

US EPA ARCHIVE DOCUMENT

LON C HILL REDEVELOPMENT PROJECT
LON C. HILL, LP

Total CCS System Annualized Cost

CCS System Component	Technology Cost (\$/metric ton)	CO ₂ Controlled (metric tons/yr) ⁽⁴⁾	Total Annualized Cost
CO ₂ Capture and Compression Facilities ⁽¹⁾	\$114	2,050,368	\$233,741,930
CO ₂ Transport Facilities ⁽²⁾	\$0.73		\$1,493,605
CO ₂ Storage Facilities ⁽³⁾	\$0.56		\$1,148,206
Total CCS System Annualized Cost	\$115		\$236,383,740

Notes

- (1) CO₂ capture and compression facilities cost per default value for natural gas combined cycle units as published in the Report of the Interagency Task Force on Carbon Capture and Storage (August 2010), Section III.D.1 <http://energy.gov/fe/services/advisory-committees/interagency-task-force-carbon-capture-and-storage>
- (2) CO₂ transport facility cost as calculated using DOE/NETL Quality Guidelines for Energy System Studies: "Carbon Dioxide Transport and Storage Costs in NETL Studies" (March 2013). Refer to CO₂ Transport Facilities costs breakdown below
- (3) CO₂ storage facilities cost as proposed in the Report of the Interagency Task Force on Carbon Capture and Storage (August 2010), Section III.C.4
- (4) CO₂ Controlled (metric tons/yr) = CO₂ Emissions per Unit (tpy) * 1 metric ton / 1.1023 short ton * 2 Units * 90% Capture Efficiency
 CO₂ Controlled = 1,255,634 short tons / yr * 1 metric ton / 1.1023 short tons * 2 unit * 90% capture control = 2,050,368 metric tons/yr

Proposed Plant Cost

Capital Cost w/o CCS	\$200,000,000
Capital Recovery Factor	0.09
Annualized Capital Cost w/o CCS	\$18,878,585

Notes:

- (1) Vendor proposed capital cost
- (2) Capital recovery factor is the ratio of a constant annuity to the present value of receiving that annuity for a given length of time. Using an interest rate, i, and a number of annuity received, n, the capital recovery factor is:

$$CRF = \frac{i * (1 + i)^n}{(1 + i)^n - 1} \quad \begin{matrix} i = 7\% \\ n = 20 \end{matrix}$$

- (3) Annualized Capital Cost w/o CCS = Total Capital Cost w/o CCS * Capital Recovery Factor

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CO₂ TRANSPORT FACILITIES COSTS

Pipeline Capital Cost Breakdown

Pipeline Capital Cost ⁽¹⁾	
Materials	\$1,414,578
Labor	\$4,895,817
Miscellaneous	\$1,564,012
Right of Way	\$506,342
Other Capital Cost ⁽²⁾	
CO ₂ Surge Tank	\$1,244,724
Pipeline Control System	\$111,907
Total Capital Cost ⁽³⁾	\$9,737,380
Capital Recovery Factor ⁽⁴⁾	0.09
Annualized Capital Cost (\$/yr) ⁽⁵⁾	\$919,140

Notes:

(1) Pipeline capital cost (materials, labor, miscellaneous and right of way) calculated as published on DOE/NETL Quality Guidelines for Energy System Studies: "Carbon Dioxide Transport and Storage Costs in NETL Studies" (March 2013).
 Where:

Materials = \$70,350 + \$2.01 * L * (330.5 * D² + 686.7 * D + 26,960)
 Labor = \$371,850 + \$2.01 * L * (343.2 * D² + 2,074 * D + 170,013)
 Miscellaneous = \$147,250 + \$1.55 * L * (8,417 * D + 7,234)
 Right of Way = \$51,200 + \$1.28 * L * (577 * D + 29,788)

Having:

Pipeline Length, L = 10 miles
 Diameter, D = 10 inches

Several candidate storage reservoirs exist within 10 to 50 miles of the proposed project, though none have been confirmed to be viable for large scale CO₂ storage at this time. However, it was assumed for this analysis that a Pipeline Diameter based on existing CO₂ pipelines in the US with similar lengths.

(2) Other capital cost (CO₂ surge tank and pipeline control system) as published on DOE/NETL Quality Guidelines for Energy System Studies: "Carbon Dioxide Transport and Storage Costs in NETL Studies" (March 2013).

(3) Total Pipeline Capital Cost = Pipeline Capital Cost + Other Capital Cost

(4) Capital recovery factor is the ratio of a constant annuity to the present value of receiving that annuity for a given length of time. Using an interest rate, i, and a number of annuity received, n, the capital recovery factor is:

$$CRF = \frac{i * (1 + i)^n}{(1 + i)^n - 1}$$

i = 7%
n = 20

(5) Annualized Capital Cost = total Capital Cost * Capital Recovery Factor

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Pipeline O&M Costs Breakdown

Fixed O&M (\$/yr) ⁽¹⁾	\$84,540
Power Cost (\$/yr) ⁽²⁾	\$489,925
Annualized O&M Costs (\$/yr) ⁽³⁾	\$574,465

Notes:

- (1) Fixed O&M cost as published on DOE/NETL Quality Guidelines for Energy System Studies: "Carbon Dioxide Transport and Storage Costs in NETL Studies" (March 2013): \$8,454/mile/yr
- (2) Power Cost based on 1000 hp (1hp = 745.7 w) electric compressor and \$0.075/kwh electricity cost
- (3) Total Annual O&M Costs = Fixed O&M Costs + Power Cost

CO₂ Transport Facilities Costs

Total Annualized Costs (\$/yr) ⁽¹⁾	\$1,493,605
Total CO ₂ to Control (metric tons/yr) ⁽²⁾	2,050,368
Cost Effectiveness (\$/metric tons) ⁽³⁾	0.73

Notes:

- (1) Total Annualized Costs = Annualized Capital Costs + Annualized O&M Costs
- (2) 90% of CO₂ emissions for both units
- (3) Cost Effectiveness = Total Annualized Costs / Total CO₂ to Control