

August 31, 2016

Re: Enabling System Flexibility - IESO Stakeholder Submission

Current Situation

The IESO has identified the need for about 1000MW of additional flexible resources, with 300MW expected to be obtained by the end of 2017 and the remaining 700MW by the end of 2018. While there are many options at the IESO's disposal for enabling flexibility in different timeframes, the primary need identified is the *Within the Hour* period between the time when intertie transactions are confirmed and real time. The IESO requires flexible resources to be available in real-time that could provide power in 20-30 minutes if called upon, in order to manage the integration of the province's expanding variable generation portfolio.

As part of the stakeholder engagement, the IESO is looking for potential solutions which satisfy the following criteria:

- Maintaining the reliability of the system
- Cost-effective, competitive, transparent and stable
- Send efficient price signals
- Scalable to system need changes over time
- Technology neutral, allowing for the development of new technology and/or maximizing capability from existing assets

We appreciate the opportunity to contribute to this stakeholder engagement process for enabling system flexibility and will introduce a new technology option--a PEM Fuel Cell Power Plant fuelled by hydrogen.

Fuel Cell Power Plant

Fuel cells have been used for many years for residential and commercial power plants. Since the fuel cell technology (either SOFC - Solid Oxide Fuel Cell or MCFC - Molten Carbonate Fuel Cell) operates at very high temperatures, the only modes of operation are providing baseload power or as a combined heat and power (CHP) plant. Today there is a new zero-emission fuel cell power plant option using PEM (Proton Exchange Membrane) technology that can be dispatched. Automobile companies use PEM technology for their FCEVs (Fuel Cell Electric Vehicles). Hydrogenics has deployed PEM fuel cell technology for stationary back-up power applications for many years (telecom towers and data centres) and has now designed and built the world's first PEM Fuel Cell Power Plant--a 1 MW pilot project with Kolon in South Korea.



Kolon-Hydrogenics 1MW Fuel Cell Power Plant



Fuel Cell Power Module (FCPM) Racks



PEM Fuel Cells

This power plant was commissioned in October 2015. While this plant is operated to provide baseload power, the same technology platform could also be dispatched to provide a flexible ramping resource. It could easily provide the full power capacity within 20-30 minutes if called upon, and could even be available within 5 minutes. And once the PEM Fuel Cell Power Plant is dispatched, the output of the plant could be changed up or down every few seconds, or even provide regulation services if the need arises. The Fuel Cell Power Plant is a modular, scalable design using FCPM racks which can be configured in 10MW, 20MW, 50MW or even larger capacity at a building site. It would be easy to add additional generating capacity as required in the future.

Other Considerations

Given that the need for flexibility during the *Within the Hour* period is driven by the challenge of managing an increasing share of variable wind and solar renewable sources in the generation mix, it also makes sense that the criteria to evaluate potential solutions to enable flexibility should also include environmental considerations. A Fuel Cell Power Plant is zero-emission ramping solution.

During the August 16th meeting the IESO presented a high level summary of how some other ISOs have tackled the need for a flexibility resource including the supply mix and different market features that are designed to meet reliability needs and determines a value for flexibility. Our understanding of the work that has been done in CAISO on flexibility products is that it started at the same point to identify ramping solutions and market mechanisms to address the situation of shortfalls in variable generation, but was later expanded to include situations where ramping is needed to address surpluses in variable generation. The IESO may wish to include this need in its scope in the future as well.

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Thank you again for the opportunity to provide feedback for this initiative to evaluate solutions to enable system flexibility. We look forward to the chance to share more information about our proposed solution as a next step.

Rob Harvey
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Hydrogenics