Dakota Gasification Company CO_2 Sequestration Verification Project

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Introduction

The Dakota Gasification Company (DGC) owns and operates the only commercial synthetic fuel manufacturing facility in North America, the Great Plains Synfuels Plant (GPSP). This facility uses a patented process to convert lignite coal into synthetic natural gas and a number of other byproducts.

One of these byproducts is CO_2. Gas separated from intermediate plant products contains the majority of the CO_2 , and is approximately 95% CO_2, 1% H_2S, and 4% hydrocarbons by volume. This gas was previously fed to plant boilers, to destroy the H_2S and utilize the heating value of the hydrocarbons, then released to the atmosphere.

DGC realized the potential to capture, compress, and transport this byproduct CO_2 for use in oil production, which would allow the sale of an additional product and which would cause a major reduction in GHG emissions. EnCana Corporation expressed an interest in purchasing CO_2 for tertiary oil recovery at its Weyburn production unit in Saskatchewan.

In late 2000, DGC completed the construction of a compression system and a 200-mile pipeline (the "Project") to transport CO_2 to Saskatchewan. EnCana currently purchases approximately 38% of the available CO_2 Product Gas, and injects it into the oil formation. Pipeline capacity is currently available to allow sale of additional CO_2 to other oilfield operators in North Dakota and Saskatchewan.

DGC retained CH2M HILL and Natsource to independently verify the GHG emissions reduction from the Project and to provide advice regarding actions required to allow DGC to take credit for this reduction under applicable regulatory or voluntary GHG programs. This paper presents the results of this effort.

This paper does not address the permanence of the geologic sequestration in the Weyburn oilfield. This topic is the focus of a study coordinated by the International Energy Agency. Draft results of this study are expected in July 2004.

Standards and Analysis

Standards for accounting of project-based GHG reductions are not well established. For corporate GHG accounting, the GHG Protocol developed by the World Resources Institute and the World Business Council for Sustainable Development is the most widely-accepted standard. A "road-test" version of the GHG Protocol Project Quantification Standard was released in September 2003, but was not available for this project. The project was therefore performed by incorporating relevant principles from the Energy Information Administration (EIA) reporting guidance, GHG Protocol corporate reporting guidance, CleanAir Canada Inc.'s (CACI) Pilot Emissions Reduction Trading (PERT) project, and other guidance.

The basic steps performed to verify and evaluate the DGC emissions reduction were as follows:

1. Evaluate project boundaries to capture all relevant primary and secondary impacts to direct and indirect emissions.
2. Evaluate estimated baseline emissions, which are the emissions that would have occurred without the Project.
3. Evaluate quantified changes in all direct and indirect emissions within the project boundary versus the baseline.
4. Verify that the estimate meets relevant reporting principles.
5. Identify potential markets for emission reduction credits, and assess prices for GHG reductions of various vintages.

Results and Discussion

Boundary Definition. The boundaries for this project were defined to include all known impacts to Scope 1 Direct and Scope 2 Indirect emissions, as defined by the GHG Protocol corporate accounting and reporting standard. As such, the boundaries included all operations at the GPSP, the Weyburn unit, and the CO_2 pipeline. The reduction estimate was prepared for reporting by DGC; impacts to Weyburn emission sources were thus defined as indirect impacts.

Scope 1 Direct emissions are defined by the GHG Protocol as emissions from sources owned or controlled by the project developers. The one primary impact to direct emissions was the reduction in CO_2 directly emitted to the atmosphere through the discharge of the CO_2 Product Gas. The GPSP is a highly complex facility with many interconnected process units. Additional fuel, produced internally at the plant, must be fed to the boilers to replace the hydrocarbon content of the CO_2 product gas; the production of this additional fuel and the reduced SO_2 loading on the flue gas desulfurization system (FGD) causes cascading impacts throughout the entire plant. Secondary impacts to direct emissions were therefore quantified for combustion emissions from the supplementary boiler fuel, raw CO_2 content of this fuel, increase in boiler fuel consumption as required to produce additional steam to gasify additional coal to manufacture this fuel, and decrease in CO_2 emissions from the ammonia plant to meet the lower FGD demand. GHG emissions due to maintenance of the CO_2 pipeline were found to be negligible.

Scope 2 Indirect emissions are defined by the GHG Protocol as emissions from purchased energy. Indirect emissions are defined by the "road-test" project standard as emissions that are a consequence of the project developer, but which occur at sources owned or controlled by another company. No primary indirect impacts resulted from the project. Secondary indirect impacts occurred due to electrical consumption of the new CO_2 compressors at the GPSP and Weyburn, and altered electrical consumption at Weyburn due to changes in quantities of managed fluids. Other secondary indirect impacts also resulted from flaring of produced CO_2 and hydrocarbons at Weyburn during initial operation of the CO_2 flood system.

Electrical usage was impacted at a number of other areas in the GPSP. These other secondary indirect impacts include increase in electrical demand of the oxygen plant to allow additional coal gasification to manufacture additional fuel, decrease in electrical consumption of the compressors that deliver unsold CO_2 to the boilers, and changes in electrical consumption at the FGD and the DakSul™ process which converts FGD effluent into fertilizer.

Baseline Definition. Baseline emissions are those GHG emissions that would have occurred in the absence of a project, and are the emissions against which the project reductions are evaluated. The EIA 1605(b) guidance for project reporting[1] defines basic and modified reference cases.

A basic reference case is used where emissions would have continued unchanged from historical levels without the project. Although operations at the GPSP are dynamic, varying based on weather, maintenance events, environmental permits, and other factors, no significant changes in plant equipment or operating procedures were implemented after the Project. A basic reference case was thus used against which to evaluate impacts at the GPSP. The Project was implemented less than one year after the last significant plant modification; as a result, historical data could not be used to directly quantify the baseline and extensive chemical process engineering analysis was instead required. This baseline definition will be reassessed during inventory of future reductions.

Oil production operations naturally change with time. The oil yield from Weyburn would have gradually decreased, and water flood rates would have been increased to compensate for this decline,

without the Project. The Project therefore caused changes to electrical power consumed by pumps, and a modified reference case was used against which to evaluate impacts at Weyburn.

Data Collection and Impact Quantification. The GHG reductions estimate was prepared using data relevant to patent, intellectual capital, and business conditions for both DGC and EnCana. Therefore, the exact reductions estimate is confidential.

The primary and secondary impacts of the Project yield a net reduction of between 0.5 and 1.0 million metric tons of CO_2 equivalent on an annual basis. Greater than 99% of the GHG emission impacts are direct or indirect CO_2, as opposed to other GHG's. The annual net reduction will increase in future years.

Registration of Reductions and Data Management. Because the actual reduction in GHG emissions occurred in the U.S., the Project was registered under a GHG program relevant to U.S. facilities. DGC reported emission impacts via the EIA 1605(b) program.

CH2M HILL developed a data management system for use in estimating future reductions. After identification of secondary impacts as deminimis to the total reduction, a spreadsheet tool was found to be adequate for this purpose. The major advantages of the data management system are that it allows easy identification of the data which must be recorded for estimation of future GHG impacts, allows real-time tracking of impacts, and promotes consistent reporting between years.

Verification of GHG Reductions. To be verifiable, the reduction estimates must meet established estimation protocols and reporting principles. Of the principles noted above, those from the PERT program were most relevant to a project-specific GHG estimate, although PERT is not directly applicable to a U.S. project. The DGC estimate is compared to principles of the PERT project and the subsequently-released GHG Protocol "Road-Test" Project Quantification Standard, below.

The five PERT principles[2] are that the reduction must be real, quantifiable, surplus, verifiable, and unique. The DGC reduction is real because it produces an observable change in emissions, and is not a result in reduction of output of the facilities. It is quantifiable per relevant protocols. It is surplus, in that the GHG reductions were not required by regulation or permit. It is verifiable; the relevant data can be documented and the emission estimated repeated. It is unique, in that no company besides DGC or EnCana can claim the reduction.

The road-test GHG Protocol[3] specifies the principles of relevance, completeness, consistency, transparency, accuracy, and conservatism. Separately, the Protocol discusses additionality, which is similar to the PERT principle of surplus. The estimate is relevant and complete; it includes *all* known primary and secondary impacts. It allows for consistency and transparency; all assumptions are stated, calculations are repeatable, and supporting data is available for review. The estimate is conservative; where engineering analyses were required, calculations were designed to underestimate GHG reductions.

Marketability of Reduction Credits. In conjunction with the verification exercise, an analysis of the potential market value and marketability of the reductions resulting from the Project was undertaken. This analysis focused on several key factors including the cross-border nature of the reductions being achieved by the totality of operations, the withdrawal of the US from the Kyoto Protocol, and the development of market-based state and regional GHG programs in the US. Further, while Canada has ratified the Kyoto protocol, the direct reductions from the Project are not eligible for Kyoto credit because these reductions originate from an emissions source in the US. Because the Project does not generate direct emissions reductions that can be used to satisfy Kyoto requirements, the market assessment focused on the value of future reductions generated by the Project under a variety of regulatory scenarios including US re-entry into the Kyoto system at a future date and the development of alternative federal-level domestic climate policies.

The analysis determined that market value and marketability of current and historic reductions achieved by the Project is quite limited, but that future reductions achieved by the Project might generate significant value under future regulatory/market programs. A key issue in this regard is the extent to which reduction projects undertaken in advance of a regulatory policy would be eligible to generate reduction credits. While the assessment found that the monetary value of the reductions (and ability to monetize the reductions) is highly dependent on future regulatory developments and market participants' expectations with regard to these developments, the development of a rigorous monitoring and verification system for the Project is a prerequisite to the capture of value for the reductions under future programs. As accounting standards are codified, the data streams and analytical methods developed for the monitoring and verification project will form the informational backbone for DGC's future project-based accounting under whatever standards and protocols emerge. Once these standards and protocols are codified, the transparent, replicable monitoring and verification program developed for the Project will enable DGC to determine if its reductions are eligible for credit under future programs. More importantly, the monitoring and verification program will also enable potential market participants to value DGC's reductions based upon their perception of future market and regulatory developments.

Conclusions

To obtain recognition for past or present GHG emission reduction projects under future regulatory or voluntary reporting programs, action is required now to collect data and document results. Required activity data is often unavailable after the fact. Project boundaries and baselines should be established as early as possible, such that pertinent data can be identified and recorded.

The international community has yet to accept a common set of standards for accounting of GHG reductions from specific projects. However, the emerging standards are generally built on accepted standards for corporate GHG emission accounting, with the addition of specific tests needed to test the validity of the project. DGC's emission reduction meets the principles of these emerging standards.

Past and present emission reductions at DGC may ultimately prove to have a discounted monetary value. However DGC is positioned to obtain recognition for its actions under future regulatory programs or voluntary reporting programs. DGC is also well positioned to market credits for future reductions, and has documented project boundaries and baselines in a fashion that should allow verification and certification under likely policy scenarios.

References

1 US Department of Energy, Energy Information Administration, Project-Specific Guidance for each of six sectors: http://www.eia.doe.gov/oiaf/1605/guidelns.html#vol1

2 Clean Air Canada Inc., "Guidance Manual on Emission Reduction Credit Creation Requirements, 2002: http://www.cleanaircanada.org/ercforms.asp

3 WRI/WBCSD, "The Greenhouse Gas Protocol, Project Quantification Standard, Road Test Draft", September 2003: http://www.ghgprotocol.org/reduction/RoadTestIntro.htm