**From:** Andrew Chartrand
**To:** Wilson, Aimee
**Subject:** RE: Sinton Compressor Station
**Date:** Monday, July 15, 2013 10:29:50 AM
**Attachments:** Carbon Capture and Storage Cost Estimate.pdf
Sinton Response to Comments_REV3.docx

---

Aimee,

The attached documents provide our responses to your questions below on the Sinton Compressor Station GHG application. Please let me know if you have any questions or follow-up comments. Thank you.

Andrew J. Chartrand
Cheniere Energy, Inc.
700 Milam St., Suite 800
Houston, TX 77002
Phone: (713) 375-5429
Fax: (713) 375-6429
Cell: (832) 358-5535

---

**From:** Wilson, Aimee [mailto:Wilson.Aimee@epa.gov]
**Sent:** Friday, June 21, 2013 12:15 PM
**To:** Andrew Chartrand
**Subject:** Sinton Compressor Station

Andrew,

I have a few questions on the Sinton Application.

Do you have an address for the Sinton Station?

What are the capital costs of CCS in comparison to the project capital costs? By what percentage would the addition of CCS increase the capital cost of the project?

Can you please provide information on what a “seal gas booster system” is and how it will reduce the GHG emissions from the blowdown stacks? By what means will the emissions from the blowdown vents be determined?

Please provide additional information to explain why a natural gas fired emergency generator engine is feasible for the Sinton Compressor Station, but not the CCL.

Please explain why 28VHP will be utilized for fugitive leak detection versus 28LAER.

Thanks,
Aimee

If you are not the intended recipient(s) and have received this e-mail in error, please immediately notify the sender by return e-mail and delete this e-mail from your computer. Any distribution, disclosure or the taking of any other action by anyone other than the named recipient is strictly prohibited.

## Carbon Capture, Storage and Storage Cost Analysis

| ***Carbon Capture Cost Analysis*** | | | | | | Source |
|---|---|---|---|---|---|---|
| ***Total Capital Investment*** | | | | | **$56,000,000** | Note 1 |
| ***Direct Annual Costs*** | | | | | | |
| | | Operating Costs | | | | |
| Operator: | 8 hr/shift | 30 $/hr | 8760 hr/yr | | $262,800 | OAQPS |
| Supervisor: | | 15% of operator | | | $39,420 | OAQPS |
| | | Maintenace Costs | | | | |
| Labor: | 0.5 hr/shift | 30 $/hr | 8760 hr/yr | | $16,425 | OAQPS |
| Material: | | 100% of Labor Cost | | | $16,425 | OAQPS |
| Utility Costs | | | | | | |
| Electrical | 0.1 $/kWh | 8760 hr/yr | 10 MW | | $8,760,000 | Estimate |
| Amine | 1 gal/hr | 1 $/gal | 8760 hr/yr | | $8,760 | Estimate |
| | | | | **Total Direct Annual Costs** | **$9,103,830** | |
| ***Indirect Annual Costs*** | | | | | | |
| Overhead: | | | 60% of O&M | | $201,042 | OAQPS |
| Administrative: | | | 0.02 TCI | | $1,120,000 | OAQPS |
| Insurance: | | | 0.01 TCI | | $560,000 | OAQPS |
| Property tax: | | | 0.01 TCI | | $560,000 | OAQPS |
| Capital recovery: | (20 Years; 7%) | | 0.09 TCI | | $5,286,004 | OAQPS |
| | | | | **Total Indirect Annual Costs** | **$7,727,046** | |
| | | | | **Total Annual Cost (DC + IC)** | **$16,830,876** | |

*(1) Total Capital Investment is estimated as 80% of Facility Capital Investment based on the "Report of the Interagency Task Force on Carbon Capture and Storage" for a NGCC plant using post-combustion carbon capture.*

| ***Transport Cost Analysis*** | | | |
|---|---|---|---|
| **Cost Type** | **Units** | **Cost Formula** | **Cost[1]** |
| | | **Pipeline Costs** | |
| Materials | $<br>Diameter (inches)<br>Length (miles) | $64,632 + $1.85 x L x (330.5 x $D^2$ + 686.7 x D + 26,960) | $12,786,179 |
| Labor | $<br>Diameter (inches)<br>Length (miles) | $341,627 + $1.85 x L x (343.2 x $D^2$ + 2,074 x D + 170,013) | $58,006,038 |
| Miscellaneous | $<br>Diameter (inches)<br>Length (miles) | $150,166 + $1.58 x L x (8,417 x D + 7,234) | $14,745,827 |
| Right-of-Way | $<br>Diameter (inches)<br>Length (miles) | $48,037 + $1.20 x L x (577 x D + 29,788) | $6,432,037 |
| | | **Other Capital** | |
| $CO_2$ Surge Tank | $ | Fixed | $1,150,636 |
| Pipeline Control System | $ | Fixed | $110,632 |
| | | **O&M** | |
| Fixed O&M | $/mile/year | Fixed | $8,632 |
| **Total Capital Investment (TCI)** | | | **$93,231,349** |
| Capital Recovery (20 years; 7%) | | 0.09 TCI | $8,800,380 |
| Annualized O&M Costs (Fixed O&M x Pileline Length x 20 years x 7%) | | | $1,933,568 |
| **Total Annual Pipeline Cost (O&M + Capital Recovery)** | | | **$10,733,948** |

*(1) Costs based on pipeline distance of: 160 miles. This assumes the closest facility that accepts an anthropogenic $CO_2$ stream is the Denbury Resources Green Pipeline, located in East Texas.*

*(2) As a conservative approach, the pipeline diameter was estimated as: 6 inches.*

*(3) Cost analysis methodology provided in NETL's "Quality Guidelines for Energy System Studies".*

**Response to Comments**
**Application Completeness Determination for Cheniere Corpus Christi Pipeline, L.P.**
**Greenhouse Gas Prevention of Significant Deterioration Permit**
**Sinton Compressor Station**



**Comment 1**

Do you have an address for the Sinton Station?

**Response**

The proposed Sinton Compressor Station is to be located on rural farmland, approximately 4 miles north of Sinton, Texas. There is no street address for this location. The driving directions from Sinton are as follows: proceed northeast on Highway 77 from Sinton for approximately 3.6 miles, take the first left turn into a private driveway after passing Edwards Road, and continue northwest for approximately 1.2 miles. The proposed location will be on the north side of the road. The site and access to it from Highway 77 is on private land.

**Comment 2**

What are the capital costs of CCS in comparison to the project capital costs? By what percentage would the addition of CCS increase the capital cost of the project?

**Response**

CCPL conducted a cost analysis, as described in Appendix B of the Sinton GHG Permit Application submitted in August 2012, for post-combustion carbon capture, compression and transport to a suitable long-term $CO_2$ storage facility. The cost analysis was developed using guidance from the U.S. Department of Energy National Energy Technology Laboratory's *Quality Guidelines for Energy System Studies: Estimating Carbon Dioxide Transport and Storage Costs* (March, 2010), and the *Report of the Interagency Task Force on Carbon Capture and Storage* (August, 2010). This analysis conservatively excluded $CO_2$ storage costs.

The total capital investment for post-combustion carbon capture is estimated to be $56 million, which is based on the Interagency Task Force guidance for a natural gas combined-cycle (NGCC) power plant using post-combustion carbon capture. This represents significantly more than 50% of the total estimated capital investment for the Sinton Compressor Station. In addition to the capital cost for carbon capture, the capital costs for carbon transport by pipeline to the Denbury Resources Green Pipeline were determined using DOE NETL guidance for pipeline construction costs. Based on the distance from the proposed project to the Denbury Resources Green Pipeline, an additional capital investment of approximately $93 million would be needed to construct the 160 mile-long pipeline to transport the compressed $CO_2$. Therefore, the additional capital investment for carbon capture and transport is approximately $149 million, which is significantly in excess of the estimate cost of the Sinton Compressor Station. The cost analysis for post-combustion carbon capture and transport is included as Attachment A.

**Comment 3**

Can you please provide information on what a "seal gas booster system" is and how it will reduce the GHG emissions from the blowdown stacks? By what means will the emissions from the blowdown vents be determined?

**Response**

The centrifugal compressors proposed for the Sinton Compressor Station are equipped with tandem dry gas seals that use natural gas as the seal gas. During normal operation, the compressor pressure and temperature ratio maintain a positive flow to the dry gas seal and avoid contamination and condensation. However, during stand-still conditions, this auto-buffering may not be possible, and the dry gas seal is at risk for contamination by hydrocarbon condensate. To mitigate this risk, depressurizing the compressor after a trip is recommended; however, this releases the blowdown gas to the atmosphere.

The installation of the seal gas booster allows the compressor to be kept pressurized for longer durations after a trip by providing a positive flow of clean, dry seal gas to the dry gas seals, which keeps the seals correctly buffered and ready to be restarted. Provided the compressor is restarted within this extended period, depressurization is not required, eliminating releases to the atmosphere in these situations. The gas booster operates on the principle of an automatic reciprocating differential area piston. An air-operated drive piston, coupled by a connecting rod to a gas piston that operates in a high pressure gas cylinder, converts compressed air flow into high pressure gas flow, in turn maintaining positive pressure on the compressor's dry gas seals.

In the event that a depressurization is necessary, or the blowdown vent gas cannot be combusted in one of the combustion turbines, the GHG emissions from the blowdown vents will be calculated using existing gas analysis, operating temperature and pressure, and blowdown pipe volume in accordance with 40 CFR §98.233(i) of the Mandatory Greenhouse Gas Reporting Rule for onshore natural gas transmission compression.

**Comment 4**

Please provide additional information to explain why a natural gas fired emergency generator engine is feasible for the Sinton Compressor Station, but not the CCL.

**Response**

The Sinton Compressor Station is a natural gas transmission facility, which will transport natural gas and enhance bi-directional flow along the proposed Corpus Christi Pipeline. Based on the function of the proposed facility, clean-burning pipeline quality natural gas will be readily available on a highly reliable basis as a fuel source for the emergency generator engine. The availability of pipeline quality natural gas eliminates the need for additional storage infrastructure and transportation requirements for alternative fuels.

**Comment 5**

Please explain why 28VHP will be utilized for fugitive leak detection versus 28 LAER.

**Response**

Based on the GHG PSD Permit Application submitted in August 2012, and the supplemental BACT analysis for process fugitives submitted in May 2013, CCPL is proposing to conduct annual GHG surveys using optical gas imaging in accordance with the Mandatory Greenhouse Gas Reporting Rule for monitoring fugitive GHG emissions from the proposed Sinton Compressor Station. LDAR programs, such as 28VHP and 28LAER, are intended for control of VOC emissions in nonattainment areas and for facilities with project emissions that exceed the significant emission rate (SER) for VOCs and require state and/or federal BACT review. While a top-down BACT analysis also requires that the lowest achievable emission rate (LAER) control candidates are included in the control candidate review, they are not strictly required in areas that demonstrate attainment. Currently, San Patricio County is in attainment, or unclassifiable, for all pollutants. Additionally, the proposed project emissions of VOCs are less than the SER and do not require PSD review.

The primary purpose of implementing an LDAR program as BACT/LAER is to control fugitive emissions of VOCs to the atmosphere. TCEQ guidance provides that an LDAR program is not necessary to satisfy BACT when uncontrolled fugitive emissions are less than 10 tpy.[1] Because the fugitive VOC emissions from the proposed project are less than 10 tpy, the TCEQ would not require CCPL to implement LDAR for VOC control. Moreover, based on the process fugitive emission calculations provided in Section 4.0 of the Sinton GHG Permit Application submitted in August 2012 and supplemented in May 2013, CCPL anticipates that there will be less than 10 tpy of $CH_4$ emissions from the process fugitives, which represents a negligible contribution to the facility's total GHG emissions.

Therefore, in accordance with the monitoring requirements in 40 CFR §98.234(a)(1), CCPL proposes to implement annual GHG surveys using optical gas imaging for equipment leak detection at the Sinton Compressor Station to comply with the Mandatory Greenhouse Gas Reporting Rule requirements for onshore natural gas transmission compression.

[1] TCEQ. Air Permits Division. *NSR Guidance for Equipment Leak Fugitives: Best Available Control Technology (BACT)*. (August, 2011). http://www.tceq.texas.gov/permitting/air/guidance/newsourcereview/fugitives/nsr_fac_eqfug.html.

# Attachment A

# Cost Analysis for Carbon Capture and Storage