Expert Insights

# CCS Technology Powering the Future in Saskatchewan, Canada

**Robert Watson**
President & CEO, SaskPower

Imagine transforming a coal-fired power plant more than a half-century old into a model of environmental sustainability, where a fuel both bountiful in supply and predictable in price generates cleaner, greener energy than ever thought possible.

Saskatchewan is a dynamic place to be right now. The province's strong economy is providing a wealth of opportunity, and the population continues to climb. As the province's Crown electrical utility, SaskPower is right in the middle of the excitement.

As the province grows, so does demand for electricity. In 2013, demand for power increased 6.4 % — the highest annual growth in 20 years. Demand is expected to increase by more than 30% over the next 20 years and double between now and 2050.

From now to 2017, SaskPower will add up to 1,300 MW to the provincial power system through new projects and initiatives as well as investments in current infrastructure. The piece of this puzzle that has captured the world's attention, the Boundary Dam Integrated Carbon Capture and Storage Project, is at center stage as SaskPower prepares for the province's future.

## PROJECT OVERVIEW

SaskPower is the developer of the world's largest and most significant post-combustion carbon capture and storage (CCS) project—the first to fully integrate CCS technology with commercial-scale coal-fired generation unit. The project involves transforming a coal-fired power turbine nearly 50 years old into a model of environmental sustainability. The aging coal-fired Unit #3 at Boundary Dam, near Estevan, Saskatchewan, is being converted into a reliable, long-term producer of 110 MW of baseload electricity.

The capture facility is now constructed and testing is underway to ensure safety and functionality. The power facility rebuild is on track for completion in 2014. The work remaining involves piping around the unit for water, oil and steam. More than 450 regulatory inspections are currently being carried out to bring the project to completion. To date, the project represents five million man-hours of work without a single lost-time injury.

In the very near future, carbon dioxide($CO_2$) emissions from Boundary Dam Unit #3 will be reduced by up to 90%, as one million tons of post-combustion $CO_2$ emissions are captured annually. The captured $CO_2$ will then be sold to Cenovus for its use in enhanced oil recovery projects. Some of the $CO_2$ will also be stored in a deep saline formation known as Aquistore.

## WHY CCS, AND WHY NOW?

Coal is an abundant energy source in Saskatchewan, and SaskPower has traditionally relied upon it as a cost-effective power supply option that is secure and affordable.

Environmental impact, however, also needs to be taken into account as we move forward. New federal $CO_2$ regulations, which will take effect on July 1, 2015, have eliminated conventional coal-fired generation without $CO_2$ capture as a future option.

The new federal performance standard will affect both new coal-fired units and units that have reached the end of their useful life. To continue to keep coal as a viable fuel source, SaskPower has taken a leadership role in incorporating CCS technology.

In choosing the technology, we evaluated a number of options and looked at factors such as plant size, location, cooling processes, new builds vs. rebuilds, and the different capture technologies available. We ultimately determined that the most

economically viable option, for a first project, was to use post-combustion technology on a refurbished, end-of-life power unit and sell the captured $CO_2$ for enhanced oil recovery. Revenue from the $CO_2$ was essential to the business case.

The Cansolv aqueous amine scrubbing technology was selected following a rigorous Request for Proposal process that considered factors such as performance, cost, and technological risk.

## BEYOND BOUNDARY DAM

SaskPower's investment in CCS technology does not end when Boundary Dam Unit #3 begins commercial operation in 2014. In collaboration with Hitachi, SaskPower is leading the development of a carbon capture test facility to validate carbon capture technologies.

Adjacent to SaskPower's Shand Power Station in southeastern Saskatchewan, the facility will offer a neutral platform for vendors to verify and improve post-combustion technologies in a commercial setting. Dozens of pilot plants worldwide are testing post-combustion carbon capture. Often, these are smaller scale facilities producing results that tend to be more qualitative than quantitative.

The Shand Carbon Capture Test Facility is unique as it has been sized to manage measurement uncertainty and is the only facility emerging from a full-scale commercial carbon capture project. SaskPower will be able to use the knowledge gained from this facility to broaden our experience base and, in turn, further support the Boundary Dam project.

What have we learned so far? Coal CCS can be both technically and commercially viable, provided that sufficient due diligence is completed, regulations are defined, and value can be obtained for $CO_2$. We look forward to showing the world what can happen when all of these factors fall into place.

As we continue to innovate in carbon capture and storage technologies, we look forward to working with Hitachi and finding new opportunities for partnership.

## LESSONS LEARNED

When you're the first to try something new, inevitably there are challenges to face along the way. The Boundary Dam project has been no exception.

Receiving approvals to undertake a technology that had never been done before on a commercial scale was the first, and largest, step we had to take. A strong business case, extensive study, and education were required before our executive, board, and provincial government felt that pursuing a CCS solution was the right course to follow.

Today, commissioning has begun and our focus is increasingly shifting to understanding what it will take to operate the plant, both from a technical and a "people" perspective.

Operating a carbon capture plant is a whole new world for SaskPower. To prepare our employees, we've brought in an unprecedented classroom training program and a simulator training system that mimics the exact control systems of the future power island and capture island control rooms in order to bring familiarity with the control system, eliminate operator error, and reduce training time.

We've learned many lessons along the way, but two in particular stand out to us—and they come right from the beginning of the project.

Lesson one: You can't overstaff in situations like this. A large project team brought together from the start is a must.

Lesson two: Investment of significant dollars into the evaluation phase of a project is essential for ensuring success after project approval in terms of design, construction, and commissioning.

Organizations can be hesitant to commit significant financial resources to estimate and design a solution prior to project approval. We spent approximately $50 million (CAN) evaluating this undertaking. This allowed us to do our homework, evaluating feasibility and setting out a target to capture up to 90% of emissions, or a million tons of $CO_2$ annually, and meet (or surpass) federal regulations.

## SHARING WHAT WE KNOW

Industry interest in the Boundary Dam project has been strong. Later this year, SaskPower will host a CCS Symposium from Sept. 30 – Oct. 2, 2014, to bring governments and organizations together from around the world.

Participants will be given the opportunity to see the project first hand and learn about SaskPower's CCS initiatives.

Based on the knowledge gained from the Boundary Dam CCS project, preliminary estimates suggest that SaskPower could save 20 – 30% on future carbon capture projects. These savings are coupled with the knowledge and efficiencies gained on budgets, time and human resources, risk and regulatory management, and CCS technology selection and integration.

More information can be found at www.saskpowerccs.com.