



Encana Corporation's Vent Gas Capture Project

Final Outcomes Report (Non-Confidential Version)
Final Version
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In 2012, with funding from the Climate Change and Emissions Management (CCEMC) Corporation and its Energy Innovation Team (EI team),¹ Encana initiated a multi-year program (“The Encana Vent Gas Capture Project” or “The Project”) to install vent gas capture systems at a large number of existing natural gas compressor sites across its Clearwater Business Unit in southern Alberta. Each vent gas capture system captures natural gas (containing approximately 95% methane) that was previously vented to the atmosphere as part of normal operations and redirects this gas into the compressor engine’s air intake to help fuel the engine. Capturing and combusting this vented gas dramatically reduces methane, a potent greenhouse gas with a global warming potential 25 times greater² than that of carbon dioxide. The SlipStream® vent gas capture technology was developed by REM Technology Inc., a division of Spartan Controls, based in Calgary, Alberta.

The vent gas capture roll-out program was coordinated by the EI team and field installations were managed by Encana’s Drumheller and Strathmore field offices. Engineering and technical support was also provided by Encana’s Technical Services group at various times during the Project. Overall a total of 59 vent gas capture units were installed from August 2012 to December 2014 at a total cost of approximately \$5.27 million. The vent gas capture program exceeded expectations on all key metrics, and these achievements are highlighted below.

- 59 vent gas capture units were installed, exceeding the original commitment to install 52 units;
- Total eligible Project costs³ were \$5.27 million, including \$2.4 million funded by the CCEMC;
- The Project is expected to deliver cumulative GHG reductions of 757,696 tCO₂e from August 2012 to the end of December 2024, which is equivalent to removing approximately 157,850 passenger vehicles from the road for one year;
- The greenhouse gas abatement efficiency of the CCEMC investment into the Project was estimated to be \$3.17/tCO₂e, representing a highly efficient use of CCEMC funds relative to the \$15/tCO₂e levy charged to large emitters under the Alberta Specified Gas Emitters Regulation (SGER).
- The Project was the first CCEMC-funded project in Alberta to generate third party verified (audited) and registered carbon offsets using a Government-approved quantification protocol. From 2012-2013, Encana verified and registered 33,516 tCO₂e of offsets from the Encana Vent Gas Capture Project, a significant achievement for a CCEMC-funded project.
- In 2014, a further 49,366 tCO₂e of reductions were achieved with only a partial year of operations from approximately 30 of the 59 vent gas capture units. Ongoing greenhouse gas emission reductions from a full year of runtime from the Project are estimated to be

¹ The Energy Innovation team was formerly called the Encana Environmental Innovation Fund prior to 2015.

² <http://esrd.alberta.ca/focus/alberta-and-climate-change/regulating-greenhouse-gas-emissions/alberta-based-offset-credit-system/offset-credit-system-protocols/documents/MemoOnGlobalWarmingPotentials-Feb2014A.pdf>

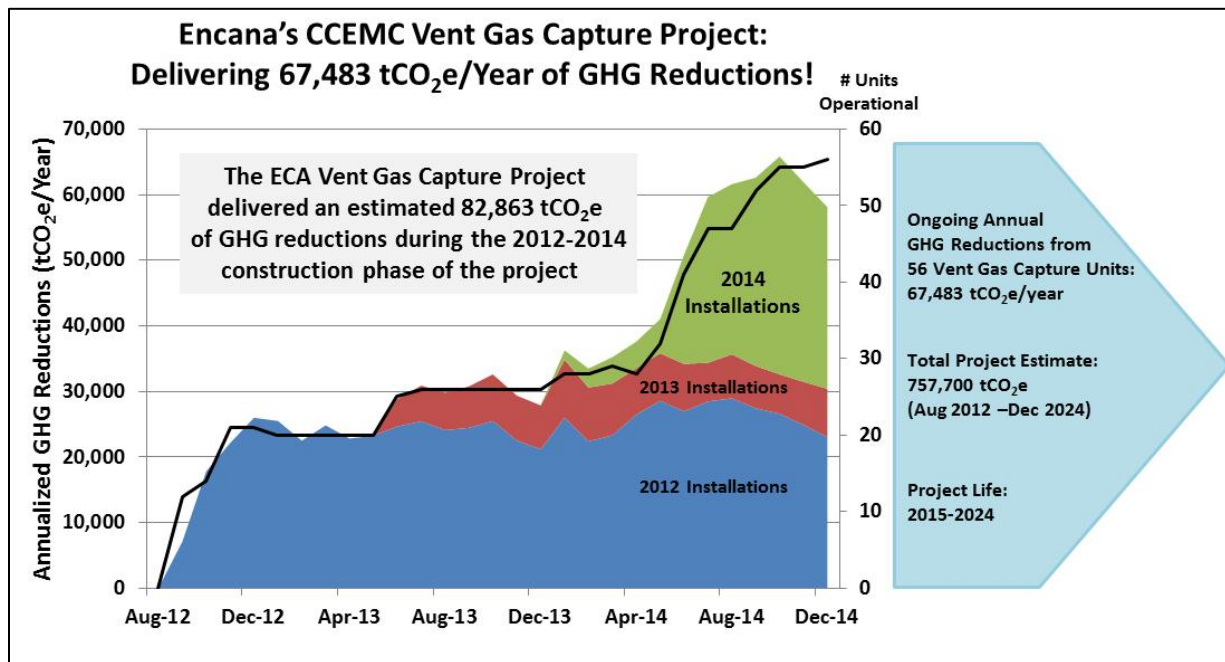
³ The reported actual Project costs do not include the value of lost production revenues related to facility downtime during the installation of the vent gas capture equipment, which were originally estimated at \$649,115 in the original CCEMC Full Project Proposal. Actual lost production revenues due to downtime during installation of the vent gas capture equipment were not formally tracked, but were likely similar in magnitude to the original estimate.

67,483 tCO₂e per year beginning in 2015.⁴ The ongoing GHG reduction estimate for 2015-2024 assumes that 3 presently shut-in compressors, as of as of year-end 2014, which had been retrofitted with vent gas capture units, will remain shut-in indefinitely. The other 56 compressors are assumed to remain operational for 10 years.

- Each vent gas capture system was equipped with flow measurement and monitoring equipment to quantify the exact amount of vent gas captured at each facility, a key element that has supported successful third party verification of GHG reductions;
- Additional data management processes and tools were developed by the EI team to optimize the performance of each vent gas capture unit, including real-time data trending and an email notification system to minimize downtime and maximize vent gas capture recovery rates.

Figure 1 and Table 1, below, highlight the results from the Project, both in terms of actual GHG reductions achieved during the construction phase of the Project from 2012 to 2014, as well as the estimated GHG reductions from ongoing operations for 2015-2024.

Figure 1 – GHG Reductions Achieved During the Construction Phase of the Project



⁴ The annual GHG reductions for 2015 and each subsequent year were estimated based on the average quantity of vent gas captured at each site in 2014, the methane content of the vent gas, typical facility downtime and other factors. Actual results will be subject to SlipStream[®] runtime, compressor/engine loading, maintenance practices, facility ownership, natural gas prices and other factors. The GHG reduction estimate assumes that 56 out of 59 units continue to operate at constant vent gas capture rates for the next 10 years with similar levels of downtime as those experienced in 2014. Effective January 15, 2015 a total of 24 vent gas capture units, or approximately 40% of the total installed base, were divested to a third party as part of a natural gas asset divestiture. As such, Encana no longer owns nor operates these units.

Table 1 – Encana's Vent Gas Capture Project GHG Reduction Summary

Encana's CCEMC Vent Gas Capture Program Summary				
Project Phase	Year	# of Vent Gas Capture Units Operational	Annual Total (tCO₂e)	Cumulative GHG Reductions (tCO₂e)
Actual Results Delivered by Encana up to Project Completion Date⁵	2012	21	6,084	6,084
	2013	26	27,413	33,497
	2014	56	49,366	82,863
Projected Results Over the Remaining Life of the Project (Estimated to be 10 Years from Project Completion Date)⁶	2015 to 2024	56	67,483	757,696
Totals		56	757,696	
CCEMC Investment (\$)				\$2,400,000
CCEMC GHG Abatement Efficiency (\$/tCO₂e)				\$3.17
Total Project Investment (Encana + CCEMC)				\$5,273,000
Overall Project GHG Abatement Efficiency (\$/tCO₂e)				\$6.96

Other notable achievements from the Project are highlighted below:

- Over the life of the Project, the total natural gas savings are estimated to be 1.7 billion cubic feet of natural gas, enough gas to heat over 15,000 Alberta homes⁷ for one year;
- The Encana Vent Gas Capture Project represented the largest deployment of SlipStream® vent gas capture technology to date and encompassed retrofits to the most common Caterpillar and Waukesha models of engines used in the upstream oil and gas sector. Encana currently operates over 55% of all the SlipStream® vent gas capture systems installed to date in Canada;

⁵ The 2012 and 2013 greenhouse gas emission reduction results have been verified by a third party auditor (TetraTech EBA Inc.). The 2014 results have been calculated based on actual measured data from each vent gas capture unit and this data will be reviewed as part of the third party verification process which is expected to be completed later in 2015.

⁶ The annual GHG reductions for 2015 and each subsequent year were estimated based on the average quantity of vent gas captured at each site in 2014, the methane content of the vent gas, typical facility downtime and other factors. Actual results will be subject to SlipStream® runtime, compressor/engine loading, maintenance practices, facility ownership, natural gas prices and other factors. The GHG reduction estimate assumes that 56 out of 59 units continue to operate at constant vent gas capture rates for the next 10 years with similar levels of downtime as those experienced in 2014. 3 SlipStream® units were not operational at year-end 2014 due to compressor shut-ins so ongoing GHG reductions were not estimated for these units. Effective January 15, 2015 a total of 24 vent gas capture units, or approximately 40% of the total installed base, were divested to a third party as part of a natural gas asset divestiture. As such, Encana no longer owns nor operates these units.

⁷ The average Alberta home uses approximately 120 gigajoules of natural gas per year, as per the following:

<http://www.calgary.ca/UEP/ESM/Pages/Reducing-Calgarys-ecological-footprint/Home-energy-savings/What-you-can-do/Energy-use-in-your-home.aspx>



In summary, the Encana Vent Gas Capture Project was an extremely successful retrofit program that has dramatically reduced and will continue to reduce methane emissions from 59 existing compressor facilities across Southern Alberta. Total GHG reductions are expected to exceed 750,000 tCO₂e over the life of the Project at a very efficient cost of approximately slightly over \$3 of CCEMC investment per tonne of CO₂-equivalent reductions. Encana's leadership in demonstrating this new vent gas capture technology on several of the most common Caterpillar and Waukesha engine types in use across the upstream oil and gas sector provides an excellent template for other oil and gas operators to replicate these methane emission reduction projects at their facilities across Canada and the United States.

Lastly, the Encana field team members in Drumheller and Strathmore deserve specific mention for their hard work, commitment and dedication to completing this challenging project over a 33 month period that featured major changes within Encana and across the broader oil and gas industry. In particular, the instrumentation and electrical technicians from the Drumheller maintenance team demonstrated strong leadership skills in working closely with the technology vendor and sub-contractors to safely execute the Project, while exceeding the original number of committed facility retrofits by a total of seven sites.