Post Combustion CO2 Capture Retrofit of SaskPower's Shand Power Station: A Business Case

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Abstract

SaskPower's Integrated Carbon Capture Storage Demonstration Project on Boundary Dam's Unit 3 pioneered the way for full scale carbon capture facilities around the world. With such an undertaking, many lessons were learned through the design, construction and operations of the facility. These lessons have resulted in novel optimizations, operating methods and overall learnings for the facility and its role as a power generator in the power utility. Through this process the original design decisions and intents were challenged, both validating and dis-proving what was at the time the best information available. An obvious opportunity exists to apply these learnings to what could be characterized as the first, 2nd generation full scale carbon capture facility on a coal fired power plant.

Saskatchewan and its provincial utility SaskPower again find themselves on the cusp of an important decision. The utility has a need to provide base load power which regionally is only available from coal or natural gas. Regulations in Canada are closing the window on coal fired power generation without carbon capture, and while there is a significant revenue opportunity to utilize and sequester CO2 for enhanced oil recovery operations, low oil prices have softened the demand for the CO2. The economics of retrofitting Coal with Carbon Capture and Storage (CCS) are further challenged by locally all-time low natural gas prices driven by a lack of pipeline capacity to export the gas from neighboring provinces.

The International CCS Knowledge Centre is currently executing a feasibility study with SaskPower in order to determine if a business case can be made for a post combustion carbon capture retrofit of the 300MW Shand Power station which is located 14 km from Boundary Dam. The study will include the addition of a 90% carbon capture facility that will have a nominal annual capacity of 2 Million tonnes per year. The study will investigate the impact of the following modifications on the business case:

- Implementation of the process learnings from Boundary Dam;
- Scale-up to twice the size of Boundary Dam;
- Utilization of an FGD versus an amine based SO2 capture system (currently used at Boundary Dam);
- Capital cost benefit of off-site and modularized construction;
- Capital cost benefits and efficiency loss associated with the re-use of the existing turbine outer casing, generator, and significant portions of the steam path;
- Capital cost benefits of a system configuration that will not be specifically designed to allow the unit to run at full output when the capture system is out of service;
- Impacts of integrating to a site that has no new cooling water, and must maintain Zero Liquid Discharge (ZLD) for the site;
- Impact of a design that allows significant load following of the unit in carbon capture mode as opposed to Boundary Dam 3's baseload only design;
- Impact of reduced design margins and variable load design that significantly reduces design margins in favour of variable capacity; and
- Capital and operating cost benefit of a single unit site which is un-congested and allows more optimal use of space, existing equipment and personnel

This paper will include interpretation of the public and non-confidential portion of this study to highlight both the overall impact on the cost of CO2 capture, as well as contrasting the impact of the major design modifications with the Boundary Dam Unit 3 system.