Improving Power System Data Quality to Enable AI Applications

What is the **problem** that needs to be solved?

With world-class artificial intelligence (AI) and machine learning (ML) research and education, Alberta is well positioned to develop and export solutions that enable more efficient performance of power systems, bringing economic and environmental benefits to customers, utilities and Albertans in general. Applications include:
- Energy storage optimization
- Electric vehicle charging optimization
- Microgrid load / generation optimization
- Facility (i.e. "behind the meter") optimization

At the same time, we see skilled graduates leave the province to seek employment with companies in other parts of the world, where new businesses are emerging to take leadership in this space.

One of the problems that must be overcome to reverse this situation concerns the quality of data that is collected and available on Alberta's power system. Although abundant data is collected by distributed companies, transmission companies, regulators, as well as customers, the *quality* (e.g. differing formats) and *availability* (e.g. multiple sources, not shared or centralized) of this data is not sufficient to inform the development of machine learning algorithms and solutions. In some cases there may be a requirement for stakeholders to collect new data.

The intention of this collaborative initiative it is to better understand:
- What data and quality is needed by AI and ML professionals, in cooperation with utility professionals, to develop machine learning algorithms to better optimize Alberta's energy system,
- Reconcile these needs with what data is currently available,
- Identify opportunities to close the "data availability and quality" gap in collaboration with power utilities, regulators and customers.

Why is it **important** to solve this problem?

For Alberta, there are at least three important reasons to solve this problem that will bring benefit to Albertans.

1. **Optimizing Alberta's Power Grid.** As distributed energy systems continue to grow, AI and ML algorithms can enable optimization solutions that can, for example, promote the development of renewable energy by unlocking intermittent generation, as well as reduce transmissions infrastructure and costs.
2. **Economic Development of Alberta's Emerging AI sector.** Reverse the "brain drain" of Alberta's AI and ML expertise by providing a better foundation to develop applied solutions from research that can be packaged and exported.
3. **Support Alberta's Climate Leadership**. Optimizing Alberta's power grid can enable more renewable energy to come online through better management of intermittent power and improve the economics.

What is the **ambition** for a solution?

Ultimately, the ambition is to have data availability and quality that will allow Albertans to capture the benefits above, namely:
- An electricity grid that is optimized given the future increase in energy storage and renewables.
- Alberta-born AI and ML businesses and exportable product and solutions.
- Climate leadership through reduced greenhouse gas emissions.

In the near term, the intention is to host a working session at the EFL's upcoming Energy.AI[3] workshop on Oct. 1, 2019 in Calgary to work on this problem. The idea is to use an existing project (e.g. storage, EV charging, microgrid, etc.) where there is potential to apply AI and ML for optimization as a case study to tease out data needs, compare to current data collected and explore ways to work together to close the data gap.

What **challenges** do you imagine facing to achieve this ambition?

There are three key challenges to achieve this solution

- **A collaboration platform with the right mix of expertise**. To move forward on a solution, a platform is needed to allow experts in AI and ML (e.g. data scientists) to work closely with electricity sector experts (in particular those with an AI background).
- **Issues related to privacy and propriety of data**. Finding answers to what data is out there, who owns it, and if there is a willingness to share it under certain circumstances?
- **Potential regulatory challenges for energy storage**. Energy storage facilities do not have a clear regulatory framework, e.g. they are under regulation as both a load and generator. This has the potential to raise issues that may need to be addressed related to the application of AI and ML. The Alberta Electricity Systems Operator (AESO) is

currently leading discussions to further explore this issue with its Energy Storage Roadmap initiative.

What has been tried in the **past** (if anything)?

There are currently no public collaborative initiatives that are looking at the application of artificial intelligence for the optimization of storage assets at the level of Alberta's electricity system. Relevant current activities include:
- Some grid-scale energy storage projects and studies are being developed with Altalink,TransCanada, Enmax, ATCO and Fortis, although it is uncertain the level of AI and ML application in these projects.
- NAIT's Centre for Grid Innovation which allows private sector stakeholders to come and test new technologies.
- Companies that are developing AI and ML solutions grid optimization in other jurisdictions, e.g. Bluwav-AI and Opus One in Ontario. There are many companies in Alberta that are leveraging AI to develop new business models but there are no known Alberta-based companies focusing on AI for the power sector.
- The Alberta Machine Intelligence Institute (AMII) has developed an AMII Innovates program to help businesses to adopt AI and ML by developing strategies, shifting processes and systems, and building in-house knowledge and teams.