop them on the other side to be picked up by a diesel tractor. All the fuelling could be done locally and the impact on local air quality would be improved immediately. The provincial and federal governments, working with the local municipalities on both sides of the border and with the logistics industry would be an excellent demonstration project with tangible health, environmental and carbon benefits.

Conclusion

There are numerous projects ready to proceed right now that are held up by red tape and access to opportunities, both financial and operational, that could be resolved by a hydrogen strategy focused on producing and using low carbon hydrogen. In Ontario

A **Hydrogen Secretariat** should be a key component of the strategy to help identify and implement the kinds of policies needed to move Ontario forward toward a low carbon economy. Our low carbon electrical generation system will benefit by implementing a **Power to Fuel program** using surplus power to make green hydrogen and provide resilience and more revenue to the system. Producers of green hydrogen will be encouraged to initiate projects knowing they have a

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market for the fuel they produce through access to the **Natural Gas Pipeline** and other markets for green hydrogen.

The strategy will lay down a framework for entrepreneurs, financiers, developers and more to create jobs and economic returns that advance Ontario's Carbon Reduction Targets and benefit all Ontarians.

These are our comments.

Respectfully,

Doug Hallett, CEO
dhallett@heatgroup.com
(613)-549-8683