Notes for Remarks
by
Bruce Campbell
President and CEO
Independent Electricity System Operator

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Check Against Delivery

Thanks for that introduction and thanks to Bala Venkatesh in particular for the invitation.

At the IESO, we're looking forward to working with you to define and expand the role that energy storage technologies can play in Ontario. Storage offers unique characteristics that could help us optimize the performance of our power system – not only at the bulk transmission level but at the distribution level as well – and deliver maximum value to ratepayers.

What I hope to do today is provide you with an overview of Ontario's power system, including what we see happening with supply, demand, conservation and emerging operability challenges. I'll review some of the ways storage can help us resolve these challenges and describe our experience to date with procuring and integrating storage into our operations. Then I'll review how we've used the IESO's Conservation Fund help drive innovation in the sector. And finally, I want to leave you with a few thoughts on the road ahead, including some of the barriers to implementation that we – as a sector – need to overcome in order to unlock the true potential of storage.

The Current Landscape

As you will all be aware, the province's energy landscape has been transformed in the last 10 years or so. The transition away from coal-fired generation to renewables, and from a centralized model of operations to an increasingly decentralized one is apparent. But it's not just the supply mix that's changing. So is practically everything else – from consumer behaviour to emerging technologies, from power system flows to regulatory frameworks, plus an emerging focus on market mechanisms.

The IESO has a unique vantage point on all this change. Our broad mandate means that we're exposed to pretty much every aspect of this unprecedented transformation – including Ontario's newly-announced Climate Change Action Plan.

Later this summer, we will be releasing the Ontario Planning Outlook, which will set the foundation for the Ministry of Energy consultations on Ontario's next Long-Term Energy Plan. The starting point is this: Ontario's electricity system is well-positioned to meet provincial needs, while continuing to adapt to significant change across the sector.

That said, we see accelerating change over the decades ahead - not just for the IESO of course, but for pretty much every individual and organization that's active in the sector. For us, one of the most critical priorities will be to ensure continued reliability given the large number of moving parts. These include the following:

- The continued expansion of renewables;
- Complex nuclear refurbishment schedules;
- Growing consumer engagement and behavioural changes;
- Limited visibility of embedded resources;
- New market mechanisms intended to spur increased competition; and
- The Climate Change Action Plan

I could go on, but that gives you a good sense of the scope of change that lies ahead. And we are confident that all this change will expand the opportunities for energy storage.

Roles for Energy Storage

Back in 2012 – feels like "way back" – we launched the Alternative Technologies for Regulation, or ATR, project. We wanted to see if we could expand the suite of technologies that were capable of providing regulation service, a grid-balancing function traditionally provided by generators.

Regulation is a contracted service that acts to match total generation on the system with total demand on a second-by-second basis. By helping to correct small, sudden changes in power system frequency, it balances power flows and helps us maintain the reliability of the power system. This quick response is becoming increasingly important as we integrate Ontario's growing portfolio of renewable resources like wind and solar and accommodate changes in consumer behaviour that impact demand for grid-supplied energy.

Through this initiative, the IESO sought to procure up to 10 megawatts (MW) of regulation from alternative sources such as dispatchable loads, aggregated demand response and storage technologies, including batteries and flywheels. To allow us to acquire experience with a range of technologies, the RFP sought proposals from multiple vendors, each providing a small quantity of regulation.

On the storage side, we reached agreements to secure regulation from a flywheel, and a battery storage system. Over the course of the three-year contracts we offered, our aim was to acquire real-time, real-world experience with these assets, enabling us to see how non-traditional resources behave.

Until this initiative, the 174 MW Beck Pump Generating Station (or PGS) facility in Niagara provided the IESO with most of its direct, operational experience with storage.

And it set a high standard for reliable operations.

Our question was whether these newer technologies could meet that standard. And I'm pleased to report that their performance to date has been solid. That's not to say everything went flawlessly with the development and integration processes but we're very encouraged by the results we've seen to date.

As we've worked through some unexpected operational issues, there have been important learnings on both sides. But we've made adjustments to our tools and processes, and we can now say with confidence that energy storage technologies can reliably provide regulation service and meet our rigorous performance requirements.

This is great news, but it really only scratches the surface. You may have seen a storage report we issued earlier this year. If you haven't had a chance to review it, I'd encourage you to take a few minutes and do so. It's a bit of a "state of the nation" for storage in Ontario right now and identifies some of the other opportunities that already exist – or are expected to emerge in the near future.

What this report shows is that energy storage facilities have the potential to provide a range of services to support reliability, including regulation, voltage control, operating reserve and flexibility – provided that they are the right size and in the right location. The report also suggests that from an economic standpoint, a storage facility that can provide more than one service stands the best chance of being commercially viable. All that being said, storage is not the only option for providing these services, and the IESO will continue to seek a balanced portfolio of resources.

But storage does offer us some operational advantages. Its quick response time makes it especially attractive as we integrate a non-hydro renewable fleet that's expected to approach 10,700 MW in pretty short order. As the province becomes more reliant on renewable generation, it's becoming increasingly urgent for the IESO to have the levers necessary to manage the interrelated issues of variability and uncertainty of production from these units. Variable generation forecasts are inputs into market-based decision tools, and uncertainty in our forecasts can affect things like unit commitment and dispatch as well as import and export scheduling. When the output of the renewable fleet differs from what's expected, it can have a material impact not just on system operations but on market efficiency as well.

So where do I see storage playing a part? In addition to providing regulation, I see three key areas where storage technologies have the potential to contribute most effectively here in Ontario:

1. **Congestion Relief** -- In Ontario's major load centres, which include the Greater Toronto and Hamilton area (GTHA), Ottawa, Kitchener-Waterloo-Cambridge-Guelph (KWCG), energy storage technologies could alleviate transmission constraints by charging off-peak and then injecting onto the grid or displacing load during peak load hours. This could help defer certain transmission and/or distribution upgrade needs in these areas.

2. **Voltage Control** – as Ontario's demand profile changes, voltage issues are emerging in some parts of the province, especially the Northwest, Northeast and some parts of the Toronto, East, Southwest, West and Essa transmission zones. Transmission-connected energy storage facilities that have voltage control capability could provide voltage control services and prevent the IESO from having to take control actions, such as taking lightly loaded lines out of service, potentially reducing the robustness of the transmission system.

3. **Emergency Preparedness** – as communities around the world come to grips with the effects of climate change, including increasingly damaging and violent storms, energy storage devices could play a part in bolstering local and regional resilience. You only need to look at what happened during Hurricane Sandy, when several community-level microgrids that included storage devices enabled neighbourhoods to operate as electrical islands and sustain relatively normal operations, to see how storage can support resilience during extreme weather conditions.

As most of you know, we completed a two-phase energy storage procurement late last year, securing approximately 50 MW in total. Phase I received an enormous amount of interest within Ontario, as well as nationally and internationally. More than 400 proposals were submitted in response to the Request for Proposal (RFP).The successful proposals included four technologies – thermal energy storage, stationary batteries, flywheels, and power-to-gas (hydrogen storage) – and a total of 12 specific projects, totalling just under 35 MW of storage capacity were selected for the first phase of this procurement.

These projects are located across different electrical zones in Ontario to enable the IESO to evaluate their effectiveness at alleviating local constraints or restrictions. All of the chosen projects are currently in the process of developing, connecting and commissioning and are expected to become operational at various stages over the course of 2016 and 2017.

Three of the projects will be required to provide regulation and nine of the projects will be required to provide reactive support and voltage control. We're looking forward to getting these resources integrated and operational, and see how well they meet expectations.

Over the course of the three-year contract term, we plan to work with each of the grid energy storage project owners to improve the offered services and maximize the learnings associated with each project's performance. We expect to share findings with the industry.

Phase II of the procurement was also oversubscribed, with potential projects submitted representing 133 MW. After a rigorous, competitive procurement process, the IESO selected five proponents for contract offers, representing nine distinct projects totalling almost 17 MW. Phase II projects will have up to 30 months to come into service and contract terms of 10 years.

Although it's still early days for integrating these new grid-connected storage facilities in Ontario, they will build up our direct experience with the various technologies, and we look forward to working with all of the project proponents to confirm and capture the full value of storage.

Storage and the IESO Conservation Fund

I promised I would spend a few minutes speaking about the Conservation Fund. The Conservation Fund was created more than a decade ago to invest in innovative technologies and operational models on the demand side of the grid. As the industry has evolved in the intervening years, the fund's mandate and funding priorities have also expanded.

One of the success stories we like to talk about concerns a company you've probably all heard of: Temporal Power. Back in 2010, they received $300,000 from the Conservation Fund to support further development of their flywheel technology. Two years later, in December 2012, Temporal and its partners were among three suppliers winning the IESO's competition to provide regulation service through the Alternative Technologies for Regulation program I mentioned. Their flywheel in Minto has been fully integrated into our operations, is performing well, and is helping us to manage small imbalances between supply and demand. From inception to execution, this project is a great example of how Ontario's innovation in energy storage can be nurtured and harnessed for our general advantage.

The Conservation Fund has been investing in storage-related projects that span the residential, industrial and commercial sectors since 2008. In addition to providing support to Temporal Power, we recently invested $500,000 in a project led by PowerStream to develop and implement the POWER.HOUSE, an aggregated fleet of 20 residential solar and energy storage systems that Powerstream can control through intelligent software to simulate a single facility capable of meeting system needs. We'll be keeping a close watch on this initiative and helping PowerStream share what it learns. Reports on project outcomes, electricity system benefits and potential new LDC business models will be produced and shared publicly with all Ontario LDCs.

And, of course, the Conservation Fund has provided funding for three IESO Distinguished Research Fellows here at the Centre for Urban Energy to conduct research in three areas: integration of urban and energy planning; integrated delivery of electricity, gas and water conservation; and energy storage. That work is well underway, and we look forward to leveraging their findings and continuing to advance thought leadership in these areas.

In terms of more immediate engagement with energy storage project developers, on Wednesday, we released a Request for Information for the provision of regulation service. We are looking to expand the depth of the regulation market in Ontario. Currently, the IESO schedules up to 100 MW of regulation range on a day-to-day basis from over 200 MW contracted. But like many other jurisdictions across North America, the IESO has identified several factors driving the need to expand our regulation market. This RFI is intended to attract both existing and new providers of regulation, and we look forward to hearing from all parts of the energy storage community. This process should provide an excellent opportunity for all of you in the storage industry to demonstrate your capabilities.

Before I sign off, I'll leave you with a few questions that we – as a sector – must address in order to extract maximum value from energy storage in Ontario.

Here's what I see as the big three:

- Operations: How do we coordinate the potential local, regional and provincial benefits of storage?
- Regulatory: Does Ontario's regulatory framework adequately recognize the characteristics of storage?
- Market: How can storage be best integrated into markets, to support the transition to a low-carbon economy?

I have no doubt that each of you might have a different list, but my real point is this – yes, we need to advance the technology – best success will only come with clear, practical operational benefits, by addressing regulatory barriers, and by ensuring that our market provides you with a fair competitive opportunity.

We don't have all the answers. But as these changes materialize, the lines between transmission and distribution will become even blurrier. That prospect is driving a re-examination of the relationship between the IESO and LDCs, and between LDCs and their customers, all aimed at closer coordination on an operational level to enhance reliable and efficient operations.

At this point in the evolution of storage in Ontario, I'm convinced there's a great story here, and I look forward to working with you to advancing those benefits across the province.