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Context: Smart Wires response to Comprehensive Review of BC Hydro: Phase 2 Interim Report

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Smart Wires welcomes the opportunity to provide comments on the Comprehensive Review of BC Hydro: Phase 2 Interim Report.

Overview:

Smart Wires is the world leader in transmission and distribution grid optimization solutions. Utilities across the globe leverage our patented modular power flow control technology to release substantial amounts of unused existing transmission and distribution capacity on power grids. We achieve this through the redistribution of power from overloaded circuits on to more lightly loaded ones. Using this technology, we can increase the transfer capacity across an existing grid without the need for building new circuits or any requirement to operate equipment outside of its design rating.

Benefits of Modular Transmission and Distribution Solutions to BC Hydro:

Smart Wires recognizes that the BC Hydro grid will require significant development over the coming decade to meet the Clean BC Electrification goals, to facilitate growing demand, and to upgrade aging infrastructure that is reaching end of life. Fully utilizing existing grid capacity can increase BC Hydro's ability to respond to these changing network conditions in a rapid and cost effective manner, while minimizing impact on both communities and the environment. Smart Wires power flow control solutions can play a key role in delivering this additional capacity in a fast, economic and non-disruptive way.

Smart Wires technology is a modular off the shelf network solution – which can provide significant cost and risk mitigation benefits to BC Hydro as opposed to traditional reinforcement solutions such as new transmission and distribution lines, reconductoring, Series Capacitors, or Phase Shifting Transformers. Modular solutions like Smart Wires' power flow controllers have multiple benefits including:

- **Optionality and Scalability:** Installations can be scaled up or down over time by adding or removing devices at any point, allowing BC Hydro to optimize the solution to meet the ever changing needs of the system over the life of the assets. This greatly reduces the risk of procuring stranded assets and can yield significant capital savings by deferring investment decisions until needs materialize in real time. This approach fits perfectly with a “least worst regrets” scenario planning approach to developing the grid, especially with uncertain future load and economic growth projections.
- **Fast Delivery and Installation:** Modular Solutions are “off the shelf” and so are quick to manufacture, easy to transport and fast to install; large projects can be fully operational to increase network constraints within 6-9 months after contract award.

- **Minimizes Risk:** The solutions can also be readily re-deployed across voltage classes over the life of the assets. Therefore, the technology can be installed as an interim solution to release near term capacity while larger infrastructure projects are completed. The technology could then be re-deployed to resolve constraints elsewhere on the network.
- **Value to Planning, Construction and Operations:** The technology can also be deployed in a mobile form factor. This mobile version can be used to manage congestion over a period of months or years during network outages and upgrades. It can be installed in 8 hours and be purchased or leased. The mobile solution can also be used to help facilitate outages and extend outage windows, making more time available to get critical asset refurbishments completed.

Experience:

Smart Wires has partnered with utilities and transmission companies across the world to address the rapidly evolving challenges of today's energy environment by transforming the way that transmission grids are planned and operated. Our vision is to deliver value to consumers by creating dynamic transmission grids that are clean, reliable, affordable and safe. Smart Wires has been installing modular power flow control for over 7 years in the USA, Europe and Australia. A sample of our customers with installations in place or currently under development include National Grid (NGET UK), TransGrid (Australia), Ausnet (Australia), RTE (France), Duke Energy (Florida), Pacific Gas and Electric (PG&E), National Grid US (Massachusetts), UKPN (UK) and IPTO (Greece) and Central Hudson Gas and Electric (New York). The modular nature of our technology allows us to deliver projects across a range of sizes and voltage levels and our current project portfolio spans projects from 25 kV to 550 kV and continuous current ratings up to 3600 A.

1. Smart Wires commentary on 'Emerging Trends':

Smart Wires agrees with the report's discussion of emerging trends and patterns with respect to load, technology and customer requirements. Variability in future load projections is driving utilities across the world to move towards a scenario planning approach to network reinforcements in an effort to develop a "least worst regrets" solution. This is manifesting itself as a more cost effective approach to planning for the future and has a profound impact on the utilities risk profile for network investments. This is achieved by enabling the utility to deploy modular network solutions to resolve known near term needs and to scale these solutions up as longer term, less certain needs materialize over time. Additionally, on the customer side, new types of customers have vastly different demand requirements to traditional heavy industry load customers. In South West Ontario for example, the growth of vegetable and cannabis demand drove capacity requirements up by 1300 MW in the last 3 years. Both the IESO and Hydro One have been looking at ways to evolve operational and planning practices to embrace this new load, which not only will have a significant impact on the electricity system but also on the growth of the local economy. This area is now seen as the Growhouse Capital of North America. Similarly, in Ireland, Data Centre demand requests have dwarfed urban Dublin City demand in the past 5 years and the overall demand in the Dublin Metro Area is expected to double in the next 5 years, if transmission infrastructure can be developed to meet this demand. Smart Wires' modular solutions can be used to help facilitate these types of requests for rapid connection or capacity increases and in general network solutions must be tailored to meet ever changing needs of its customers.

British Columbia has a similar opportunity to attract demand customers like greenhouses, data centres and currency mining entities in vast quantities due to its large supply of clean electricity and favorable

climate conditions. However, meeting the demands of customers like this presents huge challenges to utilities. These types of customers can:

- I. Ramp up initial capacity requirements in months not years;
- II. They can scale quickly and in modular form;
- III. They have choice; they are agnostic to location and equally can move to new locations very quickly, hence cannot be guaranteed to be there for typical transmission asset lifetime.

Similarly, the connection of demand customers like this can create huge shifts in the direction of power flows on the High Voltage system and drive reinforcements further in the grid. Having solutions that can respond to these changes quickly will present a unique selling point for these customers and can be used as a tool to attract new customers to the province.

2. Smart Wires commentary on 'Supporting B.C.'s Energy and Economic Development Goals through Clean BC':

From the Phase 2 Interim report it is clear that keeping rates affordable for British Columbians is the overriding objective of the government and BC Hydro. Technology solutions deployed on the transmission system can be significantly less expensive than traditional capital projects, thus helping to lower the overall cost of the capital plan and helping to keep rates low over the long term. Smart Wires' acknowledges that the Phase 2 Interim Report discussed the benefits of smart grid technology on the distribution system. Similarly, new flexible, controllable, smart technology can be used on the transmission system to provide significant benefits to British Columbia. While there are a lot of innovative cost saving solutions aimed at the Distribution system, real substantive savings also can be achieved on the Transmission system (for example, a Smart Wires solution on the National Grid UK Transmission Network, yielded cost effective transfer capacity at £16M/GW and provided nearly £400M in savings against conventional solutions).

From an assessment of the BC Hydro Capital Plans, it is clear that a number of series compensation solutions will need to be installed on the Bulk Transmission system over the coming decade to maximize power transfers from North to South and East to West. These generally require firm triggers to justify the investment (e.g Customer request, Load Growth, etc). Using a modular solution allows BC Hydro to scale in a low cost series compensation solution over time, which lowers BC Hydro's Net Present Value (NPV) Investment and more importantly helps to manage BC Hydro's investment risk. For example, instead of sizing a series compensation solution today, for an ultimate 2030 need, staging the solution with 30% the compensation required installed in 2022, 30% in 2026 and 40% in 2030, has a substantial impact on the overall NPV savings for BC Hydro, while simultaneously reducing BC Hydro's risk if the maximum load forecast does not materialize.

Furthermore, major transmission infrastructure projects can have very long lead times to the in service date, which can sometimes be longer than the lead time of an interconnection request from the industrial customer that triggered the expansion or reinforcement. This misalignment of timelines can be detrimental to economic development: the customer won't make a final investment decision unless it is certain that the utility can build the required capacity in time, but because of the long timelines the utility would need to start the project before the customer's final investment decision. The use of modular, scalable and quick to install grid devices such as Smart Wires can mitigate this risk.

Q. How can BC Hydro reduce barriers to electrification for existing and new customers?

Smart Wires sees the big impediment to GHG Emissions reduction targets worldwide as “Time”. Policy will drive electrification of consumer and large industrial load. The challenge for utilities is in being able to utilize flexible solutions that can quickly support these changes. For example, in the Metro Vancouver Area, the load demand could increase significantly and load patterns could change substantially due to rising electrification of the transportation fleet or space heating. On the other hand, energy efficiency initiatives could have a dampening effect on overall demand. In either case, having flexible solutions to meet the needs of the this changing demand on a year by year basis will help BC Hydro develop the network to meet electrification challenges in a cohesive and efficient manner. Similarly, as mentioned above, these flexible solutions will have a positive effect on rapidly connecting new customers to the grid and reducing risk profiles for the customer.

Q. How can competitiveness for business and industry be prioritized in an electrified future?

British Columbia remains a very attractive place for business with competitive electricity rates. While there is a clear need to prioritize rate structures, reliability and speed for connecting customers, it is critical for BC Hydro to facilitate electrification over the coming decade by making increased transmission capacity more quickly and readily available, at the lowest cost possible. This means:

- I. Maximizing the use of the existing Grid Assets;
- II. Facilitating connection of industrial loads to the system;
- III. Carrying out construction and maintenance works of network upgrades with minimal impact on customers;
- IV. Embracing *Digitized* solutions which will enable BC Hydro to manage change and future network conditions including more network automation and proliferation of artificial intelligence on the Network side of the business.

For example, in the Peace Region, it will be important to provide cost efficient connection access to provide strong business cases for existing gas and mining entities to connect to the grid. Additionally, they will require significant resilience and reliability metrics to support this decision so minimizing the impact of grid outages and ensuring a high degree of reliability will be important factors to consider.

Q. Other jurisdictions, including Ontario and Quebec, invest in research and development in the electricity space to expand their customer offerings. How can BC Hydro best position itself to drive innovation? What is the best way to fund these efforts?

BC Hydro, through its subsidiaries Powertech and Powerex have world class expertise in the area of Electrical Equipment and Electricity Markets. There is an opportunity to further leverage this expertise to advance innovation in both those sectors. The main barrier to new technology companies is being able to provide adequate technical assurance to utility companies, hence Hydro Quebec have an extensive process in place to test new innovative solutions in their IREQ Testing facilities. Where a solution can be shown to delivery real strategic value to the utility, fast track processes in place to test these solutions, either on the live system or in laboratory environment should be a priority. This type of risk mitigation has been shown to deliver substantial benefits to both utilities and to the local economies who benefit from deployment of these solutions at scale on the electricity grid. However, it is

important for smaller companies to get certainty around timing of these processes. Smart Wires has availed itself of Network Innovation Allowance (NIA) funding in the UK to advance studies and real system projects to deliver value for customers. Similarly, in Australia, Smart Wires has availed of Network Capability Incentive Parameter Action Plan (NCIPAP) funding to deploy early installations in New South Wales, South Australia and Victoria. These funds are allocated as a percentage of the overall utility revenues; e.g in UK, the NIA allowance allows the utility to spend up to 2% of the utility revenue/year and earn a higher RoRE on these projects. This helps to incent innovation projects and offset overall risk of deploying new technology. However, the innovation mechanisms must ensure they demonstrate long term value to the customers and this should be factored into any similar framework put in place in British Columbia.

Network Innovation is increasing in the energy sector, however, given the importance of security of critical infrastructure it is important that new technologies are carefully considered before wide scale deployment on electricity networks. The role of qualifying new technologies is often not very well aligned with the objectives of the business and there is frequently a focus on delivering pilot projects as an end in themselves with limited thought to the transition of the technology to business as usual.

If a technology has potential to deliver value and it is at an appropriate level of maturity, then it could be prudent to proceed in a structured technical approval process rather than through innovation projects. This process should ideally:

- I. Establish a timeline for qualification with milestones. Progress on qualification should be monitored by the function responsible for large scale capital investments that could use this technology;
- II. Identify the specific needs of technical qualification in advance, i.e. what needs to be validated before this technology could be placed in wide scale usage;
- III. Identify the most efficient way of validate each component, this could include: reference from other network operators that have used the technology, site visits, studies – including highly detailed real time simulations and if necessary a pilot project.

3. Smart Wires commentary on ‘Leveraging our Strengths’:

Q. What factors should be considered if BC Hydro looks to expand its business interests including considering new opportunities outside of B.C. via Powerex or a new subsidiary?

Powerex provides a strong business centre and revenue source for British Columbia year after year. The opportunities to leverage the capabilities of Powerex will increase in the future as more of the surrounding states move to 100% RPS goals. BC Hydro and Powerex should continue to look at ways to maximize their ability to sell into the Western Interconnection. Network solutions such as Power Flow Control is one way of helping to optimize those trading corridors, by:

1. Installing mobile solutions during the Outage season to minimize the constraints on BC’s system that limit import or export capacity;
2. Proposing mobile solutions to neighboring utilities and the Northern Grid Group, to alleviate constraints that might be limiting Powerex’s access to markets;
3. Maximizing the use of the existing Cross Border tie-lines and preparing a solution to replace aging Phase Shifting Transformer on the 230 kV Nelway-Boundary circuit; and

4. If assessing new transmission capacity, leverage interim power flow control solutions to provide short term capacity increases until the new line(s) are in service.

While traditional multi-billion dollar solutions have been assessed in the past to maximize transfer capacity between British Columbia and the United States, it is possible that smaller sub \$10M investments which have a positive impact on Powerex's ability to transfer power, yield a much greater return on investment and may be worth exploring further on either BC Hydro's system or neighboring systems, to increase Powerex revenues.

Q. What are important considerations for a 100% clean electricity energy standard for BC Hydro's integrated system?

Smart Wires considers the following to be crucial elements to consider for a 100% clean electricity standard for BC Hydro's integrated system:

1. Embrace flexible solutions to account for change and uncertainty in load growth;
2. Embrace solutions that can be deployed quickly and provide optionality to help minimize BC Hydro risk and allow a phased approach towards 100% clean electricity;
3. Embrace innovation to accelerate towards 100% clean electricity through Powertech and Powerex;
4. Embrace digital solutions to interface with customers on the distribution side of the business;
5. Focus on ways to facilitate electrification of large industrial loads including Gas, Mining and LNG loads in northeast and northwest British Columbia.

In conclusion, Smart Wires commends British Columbia and BC Hydro for undertaking the comprehensive review to best position BC Hydro for long term success. Smart Wires believes that smart grid technology designed for the transmission system can make a significant contribution to the objectives of keeping rates affordable, meeting the climate change goals and supporting economic development.

Kind Regards,

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