September 16th, 2019

500-5935
Airport Road
Mississauga, ON
L4V 1W5

Phone: 905-695-1005 ex.5738
Mobile: 437-237-1928
Fax: 905-695-0525
Email: rachael.taljaard@cima.ca

Attention: **Ontario Energy Board**

RE: **EB-2019-0207 Distributed Energy Resources Connections Review Initiative**

The Ontario Energy Board (OEB) is responsible for protecting end users, setting energy rates, ensuring utilities operate within their set mandate, and developing policy to encourage a sustainable and reliable energy sector. There is also a responsibility to those seeking to connect generation, or Distributed Energy Resources (DER), to the grid. OEB has been listening to industry stakeholders, DER developers and to the concerns that have been raised relating to the costs and timescales involved when seeking to connect DER projects. OEB is seeking to listen to input from industry stakeholders to standardize the regulatory rules regarding DER, the cost responsibility to be borne by DER customers seeking connections, and to establish more standardized timelines for the overall connections process.

DER developers are experiencing inconsistencies in the service provided by utilities when seeking a connection, with some erring towards more conservative approaches to connection than others. By taking a very conservative approach to network planning, while the network remains safe for any potential worst-case scenario, a significant proportion of capacity remains underutilized. There is potential for innovative technologies to release this unused capacity to DER developers seeking to connect.

CIMA+ is an engineering consultancy with over 40 years of experience working in the power and energy sector. Our experience working with both utilities and DER developers makes us well placed to offer a unique perspective on the issues the OEB is wishing to address. Our responses to the questions posed in the OEB's "Distributed Energy Resources Connections Review Initiative" letter dated August 13th, 2019 are laid out below.

1. Are the objectives for the DER Connections Review initiative clear?

The objectives of the review are clearly laid out with the intentions being to: standardize and clarify on definitions, terminology, and regulatory rules relating to DER; develop clear rules regarding the cost responsibility of DERs to ensure fairness across all customers; develop detailed and comprehensive timelines for the connections process; and appropriately standardize technical requirements.

2. Have staff identified the right topics for the DER Connections Review and do stakeholders have any other specific concerns that they want to identify?

Yes, we believe the right topics have been identified for review. The issues surrounding cost and timescales for DER connections are not unique to Ontario and there is opportunity to draw on international experience in this area. The UK has experienced a significant shift in the energy landscape in the last decade, driven by saturation at transmission level and developers seeking to connect DER at lower voltage levels, resulting in bi-directional power flows at distribution level. With the growing trend of connecting at the distribution level, there are now pockets of saturation in the distribution networks. Costs of network upgrades and reinforcements are the responsibility of the connecting DER that has triggered the reinforcement, and in many cases these costs are so high it renders the development infeasible. Through innovation funding new concepts and technologies were trialed and introduced. One of them was Active Network Management (ANM) – the ability to actively manage DER export in real-time against specific locational constraints in the distribution network thus releasing unutilized capacity to DER seeking a connection. This has since developed into the DER Management System (DERMS) concept. DERMS itself encompasses many aspects of network operation (scheduling, forecasting, optimization, dispatch) however it is ANM, the reactive fail-safe element, that ensures the network remains in a safe operating state by taking the necessary action to avoid overloads or over-voltages.

3. Are there any proposed solutions that stakeholders wish to identify at this point?

Electricity networks are traditionally designed in a “fit-and-forget” manner, taking an N-1 approach to redundancy, meaning the network is over planned for what is connected and operational. This results in a network that can cope with large disturbances, knowing that at least half of the available capacity is unutilized. The down side to this approach is that there is so much unutilized capacity, and developers are facing significant costs to connect in order to maintain this. The distributed generation trend has resulted in more active networks, bi-directional power flows, and at the same time consumers are becoming more energy aware. As consumers incorporate their own DER (rooftop PV and home battery storage systems) the available capacity for larger DER to connect upstream is also reduced. Some nations have looked at innovative approaches to addressing these issues in the most cost-effective and technically feasible ways.

One example is that in Germany. There the cost of reinforcement for connection is socialized across all demand customers, so the economic model for generating DER is different. They have been seeing constraints in their networks and rapidly rising consumer bills, however, as a result of the volume of wind and PV connecting. Previous legislation introduced in Germany stated that all export from renewable energy must be accommodated, with curtailment reserved for when there was no alternative for keeping the network safe. Three (3) questions were posed:

- Does it make economic sense to construct a grid for conditions that occur so rarely (worst case conditions)?
- By what percentage could connection capacity be increased if the grid did not have to account always for the worst-case scenario?
- What is the economic balance when substituting grid augmentation for capacity growth through curtailment?

EWE-Netz, a German network operator, sought to answer these questions and to investigate curtailment for increasing hosting capacity. They pioneered the 5% rule, the theory of which being “the load flow dependent throttling of a low percentage of yearly feed-in carried out in maximum load situations leads to a drastic increase of grid connection capacity” [1]. As a result of this of this trial EWE-Netz were able to show that a 5% curtailment of generation could result in a 200% increase in connection capacity. The

field testing of this concept resulted in a change in legislation whereby 3% curtailment of all distribution connected generation is permitted in order to avoid network reinforcements and upgrades.

This curtailment is implemented based upon forecasts, and frequently forecasts are wrong. In Germany curtailment is compensated and, with the error present in forecasting generation, is frequently over curtailed, resulting in increased payments made to DER.

ANM, or DERMS, is one solution that can take this concept further. In the UK the national regulator, Ofgem, encourages innovation in the networks through the Low Carbon Network Fund that has now been replaced by the Network Innovation Fund. This has resulted in new technologies and commercial processes being adopted after trials in a business-as-usual fashion. ANM is perhaps the best example of this, and there are now 14 operational schemes across the UK actively controlling DER, batteries, and domestic demand. The first incarnation of ANM was the Special Protection Scheme (SPS), which has become more active as system balancing becomes more challenging with increased volumes of renewables. ANM can significantly reduce the impact of SPSs, reduce curtailment, and ensure the SPS does not operate. This concept has been demonstrated in the Orkney ANM scheme [2] where hosting capacity has been doubled, saving over £30 million in avoided grid reinforcements.

In the UK it is very difficult to construct transmission lines and it can take a very long time. This causes problems at the distribution level as there are now net exports upstream to an already congested transmission network. This can be mitigated very cost effectively with a small amount of curtailment. The table shown below, Figure 1, is from the Flexible Plug and Play innovation project run by UK Power Networks, a UK network operator. The aim was to reduce the time taken to connect and the cost of the connection by using ANM technology. This project managed to reduce connection times by approximately 29 weeks and saved on average £2.9 million per connection[1].

CONNECTION OFFERS					CURTAILMENT		
Capacity	Type	Firm BAU	Interruptible FPP	Saving	% Curtailment	MWh/yr	£/yr
8 MW	Wind	£3.5 m	£881 k	75%	2.7%	704	£32k/yr
10 MW	Wind	£4.8 m	£590 k	88%	5.33%	1,402	£63k/yr
0.5 MW	Wind	£0.8 m	£157 k	81%	5.33%	70	£13k/yr
0.5 MW	CHP	£2.5 m	£117 k	95%	1.73%	76	£13k/yr
6.6 MW	PV	£9.0 m	£1,734 k	81%	2.57%	166	£12k/yr
10.25 MW	Wind	£5.2 m	£1,584 k	70%	5.33%	1,437	£65k/yr
0.5 MW	Wind	£1.8 m	£234 k	88%	5.33%	70	£13k/yr
1.5 MW	Wind	£1.9 m	£157 k	92%	5.33%	210	£20k/yr
0.5 MW	Wind	£3.5 m	£881 k	75%	5.33%	70	£13k/yr

Figure 1: Cost saving for interruptible connections (ANM) versus traditional connections (with reinforcements)

[1] https://innovation.ukpowernetworks.co.uk/projects/flexible-plug-and-play/

4. What is the best approach for development of solutions to the issues identified?

Allowing pilot projects to trial an ANM / DERMS approach for increasing hosting capacity and reducing connection costs/timescales would allow the Ontario energy market to build confidence in the technology and roll it out into a business-as-usual connection offer. This coupled with suitable education across the industry should see successful integration of the technology and benefits to DER developers.

I believe this to be a relevant avenue of investigation for OEB as they seek to refresh the connections process. I would like to take this opportunity to express my interest in participating in the Working Group.

Sincerely,

CIMA Canada Inc.

Rachael Taljaard, Ph.D.

Project Analyst - Energy

References:

[1] E. Wieben, T. Kumm, H. Hohn, M. Rohr and M. Stadler, "The 5% approach as building block of an energy system dominated by renewables," in *28th EnviroInfo Conference*, Oldenburgh, 2014.

[2] C. Foote, R. Johnston, F. Watson, R. Curries, D. Maclemman and A. Urquhart, "Second generation active network management on Orkney," in *22nd International Conference and Exhibition on Electricity Distribution (CIRED)*, Stockholm, 2013.