Texas Clean Energy Project
Development Update – Plus CO$_2$/EOR Observations

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Part 1

Status Of The

Texas Clean Energy Project
Snapshot of TCEP

- 400 MW “polygen” IGCC project w/ 90% carbon capture
- Siemens gasifiers & 1x1 F-class CCCT w/ high H₂ CT
- Near Odessa, TX site directly atop Permian Basin
- All components already in commercial use elsewhere; only the integration is new; intended as a reference plant
- Fixed-price, lump sum, turnkey EPC contracts complete
- Siemens & Linde will warrant long-term performance & availability under 15-year O&M Agreement
- 90% carbon capture rate yields ≈ 2.5M stpd of CO₂
Update: TCEP is Ready

• Permitting complete:
  – Record of Decision from US DOE on 9/29/11 (completes NEPA/EIS process)
  – Air permit issued 12/28/10 (no greenhouse gas emissions limits)

• Off-take agreements complete:
  – 100% of power sold to CPS Energy for 25 years
  – 100% of CO2 sold for 30 years (three different buyers)
  – 100% of urea sold for 15 years (major fertilizer/chemical company)

• EPC contracts complete:
  – Siemens, Linde, and SK E&C are the EPC contractors
  – Lump-sum, fixed-price, turnkey EPC contracts (power block + chemical block)

• IRR range looks good for equity investment

• Bank syndicate (led by RBS) formed to obtain necessary debt
Off-take information

• Power sales agreement with CPS Energy (largest U.S. muni utility):
  – 195 MW of take-or-pay capacity; delivery point is nearby ERCOT substation
  – Buyer pays fixed cost for capacity + agreed O&M charges for energy
  – Carbon content of power: less than 25% of that from a natural gas CCCT
  – First time any utility has bought low-carbon power from a commercial-scale carbon capture power plant – a milestone in global environmental history

• CO₂ sales (for 2.5 million tons per year of CO₂, take-or-pay):
  – Slightly different pricing formulas in each of three (3) contracts
  – Price is for each Mcf; average price somewhat higher than reported “market”
  – Buyer pays (a) transportation costs, plus (b) increases in compression costs
  – Buyer gets 100% of severance tax and sales tax benefits under HB 469

• Urea sales (one buyer under take-or-pay contract):
  – Agreed floor price with formula for sharing market price above floor
  – Excellent long term market price outlook
Status of Financing

• DOE $450M award is vested (can’t be “clawed back”)
• $313M Sec. 48A investment tax credit also vested via an IRS contract
• TCEP also qualifies for accelerated depreciation (5-year MACRS)
• Well over $1 billion in total tax benefits (TCEP’s “fourth product”)
• Financial model yields sufficient debt service coverage & returns

• Potential upside for equity investors:
  – Congress can eliminate $157M tax on DOE grant (this is revenue neutral to US)
  – DOE has legal ability to provide more funds & ITC if/as/when available
  – TCEP’s carbon credits expected to be saleable; decent prices forecasted
  – TCEP may receive cost-sharing payments from future replica projects
  – Price of oil may exceed $70 per barrel! (The number used by the banks.)
CO₂ sales

- TCEP’s captured CO₂ ≈ 147,000 Mcf per day in normal operation
- Volume smaller than originally planned because we increased urea
- Blue Source/Blue Strategies led our sales effort
- Sales negotiations were conducted on non-exclusive basis
- Buyers will receive two large benefits under HB 469:
  - Oil severance tax cut to 25% (i.e., 50% of normal CO₂/EOR rate)
  - Sales tax exemption for CO₂ transport & injection equipment
- Connection to Kinder-Morgan’s nearby Central Basin Pipe Line
- Approved MVA plan that Blue Source devised for producers
Part 2

Observations* on CO2/EOR & Financing Power Plants with CO2 Capture

* Primarily E. Redman at Summit Power
Key Concepts: (1) Lenders don’t take ANY risks; (2) all risks must be taken by others; and (3) the others must have deep enough pockets

Completion Costs & Mechanical: Use EPC Turnkey contracts with full warranties, “must fix” & liquidated damages (LDs), plus, project cash reserves for contingencies

Operations & Maintenance: need long-term warranties, LDs, some significant portion of costs fixed, some “must fix” provisions

Revenues vs. Costs: Need “bankable” off-take contracts & secure supply contracts; ideally these should “track” each other; duration of contracts matters a lot, match or exceed debt service period

Financial capital cost risks: Things turn sour quickly if costs exceed revenues for long; not like running a company quarter-to-quarter; trap door opens under projects if DSC requirements are not met, lenders then own everything – You 0.
CO₂/EOR in the Permian Basin: pluses

- Forty year history of safe, successful CO₂ injections (geologic CO₂)
- No serious environmental issues (no fracking is used)
- Widespread acceptance by producers, environmentalists, & public
- Very large volumes injected annually (both new & “recycled”)
- Good data already available on permanence of sequestration
- Large existing CO₂ pipeline infrastructure (thousands of miles)
- More CO₂ pipelines can be built, relatively easily
- Favorable federal tax treatment of (1) EOR, and (2) CO₂ pipelines
- Large remaining CO₂/EOR production possible in the MPZs
- Enormous CO₂/EOR production possible in residual oil zone (ROZ)
- For practical purposes, the ROZ is an infinite sink for CO₂ – the limiting factors will not include lack of remaining oil for production
• Liability issues in CO₂/EOR context (not other forms of CCS) are settled under Texas law, to the satisfaction of most producers
• In Texas, injection of CO₂ (or water) for EOR requires State approval
• If the injection is approved by the State, then –
  – There is no liability for underground migration of the injected fluids (i.e., no legal trespass) under “reverse law of capture” doctrine; and
  – There is no obligation to remove the injected water or CO₂ once injected
• This creates (1) effective immunity from trespass suits, and (2) an effective legal right of storage, in the specific context of Texas EOR
• “Who owns the pore space?” effectively a non-issue in TX CO₂/EOR
• Monitoring regimes for CO₂ are intended to prevent any escapes
Apparent Lessons - 1

- Even today, anthropogenic CO$_2$ is still surprisingly difficult to sell
- Oil producers are skeptical that CO$_2$ capture projects will be built
- Producers have “kissed a thousand frogs & never met a prince”
- Producers worry about EPA regulation of CO$_2$/EOR – and aren’t entirely comfortable with TX requirements for MVA (MRV)
- These fears are particularly great for anthropogenic CO$_2$ (“CO$_2$-a”): there is little or no regulation of other CO$_2$/EOR at this time
- Producers prefer natural geologic sources:
  - Flexibility in deliveries to accommodate fluctuations in injection rates (CO$_2$ domes act as surge tanks & storage reservoirs); term can vary, too
  - No expected liabilities or obligations for the producers for geologic CO$_2$
  - Settled pricing: “market” per Mcf for CO$_2$ compressed & delivered in the field (i.e., buyer does not pay extra for pipeline transportation)
Apparent lessons - 2

- For financing, “market” price didn’t yield enough revenue for TCEP, even with DOE’s financial support – we needed to do better
- Without DOE support, no CCS power plant would be economic even in the Permian at “2% of crude”— yet CO$_2$ seems to be worth more
- At “2% of crude” and $80+ oil, nearly 90% of incremental oil revenue goes to the producer – only about 10% to the CO$_2$ supplier
- The oil producer has major capital & operating costs, of course!
- Still, to get more CO$_2$-a will require a less lop-sided division of dollars
- Given that (1) the Permian is “short” CO$_2$, and (2) this shortage constrains Permian production, this situation is sub-optimal
- Benefits of fixing this situation: (1) more on-shore US oil production & jobs, and (2) more CO$_2$-capture plants, jobs, clean energy
Apparent lessons - 3

- Beyond TCEP (i.e., “beyond major DOE cost contributions”) CO$_2$-a will need **more CO$_2$ sales revenue per ton** to finance capture plants
  - The costs of the capture plants (per unit of output) will come down, but –
  - Revenue contribution of oil to CO$_2$ capture plants still needs to come up

- CO$_2$ capture plants also need off-take arrangements that can act as “sinks” for fluctuating volumes of CO$_2$
  - “Single source, single sink” would be a poor model for capture plants
  - No balancing agreements yet exist on CO$_2$ pipeline systems (unlike NG)
  - Capture plants will have maintenance, forced outages & an initial “ramp”
  - Plants need **all** their CO$_2$ to be sold for revenue – and none to be vented

- For financing, CO$_2$ capture plants need to **sell output for long terms**
  - Banks want off-take contracts for the life of the project debt (15-30 years)
  - Producers prefer shorter commitments, reflecting realities of CO$_2$ floods
Beyond TCEP and beyond Summit

• Potential scale of CO₂/EOR in the Permian exceeds past estimates
• At last year’s conference, ARI/Melzer publicly estimated nearly 4 billion bbls of recoverable oil in the ROZ in a single Texas county
• If considered a separate oil field, this would be in top 10 in the US
• At 2 barrels of oil per ton of CO₂, 4 billion bbl would require some 2 billion tons of CO₂, or about 66 million tpy for 30 years
• This is equivalent to twenty-six (26) TCEPs, each 2.5 million tpy
• Together with the ROZ elsewhere in the Permian, this represents:
  – A very large volume of cleanly-produced, low-risk, on-shore US oil;
  – A very large potential sink for CO₂, with permanent sequestration;
  – A huge challenge (because of numerous potential bottlenecks); and
  – A national opportunity to develop CCUS & associated infrastructure (water demineralization, transmission, etc.) to an astonishing degree
Meanwhile . . .

- Summit has created Summit Carbon Capture, LLC (SCC)
- SCC will focus on (1) CO$_2$ capture plants, for (2) EOR, in first instance
- EOR is the current key to CO$_2$ capture plants; other CCS comes later
- The plants we currently plan include:
  - TCEP “replicas” in the U.S. and abroad
  - Natural gas-fired plants with oxy or post combustion CO$_2$ capture
  - Coal-fired plants retro-fitted with PCC
  - Surface facilities for underground gasification with CO$_2$ capture
  - Gasification facilities (without power production) with CO$_2$ capture
  - Facilities to capture CO$_2$ directly from the surrounding air
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