Press Release Q&A

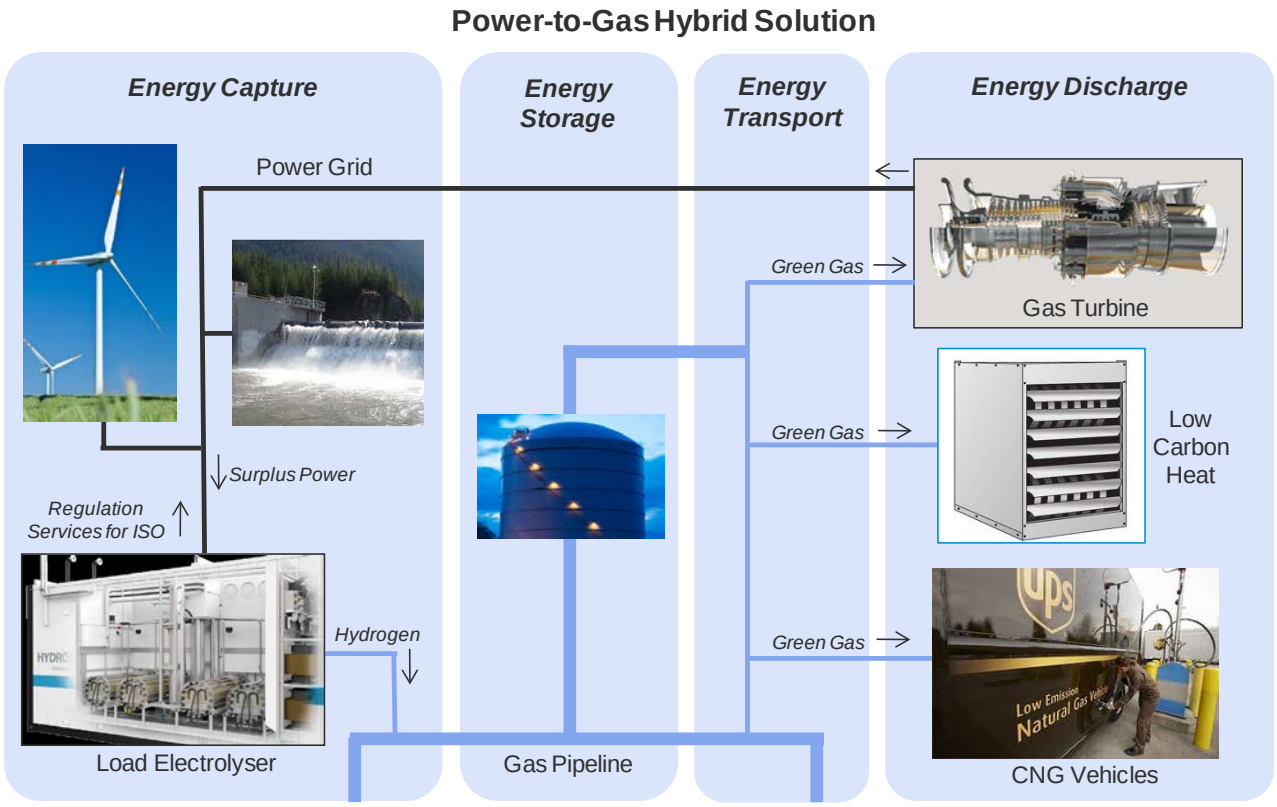
Why do we need Utility Scale Energy Storage?

Electricity is a product that must be consumed at the same moment is produced. The Electricity System Operator must dispatch generators to produce precisely the right amount of power to match the demand every five minutes of the day. As more clean sources of renewable generation are added to generation mix, the challenge of integrating intermittent and fast ramping generation increases. During periods of surplus generation, a better alternative to exporting the surplus power or curtailing the generation of power is to store the energy. However, in order to make a difference, the amount of energy storage required at any hour is in the hundreds of megawatt-hours. This utility scale of energy storage is unprecedented and requires a new solution.

What is Power-to-Gas?

Power-to-Gas is a hybrid solution which:

a) Integrates renewable generation while helping to stabilize the power grid,
b) Converts this surplus generation to hydrogen using next-generation electrolyzers,
c) Stores the energy in the existing natural gas pipelines and storage assets,
d) Enables the discharge of the stored green gas at any time and place it is needed as gas turbine power, low carbon heat or as CNG fuel for transport



Why is Power-to-Gas better than other Energy Storage options?

There are only two other Energy Storage options which approach the capacity of Power-to-Gas. Pumped hydro is a mature storage option where water is pumped up to the reservoir during off-peak periods to gravity fed to a turbine to produce power a later time. Compressed Air Energy Storage (CAES) uses large caverns to store energy as compressed air which is later released to feed a gas turbine generator. Both of these options have limitations related to geography and have a finite storage capacity measured in hours or days. In contrast, the Power-to-Gas solution has:

a) Unrivalled energy storage potential of terawatt-hours measured in months using North America's natural gas pipeline and storage infrastructure.
b) Allows the stored energy to be released anywhere on the gas or electric system (Pumped Hydro and CAES the stored energy can only be released at the point where it was stored)
c) The stored energy can be released as either gas turbine power, low carbon heat or as CNG fuel for transport whereas other options can only be released as electricity

How big is terawatt-hours of energy storage?

Injecting only small amounts of hydrogen into the gas grid (less than 5% by volume) offers significant potential. In large markets, like Ontario, the energy storage potential could provide power for over 160,000 homes. This is the equivalent of the new Niagara Tunnel hydro power project in Niagara Falls.

What is the benefit of building a bridge between the Electricity and Gas Networks?

Power–to-Gas leverages the existing natural gas pipeline and ground-storage networks. Furthermore, when stored energy is needed on the power grid, existing combined cycle gas generators convert this stored, renewable energy back to electricity. New power plants are not necessary. The distributed nature of gas pipelines allows planners to consider storing high-value electricity where grid constraints exist. Regeneration of this stored energy can then occur when, and where, it is needed most. This offers alternative transmission and distribution options for electricity by using gas networks. Significant potential exists for cost savings and synergies while maintaining the operability of the power grid.

How does Power-to-Gas help stabilize the operation of the power grid?

In addition to storing very large amounts of energy, the Power-to-Gas solution provides second-by-second response to ramp up or down as a dynamic, dispatchable load. With intermittent swings in output from wind and solar plants, an electrolyzer could provide ancillary services to the Independent System Operator used to stabilize the electricity grid. Historically, thermal generating plants (coal and gas) have provided these services such as frequency regulation, but using Power-to-Gas for these ancillary services during the periods they operate would reduce pollutants related to providing these services. Since an electrolyzer has a faster response time than generation assets, it would also reduce the total capacity required of ancillary services required which would result in reduced costs for electricity customers.

Does a Power-to-Gas Solution support a Smart Grid in Ontario?

Energy storage is an essential element of a future Smart Grid. It can ease points of congestion in transmission and distribution networks by temporarily absorbing surges and excess power flow, allowing for the deferral of expensive system upgrades. As part of the Smart Grid, energy storage is a kind of insurance policy—it brings flexibility, reliability and predictability to many aspects of system operation, particularly the integration of distributed sources of wind and solar renewable generation. Hydrogenics has demonstrated that it is Smart Grid ready during its electrolyzer test with the IESO in its Study of Distributed Loads for Regulation.

What is the impact of Power-to-Gas on GHG Reductions?

Every GJ of hydrogen produced by a Power-to-Gas application converting surplus renewable generation will displace one GJ of natural gas consumption with a commensurate reduction of 56kg of CO2 equivalent. The estimated annual GHG reduction from a 100MW Power-to-Gas project would be 25 CO2 equivalent kilotonnes. The Power-to-Gas solution can play an increasingly important role in integrating larger amounts of renewable generation in the future in Ontario and other jurisdictions.

How does Power-to-Gas fit with Ontario's Clean Energy Economic Development Strategy?

Ontario has launched its Clean Energy Economic Development Strategy to leverage the province's clean energy experience to become a global leader in key areas of the energy sector. One of the priorities identified is energy storage. The plans to commercialize Power-to-Gas is aligned with this initiative to demonstrate advanced clean energy systems, to expand and take Ontario technologies abroad, and to create more jobs and investment opportunities in the province.

How will Hydrogenics and Enbridge work together to develop utility scale energy storage projects within Enbridge's North American footprint?

The first stage will be to develop a 1MW Power-to-Gas pilot project in Ontario to test the integrated system, develop gas network interconnections and work with the IESO and Canadian Gas Association to design the operating standards and market protocols to run a Power-to-Gas application. After developing commercial scale electrolyzer capability, Hydrogenics will have the opportunity to participate in up to 50% ownership in a build own operate model for energy storage projects with Enbridge.