



PARTNER UPDATE

SUMMER 2011

Partner Profile: Encana's Environmental Efficiency Program Creates Methane Emissions Reduction Opportunities

Although many methane emissions reduction technologies offer a reasonable return on investment, when operators have the option between investing in emission reduction projects and optimizing a well's production performance, the latter usually wins. For this reason, Encana developed its Environmental Efficiency Program. In 2007, Encana began setting aside funding for projects that target greenhouse gas (GHG) emissions reductions through cost-effective



technology implementation. This funding resides outside of business-as-usual capital budgets, which allows the various operating teams throughout Encana's U.S. Division to implement GHG reduction projects separate from their development programs.

To qualify for funding through the company's Environmental Efficiency Program, projects must go through a formal review and approval process. An executive summary including project risks, implementation timeline, economic metrics, and environmental metrics are compiled and submitted to a review committee. If recommended by the U.S. Division review committee, the project is sent on for final corporate review and approval. Emission reduction efforts in the natural gas industry provide bottom line value, and these Environmental Efficiency projects are no exception. A typical project will have an internal rate of return (IRR) of greater than 20 percent and a production efficiency of less than \$10,000 per thousand cubic feet per day (Mcf/d). Production efficiency is a project's capital investment divided by its production increase, and this indicates how effective particular projects are at generating revenue (i.e., a lower production efficiency is desired, meaning that it costs less to increase production). On the environmental side, projects are judged using a carbon dioxide equivalent (CO₂e) abatement efficiency value, which is computed by dividing a project's capital cost by the GHG reductions over the project life. Projects must be less than \$50/tonne CO₂e. The economic and environmental metrics are used to rank multiple projects, which are then funded in order of greatest priority.

- Encana is one of the largest natural gas producers in North America with approximately 11.7 million net acres of land and 14.3 trillion cubic feet equivalent of proved gas reserves.
- It has operations in both Canada and the U.S. with a forecasted 2011 natural gas production of between 3,475 million cubic feet equivalent per day (MMcfe/day) and 3,525 MMcfe/day.
- Encana's five key natural gas resource plays in the U.S. are in East Texas, Fort Worth, Haynesville, Jonah, and Piceance.

The program facilitates technology transfer within the company, encouraging business units to learn more about reducing methane emissions. On average, there are twelve to fifteen project



proposals submitted per year to Encana's Environmental Efficiency Program. When one business unit implements a reduction project, other business units might see that and realize the same opportunity exists for them. Most projects to date have been retrofits at existing facilities, but some have also been implemented at new construction sites. In the new construction cases, the company usually funds the incremental amount between the business-as-usual technology and the proposed project. Staffing to implement these reduction projects is resolved by scheduling.

Since its formation, the Environmental Efficiency Program has allowed Encana to implement several wide-scale retrofit projects, including converting over 1,300 high-bleed liquid level



Exhibit 1: Comparison of Mizer (top) and existing pilot valve (bottom).

controllers to low-bleed on production facility separators. The high- to low-bleed conversion project was completed in the Wind River field in Wyoming and the Piceance Basin in Colorado from 2007 to 2009 at a total cost of approximately \$350,000. The conversions were simple to implement by using the Mizer pilot valve, currently patented by WellMark. The Mizer valve replaces the existing pilot valve in controllers and reduces venting significantly. The installations took twenty minutes on average to complete, with some taking as little as ten minutes. Given the large scale of this effort, Encana began the process of securing carbon offset credits resulting from the conversions in late 2010. As a result of the reductions achieved, these offset credits are

expected to exceed 4,200 tonnes of methane per year (about 90,000 tonnes of CO₂e annually). Encana's project plan was certified by the American Carbon Registry (ACR) in March 2011—one of the first hurdles in securing the credits—and is currently undergoing validation.

Aside from implementing proven technologies, Encana's Environmental Efficiency Program also provides funding for pilot-testing emerging technologies. Funding was utilized for this purpose by the operations team responsible for Encana's Jonah field in Wyoming. The team sought a solution to eliminate natural gas venting from glycol circulation pumps utilized for heat tracing equipment during winter operations.

One alternative would have been a solar-powered pump, but given high glycol circulation requirements, solar was not a suitable option due to a lack of battery power storage. Instead, the team identified a system that was driven pneumatically by natural gas. This system was



Exhibit 2: A SCADA-controlled solar chemical pump system (left). The HPGD pump (right) was tested at five Encana facilities as a possible option instead of a solar-powered pump.

similar to the existing pumps, but the exhaust gas was relieved back into the production process instead of being vented to the atmosphere. The system worked by tapping high pressure gas from the well casing and using it to drive the pump's piston. Once used, the exhaust gas remained at a pressure great enough to be discharged upstream of the three-phase separator

at production facilities. The system, appropriately called the High Pressure Gas Driven (HPGD) pump, was tested at five facilities.

The results of the test varied. The HPGD pump worked well at some sites, but it had trouble meeting the circulation requirements at others. For most wells in Encana's Jonah field operations, the HPGD pump was not a feasible solution because the site-specific circulation requirements were greater than what the casinghead pressure could support. In the end, the team decided full-scale implementation of this technology was not the appropriate solution, based on the pilot-testing. Not all pilot tests are successful; however, the Environmental Efficiency fund allowed operations to test a technology without having a negative impact on the team budget.

Since its inception in 2007, Encana has funded nearly \$4 million in methane emissions reduction projects through its Environmental Efficiency Program. Several of these projects originated as Natural Gas STAR Partner Reported Opportunities (PROs)—converting from high-

Encana has maintained an active role in Natural Gas STAR since joining in 2004 as a production sector Partner:

- In 2009, it reported over 7 billion cubic feet (Bcf) in reductions by implementing Natural Gas STAR recommended technologies and practices.
- Over 82 percent of Encana's 2009 methane emissions reductions are the result of:
 - performing reduced emissions completions
 - installing plunger lifts on wells
- Encana also implements other activities such as:
 - instrument air system conversion
 - directed inspection and maintenance (DI&M)
 - electric compressor installation
- The company was named 2007 Production Partner of the Year and sponsored a Producers Technology Transfer Workshop in 2008.

to low-bleed devices, from gas to solar pumps, from instrument gas to instrument air; installing VRU's; and replacing gas starts with air starts. Besides the methane reduction efforts, the fund also aims to reduce carbon dioxide emissions from combustion sources, test water treatment technology for reuse in operations, and reduce criteria pollutant emissions such as volatile organic compounds and nitrogen oxides. In general, the program fosters creativity and collaboration amongst operating groups and helps drive innovation with the purpose of conducting business with less impact to the environment.

Natural Gas STAR International and the Global Methane Initiative Conduct First Technical Study Tour in Texas and New Mexico

Representatives of two Natural Gas STAR International Partners (ONGC and ENAP Sipetrol) as well as representatives from Gazprom recently joined their U.S. Partner peers to tour operational facilities and exchange ideas for accelerating methane capture and use project implementation. Three U.S. Natural Gas STAR Partners—Chevron, Oxy, and ConocoPhillips—hosted the first-of-its-kind event that took the international team more than 1,100 miles over ten days.

The West Texas and New Mexico sites visited were carefully chosen to showcase specific methane emissions reduction projects including vapor recovery units, plunger lifts, and reduced emission completions. Participants discussed these projects with the hosts and collected information to help them evaluate the project's applicability at their own facilities. The participants also benefitted from workshop presentations highlighting various technologies and



emission reduction projects (e.g., compressor rod packing, vapor recovery units, pneumatic devices). The workshop sessions included a number of vendors and service providers used by domestic Partners such as [CECO](#), [FLIR](#), [Flowserve](#), [Hy-Bon Engineering](#), [Weatherford](#), and [WellMark](#).

Highlights of the Study Tour:

- The group discussed reciprocating rod packing emission causes, such as wear, rod length, cup depths, packing box geometry, and rod surface roughness, as well as potential solutions such as packing replacement, low emission packing technology, and machining packing components periodically.
- The group studied techniques for infrared camera use such as taking advantage of the FLIR camera's high sensitivity mode and adjusting the camera settings for the specific environment being surveyed.
- The group visited manufacturing facilities to view various types of vapor recovery units and emissions inspection / quantification tools. Some key considerations for tank vapor recovery unit design include a very accurate understanding of the gas composition and flow rate.
- The group explored methane emissions capture and control methods with equipment experts on pneumatic devices, centrifugal compressor seals, well completions, and well liquids unloading.
- ONGC's carbon management team gave a presentation on the company's current facilities, recent involvement with GMI, and specific reduction technologies implemented. The highlighted technologies were: 1) a tank vapor recovery unit at the Uran plant, 2) replacement of a servo gas system with instrument air at the Kallol facility, and 3) vapor recovery using an ejector system at the Kuthalam facility.



Exhibit 1: Study tour participants and a ConocoPhillips representative near a well completion site.

Next Steps:

Both the international and domestic Partners appreciated this unique experience, noting the value of sharing information and ideas with industry peers, suppliers, and government. The opportunity to witness the projects and technologies first-hand was also extremely helpful and facilitated valuable conversations. Natural Gas STAR International is now considering follow-up activities at international locations in 2012. In addition, Partner companies are now considering implementing some of the practices and technologies exhibited during the study tour. ENAP Sipetrol is considering vapor recovery projects this year, and ONGC is sharing project ideas learned during the study tour internally and making recommendations for new projects. Also,

EPA and Gazprom have recently co-authored a paper describing opportunities to reduce methane emissions in the natural gas transmission sector.



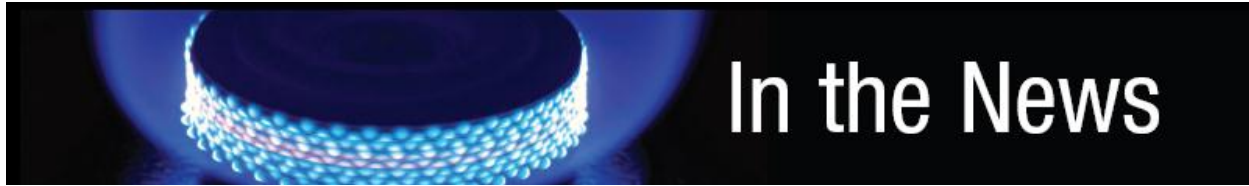
Exhibit 2: Study tour participants and Oxy representatives outside of the North Cowden facility.



Exhibit 3: Study tour participants and Chevron representatives outside of the Headlee Gas Plant.



Exhibit 4: Study tour participants at an oil well using a sucker rod pump.



Looking Ahead - Spring 2012!



Natural Gas STAR Annual Implementation Workshop Rescheduled

U.S. EPA's Natural Gas STAR Program will hold the 18th Annual Implementation Workshop in the spring of 2012. Further information regarding the workshop including date, location, and registration will come in the near future. Stay tuned!

Please continue to check the Natural Gas STAR website for updates at:
epa.gov/gasstar/workshops/index.html.

The Updated 2011 U.S. Greenhouse Gas Inventory Recently Published

In mid-April, EPA finalized and submitted the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009 ("Inventory") to the United Nations Framework Convention on Climate Change (UNFCCC). The Inventory is prepared annually by EPA, in collaboration with other federal agencies, and tracks annual greenhouse gas emissions. This inventory of anthropogenic greenhouse gas emissions provides a common and consistent mechanism through which parties to the UNFCCC can estimate emissions and compare the relative contribution to climate change from individual sources, different greenhouse gases, and various nations. As reported in the 1990-2009 Inventory, the following changes in annual emissions occurred:

Emissions Category	Change from 2008 to 2009
Overall U.S. greenhouse gas emissions	-6.1%
Methane emissions from natural gas systems ¹	+4.4%
Methane emissions from petroleum systems ²	+2.4%
CO ₂ emissions from natural gas systems ³	-2.0%
CO ₂ emissions from petroleum systems ⁴	+2.2%

¹2009 methane emissions from natural gas systems are estimated to be 221.2 teragrams carbon dioxide equivalent (Tg CO₂e).

²2009 methane emissions from petroleum systems are estimated to be 30.9 Tg CO₂e.

³2009 CO₂ emissions from natural gas systems are estimated to be 32.2 Tg CO₂e.

⁴2009 CO₂ emissions from petroleum systems are estimated to be 0.5 Tg CO₂e.



This year's report includes key methodological improvements for estimating methane emissions from natural gas systems such as updating activity factor calculation methods and emission factors for gas well cleanups, completions, workovers, condensate storage tanks, and centrifugal compressors. As a result, the total 2008 methane emissions from natural gas systems, as reported in the 1990-2009 Inventory, are 211.8 Tg CO₂e. The methodological changes in this year's report result in a 120 percent increase in methane emissions from the 2008 value estimated in the 1990-2008 Inventory (96.4 Tg CO₂e). Because the latest methodological improvements were applied to all years in the time series, the real change in methane emissions from 2008 to 2009 is the 4.4 percent increase reflected in the table above.

The Inventory also reflects 52.2 Tg CO₂e of methane emissions reductions reported by Natural Gas STAR Partners in 2009.

For more information, the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009 is available at: epa.gov/climatechange/emissions/usinventoryreport.html.

EPA Participates in “Natural Gas in a Low-Carbon Future: Challenges and Opportunities” Panel

In May, the Carnegie Endowment for International Peace hosted a discussion of the role of the natural gas industry in climate change and the obstacles that need to be addressed to turn natural gas into a key component of building a low-carbon future. The event consisted of a panel of experts including Roger Fernandez of the EPA (Natural Gas STAR Program), Fiji George of El Paso Corporation, and Robert Howarth of Cornell University. Carnegie's Adnan Vatansever moderated.

Among other issues, the panel discussion addressed the significant increase in EPA's estimates of methane emissions from natural gas systems between the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008 and the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009. Fernandez clarified that the increase—driven primarily by higher estimated emissions from well venting and flaring—resulted from recent improvements in EPA inventory methodology and is not indicative of backsliding in natural gas industry practices.

Presentations and additional information about this panel can be found at: carnegie-mec.org/events/?fa=3250.

Global Methane Initiative to Hold October Partnership-Wide Meeting in Krakow, Poland

The government of Poland will be hosting a Global Methane Initiative (GMI) partnership-wide meeting in Krakow from October 12th to the 14th. The meeting will cover all sectors (oil and gas systems, agriculture, coal mines, and landfills) and will include a high level plenary and technical and policy sessions in all GMI sectors. GMI periodically holds cross-sector meetings to discuss ideas and recent happenings, which further the goals of advancing cost-effective, near-term methane recovery and use as a clean energy source. The event will also include site tours, and Gaz-System, SA—Poland's gas transmission company—is assisting with organizing a site tour for the oil and gas sector. The GMI Oil and Gas Subcommittee will be developing the agenda for the oil and gas technical and policy session over the next few months and is open to suggestions. Continue to check the GMI website for further information and registration details as they become available at globalmethane.org/news-events/index.aspx.



Using Carbon Credits to Spur Project Development

The Natural Gas STAR Service Provider Directory has information on companies that can assist oil and natural gas operators to identify, finance, and execute capital projects (including equipment upgrades and swap outs) that reduce methane emissions. One project type completed by Natural Gas STAR Partners is attaining carbon credits by reducing methane emissions. Carbon credits are tradable certifications that represent one tonne of carbon dioxide (or the carbon dioxide equivalent of another greenhouse gas) not emitted to the atmosphere. Carbon credits can be traded in various national and international markets.

As one example, carbon credits from pneumatic device retrofits can provide Partners, with applicable equipment, a substantial new revenue stream from their methane reduction activities. A registered American Carbon Registry project covering the retrofit of over 2,500 high-bleed controllers generated gas savings of 250,000 Mcf per year and 100,000 tonnes carbon dioxide equivalent per year (tCO₂e/year). At a carbon price of \$1 per tCO₂e, an incremental \$100,000 could be generated annually over a ten year project life.

For more information on carbon market opportunities to finance projects, consider contacting several of the firms listed on the Service Provider Directory page by selecting **Project Development/Financing/Carbon Markets** under "Search by Service." *EPA does not endorse any product, service, or company but simply shares information with interested parties.*

epa.gov/gasstar/tools/service-provider-directory.html

Upcoming Events

Stay tuned for more upcoming Natural Gas STAR events. Additional technology transfer workshops will be announced soon!



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