Industrial Energy Efficiency and Reducing Emissions with AI

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

There is a continued need to improve the efficiency of industrial processes driven by the need to reduce costs and tackle climate change. Classic engineering approaches that focus on physical changes to facilities, such as retrofits, rebuilds and/or redesigns, are costly, time consuming, have long lag times, and do not scale well to other facilities.

Artificial intelligence (AI) and machine learning (ML) offer a new opportunity to explore energy efficiency gains of existing infrastructure and data at lower costs, quicker turnarounds and higher scalability. This represents a huge opportunity to maximize energy efficiency and lower carbon emissions. This approach has been tested and implemented in other industries successfully, but has not been tried in oil and gas, to date.

In collaboration with Cenovus, AIRIA Cloud and GDGYYC (Calgary's Google Developer Group), this initiative will:

- Build on the work of Google DeepMind which successfully developed AI and ML models used to greatly improve the energy efficiency of its data centres even though those same data centers were already the world's most efficient.
- Explore lessons that can be applied from this work to the oil and gas sector and improvements in its facilities.
- Prototype ML models with existing oil and gas data, with the aim to develop and train a model focused on predicting facility energy use. Further applications will follow to then apply the model to optimization.
- Draw learning from the prototype and identify other scenarios to apply similar use cases to reduce energy use.

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

Climate change is an important and urgent issue where Alberta's energy industry wants to take leadership. AI and ML offers a new pathway to demonstrate leadership that is faster and cheaper than existing options. Developing a proof-of-concept of ML model that can reduce energy use and its associated carbon emissions can help the industry adoption these ideas more broadly.

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

The ambition is to draw on lessons from Google's successful implementation to build an ML model that uses existing component and performance data from one oil and gas facility to accurately predict then optimize energy use. For example, the ML model used in Google's data centre was able to predict energy usage with a 99.6% accuracy allowing for a 40% decrease in cooling costs. An ML model that can reduce energy efficiency by even 1% can result in significant energy efficiency increases. While this is a conservative estimate, Google achieved 40% energy efficiency improvements in their data centers.

What challenge(s) to achieve this ambition?

Potential challenges include:

Lack of component-level (e.g. at the pump or boiler) data. There may not be sufficient available component-level electricity data available. There is a need for time-series data with 30 second resolution over 7-8 months = 170,000 points of data for each component. Is there a way to get this data or is there potentially a way to do without it?

Non-sufficient data quality. The quality of the data needed to train a ML model may not be sufficient, resulting in significant work to "clean-up" the data.

Starting with the wrong application. Picking the wrong application to start with will burn a lot of time and resources and show little benefit. This can be avoided by learning from the lessons of Google and others that have done work on similar applications in the oil and gas sector.

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

- Through Google's Deepmind, Google has trained and deployed Artificial Intelligence to reduce its Data Center energy use by 40%. A number of articles and videos are available that provide more insight into this work.
- Imaginea Energy had pioneered work to apply the lessons above to the oil and gas sector. This work continues with AIRIA Cloud.