Texas Clean Energy Project

A Progress Report

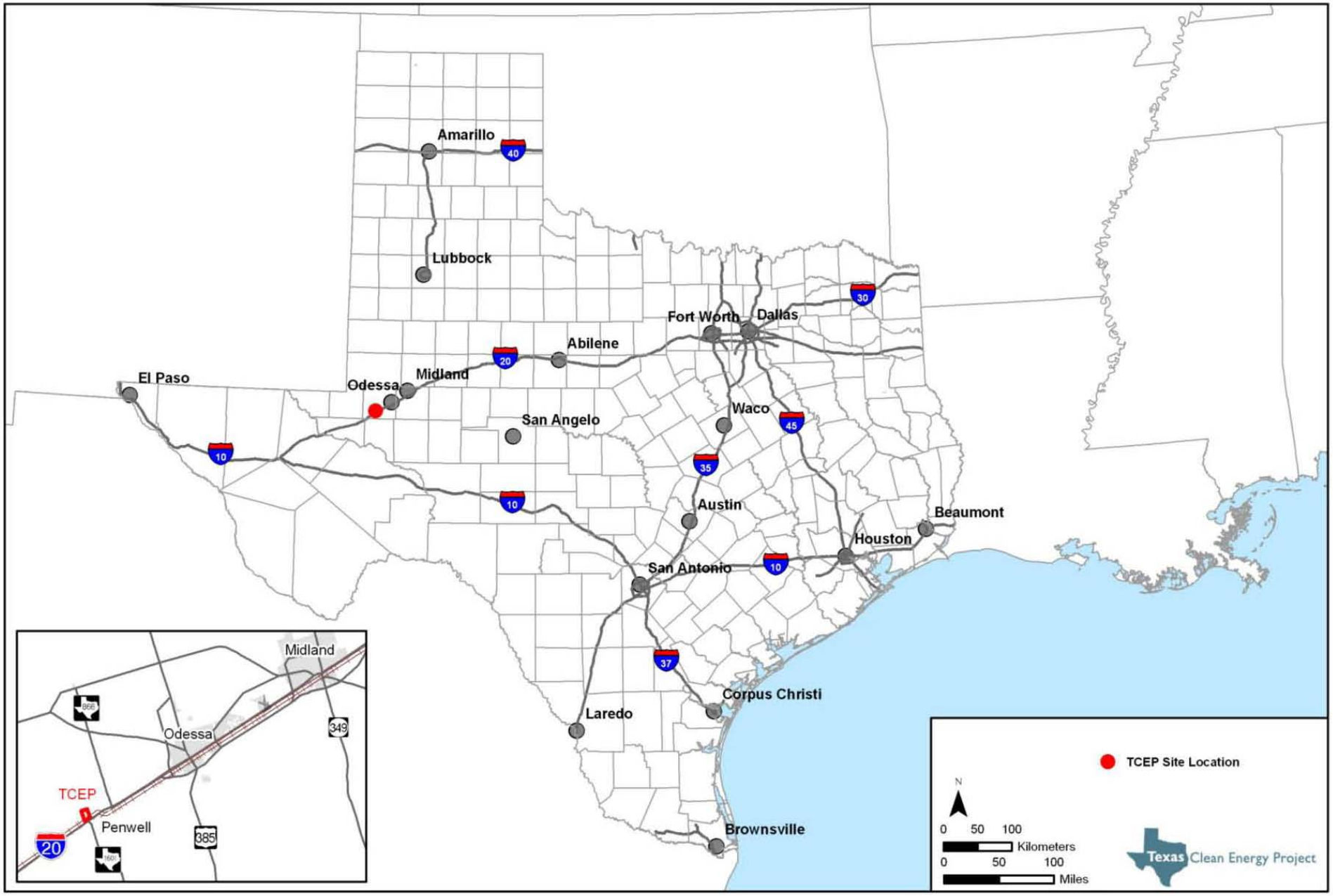
2011 NETL CO_2 Capture Technology Meeting
Pittsburgh, PA
August 25, 2011

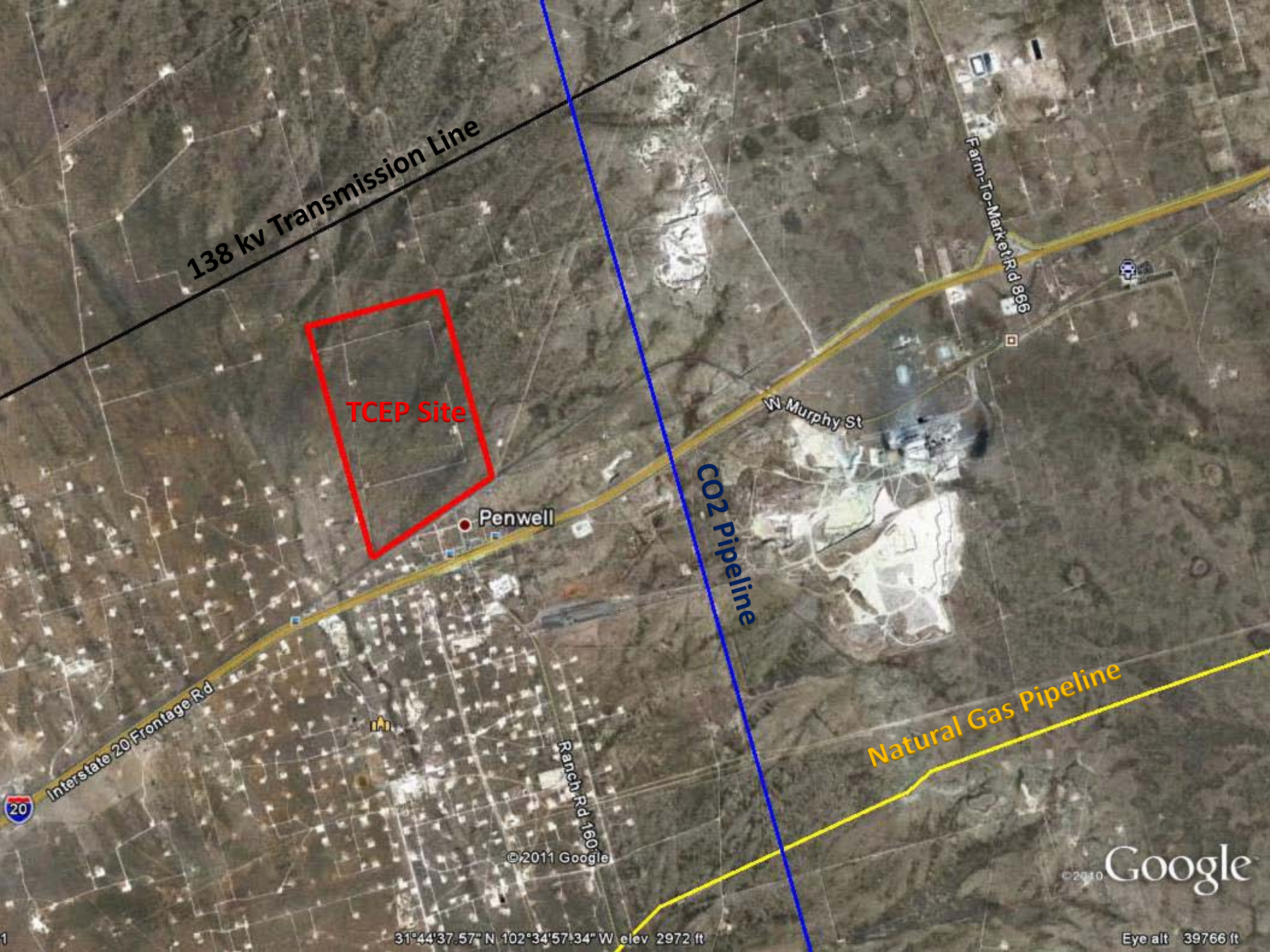
Snapshot of TCEP

- 400 MW IGCC project with 90% carbon capture
- Powder River Basin Coal, ~ 2 million tons/year
- Siemens gasifiers & 1x1 F-class CCCT w/ high H2 CT
- Rectisol CO_2 Capture Process
- Located at former FutureGen site directly atop Permian Basin
- All components already in commercial use elsewhere; only the integration is new; intended as a reference plant
- 90% carbon capture rate yields ≈ 3M short tpy of CO_2; CO_2 emissions only 20 to 30% of a natural gas CCCT's

Project Overview

- Total Capital Cost ~ $2.2 Billion
- Three year construction schedule – average 1,500 jobs
- Annual operating expenses ~ $85 million – 150 permanent jobs
- Approximately 3 million tons/yr of CO_2 = 9 million bbls of oil
- Powder River Basin Coal
- Natural Gas for Startup and Back up
- Some turndown capability from duct burners


Amarillo
Lubbock
Fort Worth
Dallas
Abilene
Midland
Odessa
El Paso
San Angelo
Waco
Austin
Beaumont
Houston
San Antonio
Corpus Christi
Laredo
Brownsville
Midland
Odessa
TCEP
Penwell
TCEP Site Location
N
0 50 100
Kilometers
0 50 100
Miles
Texas Clean Energy Project


138 kv Transmission Line
TCEP Site
Penwell
W Murphy St
Farm-To-Market Rd 866
CO2 Pipeline
Natural Gas Pipeline
Interstate 20 Frontage Rd
20
Ranch Rd 160
©2011 Google
Google
31°44'37.57" N 102°34'57.34" W elev 2972 ft
Eye alt 39766 ft

TCEP as #1 project for climate & CCS

- TCEP is Administration's #1 project for carbon capture and sequestration (CCS) – most funding of any project
- Ardent support from national environmental groups – NRDC, EDF, Clean Air Task Force
- No environmental opposition – not even Sierra Club
- Received air permit without opposition, in record time
- The US project chosen for CCS collaboration with China

Project Background

- DOE had selected TCEP on 12/4/09 for $350M award in Round 3 of the Clean Coal Power Initiative (CCPI-3)
- 1/29/2010 – DOE and Summit sign the Cooperative Agreement (first U.S. government contract in Summit's twenty-year history)
- 6/2010 – DOE awards TCEP $100 million more in CCPI funds and indicates that TCEP will be a U.S. project for U.S. – China collaboration on carbon capture & sequestration (CCS)

Things began to roll

February 2010

- FEED Study contractor negotiations begin; this becomes a competitive process among “A Team” firms & companies
- Negotiations begin for sale of TCEP’s main products & for water supplies
- Environmental permitting work begins

March 2010

- Summit Texas Clean Energy, LLC (the project company) acquires the project site with Odessa Development Corp grant

April 2010

- Air permit application filed
- IRS awards TCEP a Section 48A investment tax credit of $313,436,000.00

And roll . . .

May 2010

- Decision to bring more detailed engineering into Phase 1 from Phase 2, requiring more non-Federal funds for Phase 1

June 2010

- FEED Study contractors selected: Siemens, Linde, Fluor
- FEED study commences
- Added Phase 1 non-Federal funds successfully raised

Summer 2010

- Paperwork, systems, and audit complete, DOE commences cost reimbursements for TCEP

October 2010

- TCEQ issues draft air permit for TCEP

Where things stand

- Air permit final 12/28/2010 – without opposition & in record time
- Final EIS NOA on 8/6/2011 - Record of Decision (ROD) expected early September
- FEED Study complete end of June 2011
- EPC contract negotiations underway
  - Linde (chemical block), Siemens (power block) (balance of plant & integration)
  - Scheduled for completion end of August
  - All three EPC contractors have financial “skin in the game”
  - Summit has added professional resources for negotiations
- Water & coal supplies: Multiple options, all in active discussion
- Rail transport: Good cooperation to date from Union Pacific
- Negotiating Transmission Interconnect Agreement

Estimated Schedule

- FEED Completion - End of June 2011
- Complete contracts – August 2011
- Financial Close – October 2011
- Start of Construction – Late 2011, Early 2012
- Combined Cycle Commercial - Early 2014
- Commercial Operation – 4th Qtr 2014

Product sales

- TCEP is a “polygen” IGCC project – it has multiple products
- Three major products account for 95% of revenue:
  - Power: ~200 MW at busbar, large on-site commercial loads; *negotiating PPA with CPS Energy*
  - Urea for fertilizer: up to 750,000 tons per year (~20% of US production); *100% urea sold to major urea distributor*
  - CO_2 for EOR: Approximately 147,000 Mcf per day; *60% of CO_2 sold to Whiting Oil*
- Minor products: Argon gas, sulfuric acid, inert non-leachable slag
- Thanks to DOE financial support, all products can be sold at “market” rather than at “cost” – which would be hard to calculate in any event

Water Requirements

- Minimize water usage
  - Dry cooling for power block
  - Zero liquid discharge
  - Recycle
  - Deep Well Injection
- Current estimated average demand ~ 4 MGD
- Current estimated peak demand ~ 4.8 MGD

Water Supply & Challenges

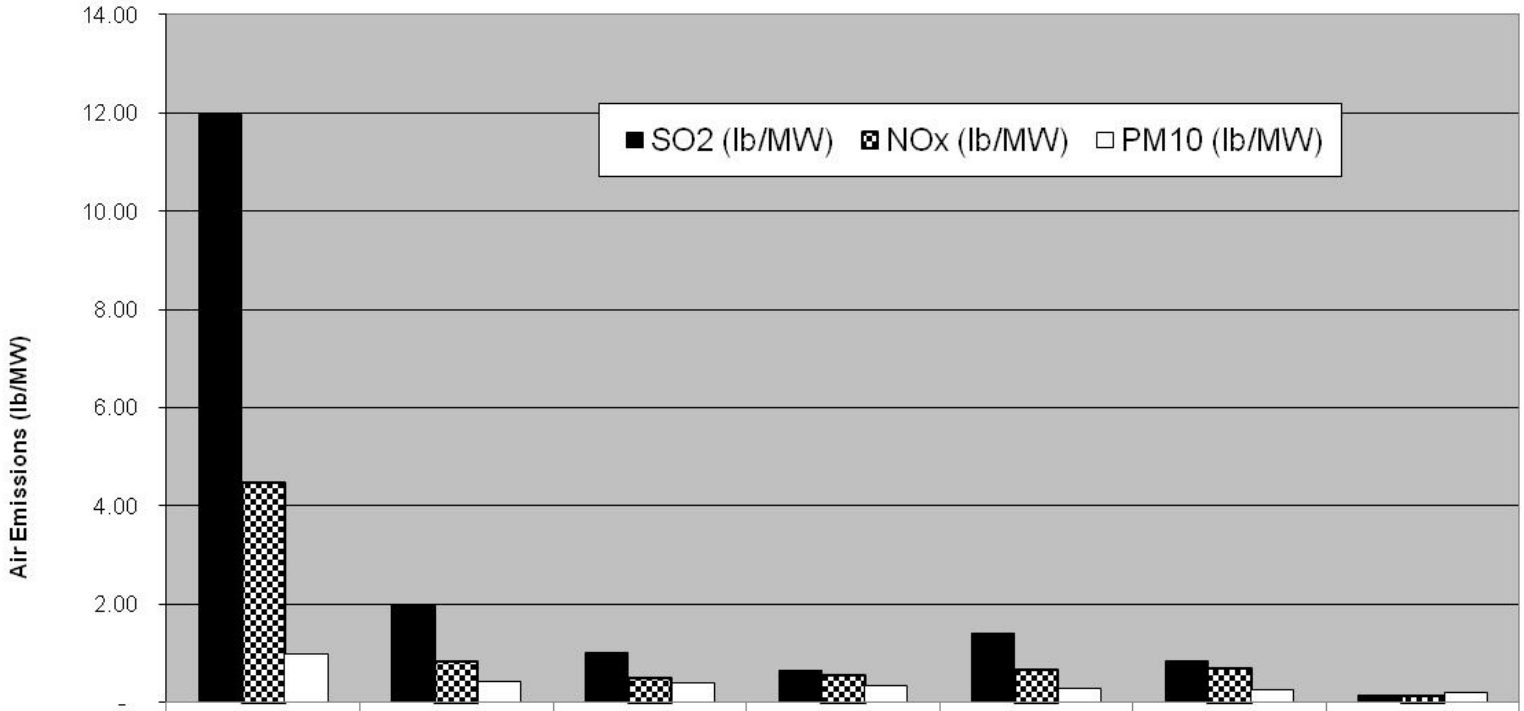
- Fresh Ground Water
  - On-site wells
  - FSH
  - Other
- Brackish Ground Water
  - Capitan Reef
- Municipal Waste Water
  - Gulf Coast Waste Disposal Authority
    - City of Midland
    - City of Odessa

Low Air Emissions

- Texas Commission on Environmental Quality (TCEQ) issued final air quality permit for TCEP on Dec. 28, 2010; draft permit had no environmental opposition or requests for hearing
- NOx, SOx, & PM far below lowest-yet limits permitted in Texas for fossil fuel power plants
- Sulfur removal is 99% despite using low sulfur coal
- Mercury removal greater than 95% from syngas
- CO_2 capture rate of 90%

  - CO_2 emissions rate (lbs per MWhr) only 20 to 30% of a natural gas combined-cycle power plant

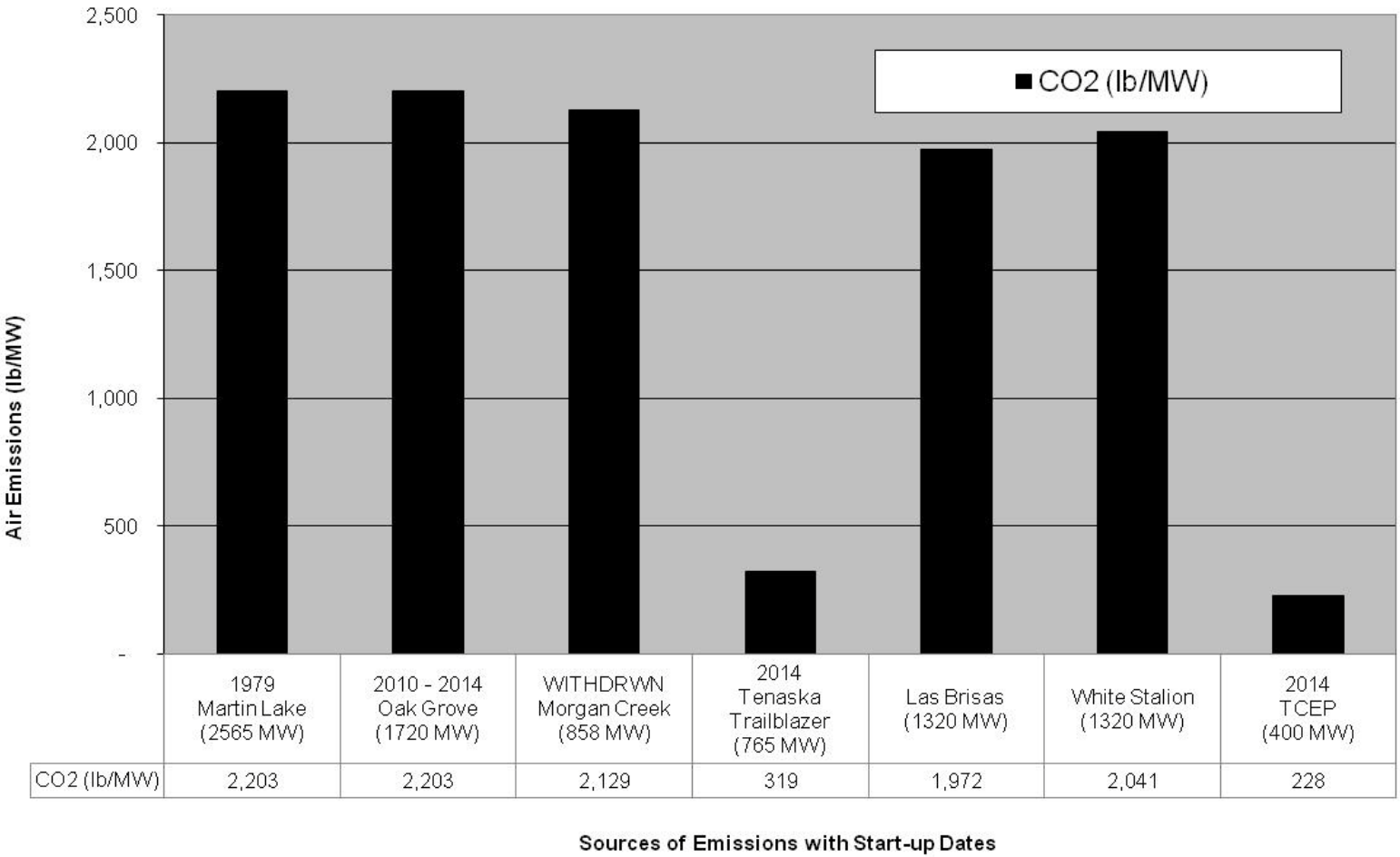
SO_2, NOx, PM10 Bar Chart



	1979 Martin Lake (2565 MW)	2010 - 2014 Oak Grove (1720 MW)	WITHDRWN Morgan Creek (858 MW)	2014 Tenaska Trailblazer (765 MW)	Las Brisas (1320 MW)	White Stalion (1320 MW)	2014 TCEP (400 MW)
SO2 (lb/MW)	11.97	2.01	1.01	0.65	1.40	0.86	0.14
NOx (lb/MW)	4.49	0.84	0.50	0.55	0.66	0.70	0.13
PM10 (lb/MW)	1.00	0.42	0.40	0.35	0.29	0.26	0.22

Sources of Emissions with Start-up Dates

CO_2 Bar Chart



Texas Emissions Comparisons

Power Plant Emission Summary - Per MW Comparison

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PM10 (lb/MW)	1.00	0.42	0.40	0.35	0.29	0.26	0.22
Hg (lb/MW)	0.000214	0.000096	0.000021	0.000019	0.000019	0.000008	0.000007
CO2 (lb/MW)	2,203	2,203	2,129	319	1,972	2,041	228

1. EPA has determined that permit limits for CO2 will be required January 2, 2011.
2. Tenaska CO2 emissions are scaled from Morgan Creek and assume 85% capture.
3. Martin Lake CO2 emissions are scaled from Oak Grove.
4. TCEP PM10 emissions are 0.08 lb/MW without coal drying and urea production emissions.

CO_2 Management

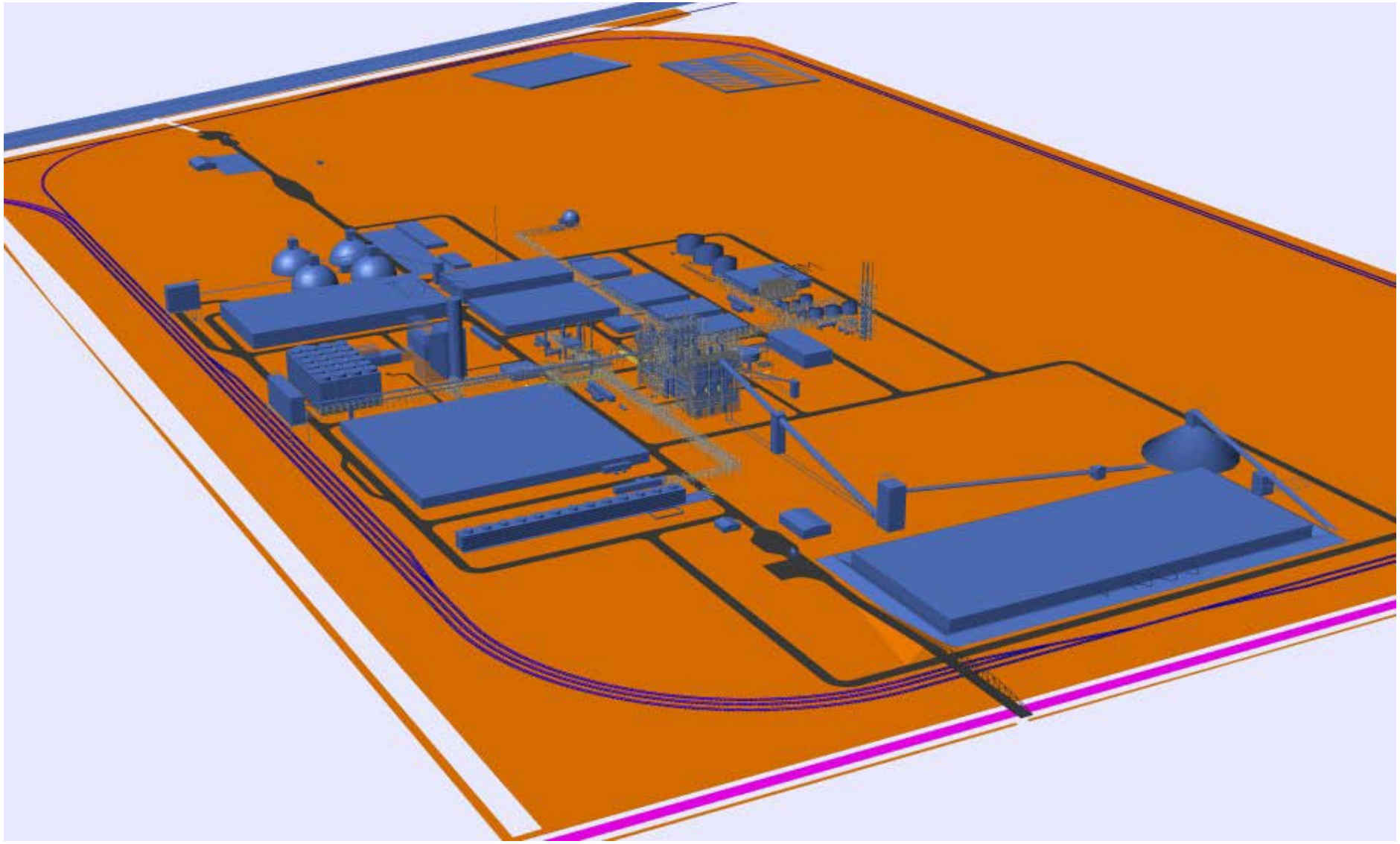
- **Blue Source will manage most CO_2 matters**
  - Sale of CO_2 for EOR, arranging pipeline transport, and certification of verifiable emissions reduction (VER) credits
- **TX Bureau of Econ Geology will approve the MVA**
  - New state law contains comprehensive requirements for MVA (monitoring, verification, and accounting of CO_2)
  - Texas has the most progressive clean coal policies in U.S.; could be model for the nation
- **Carbon Management Advisory Board will be created**
  - CCS scientists, policy-makers, environmentalists
  - To advise re: capture, sequestration, MVA, policy, etc.

CO_2/EOR = CCS + a bridge

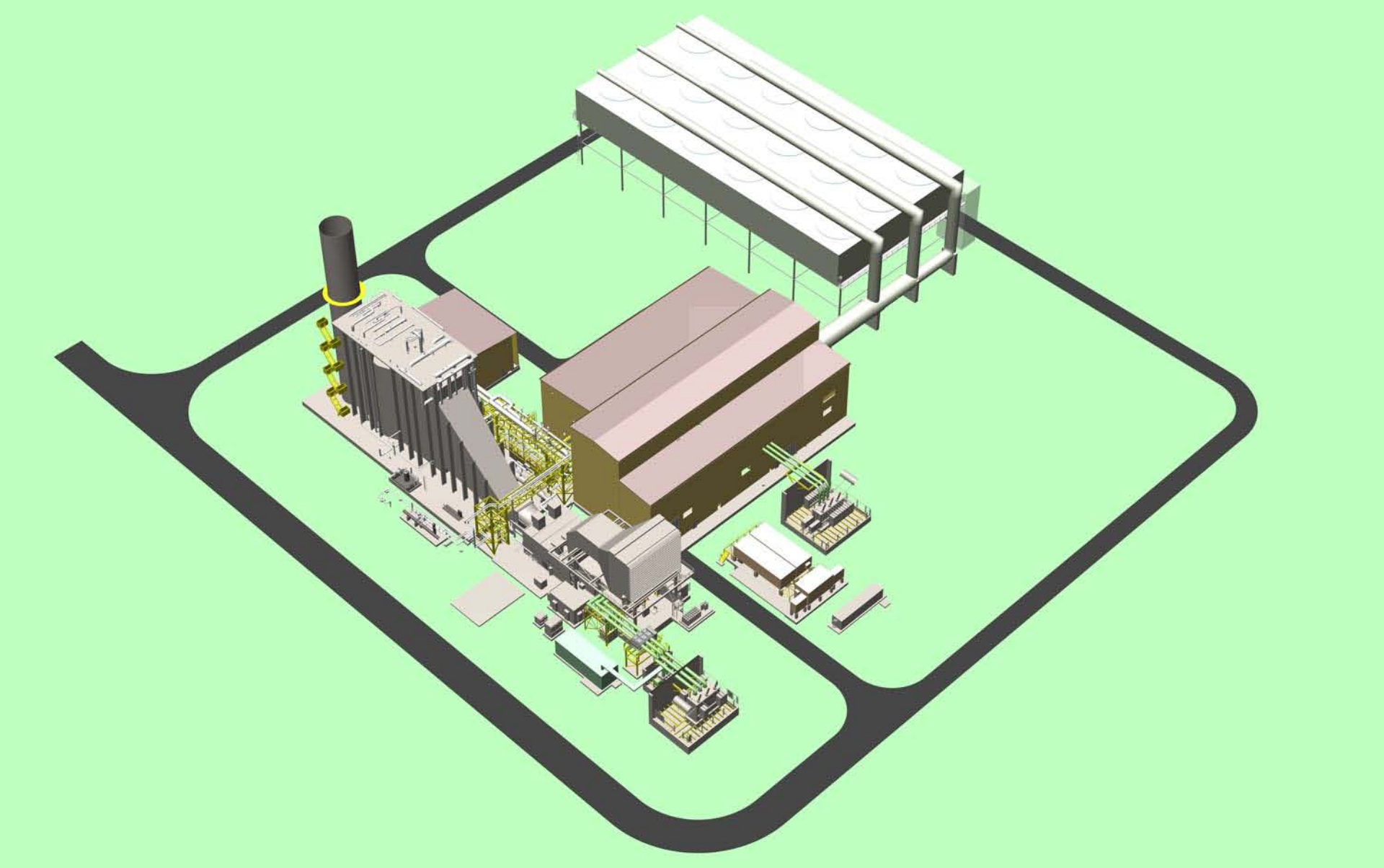
Photo by Briley Mitchell

- **CO_2/EOR has long, safe, reliable, high-volume history**
  - Especially in Permian Basin, this is <u>not</u> an experiment
- **CO_2/EOR with MVA can be highly reliable form of CCS**
  - CO_2 can remain sequestered for more than 1,000 yrs (the TX std)

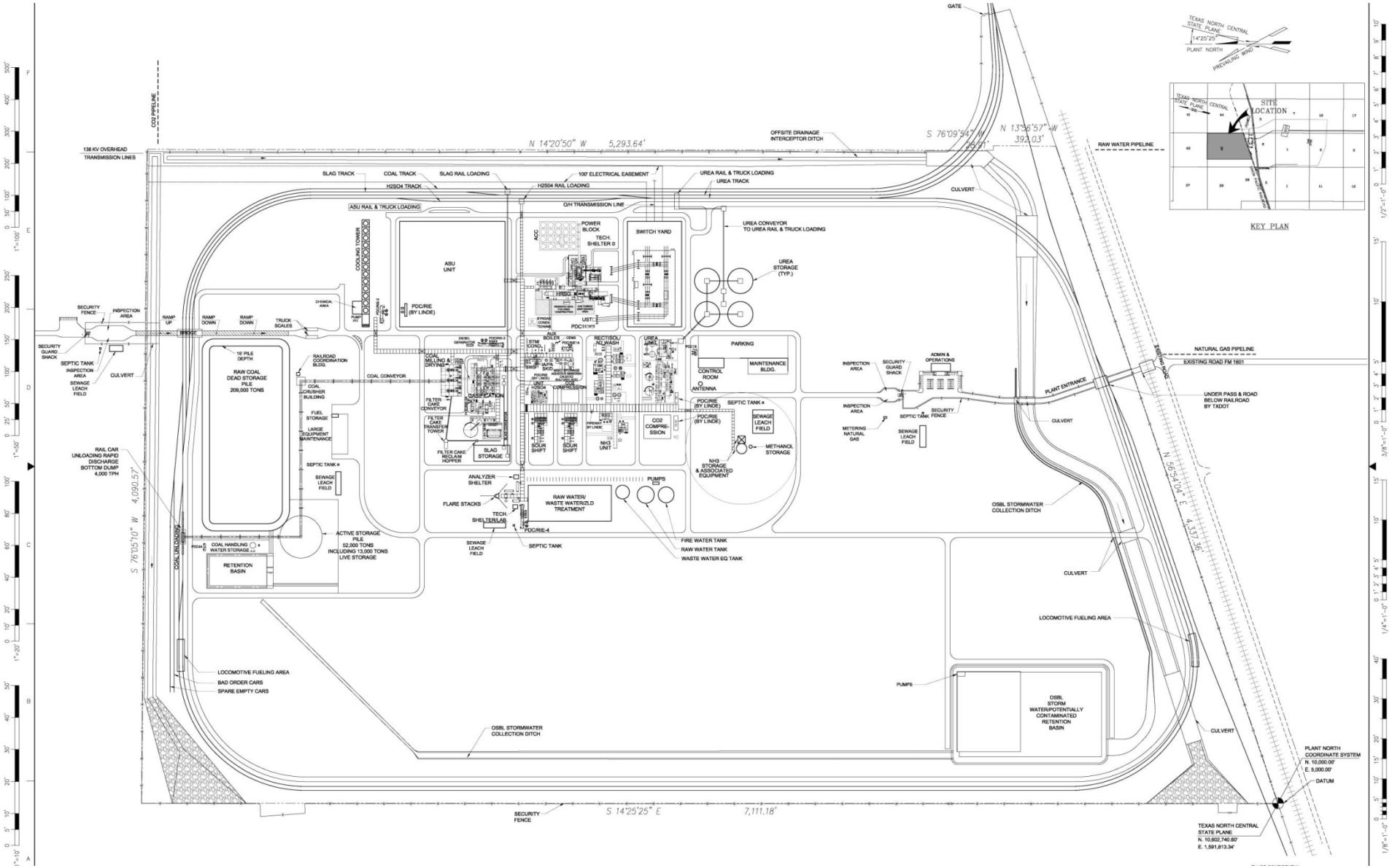
Plant Rendering



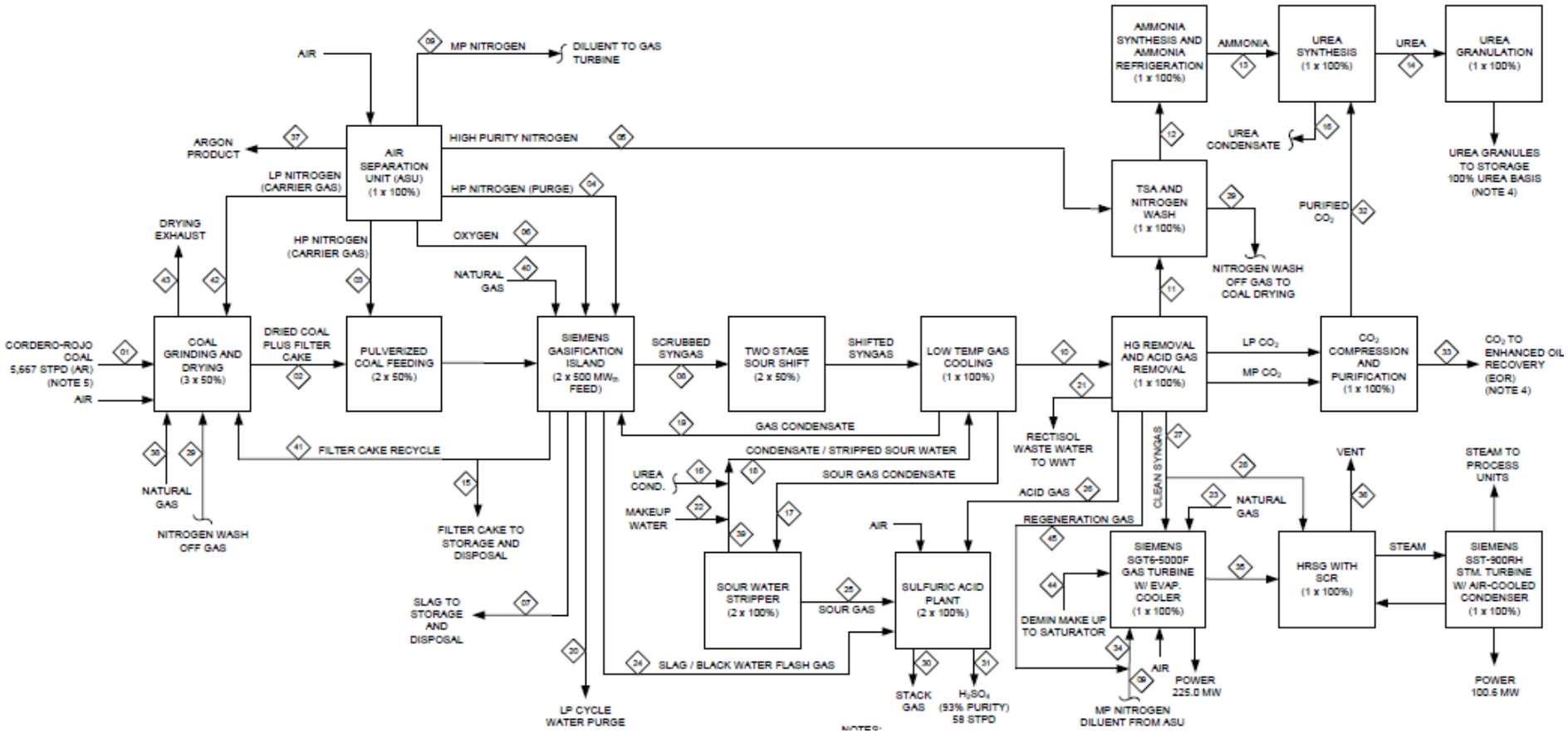
3D Rendering of TCEP Plant Power Block



Plot Plan


GATE
TEXAS NORTH CENTRAL STATE PLANE
14°25'25"
PLANT NORTH
PREVAILING WIND
SITE LOCATION
KEY PLAN
CO2 PIPELINE
138 KV OVERHEAD TRANSMISSION LINES
N 14°20'50" W 5,293.64'
OFFSITE DRAINAGE INTERCEPTOR DITCH
S 76°09'54" W 152.01'
N 13°56'57" W 392.03'
RAW WATER PIPELINE
SLAG TRACK
COAL TRACK
SLAG RAIL LOADING
100' ELECTRICAL EASEMENT
UREA RAIL & TRUCK LOADING
UREA TRACK
H2SO4 TRACK
H2SO4 RAIL LOADING
CULVERT
ASU RAIL & TRUCK LOADING
G/H TRANSMISSION LINE
COOLING TOWER
ASU UNIT
POWER BLOCK
TECH. SHELTER
SWITCH YARD
UREA CONVEYOR TO UREA RAIL & TRUCK LOADING
UREA STORAGE (TYP.)
SECURITY GUARD SHACK
INSPECTION AREA
RAMP UP
RAMP DOWN
TRUCK SCALES
CHEMICAL AREA
PDC/RIE (BY LINDE)
SEPTIC TANK
SEWAGE LEACH FIELD
15' PILE DEPTH
RAW COAL DEAD STORAGE PILE 209,000 TONS
RAILROAD COORDINATION BLDG.
COAL CONVEYOR
COAL CRUSHER BUILDING
FUEL STORAGE
LARGE EQUIPMENT MAINTENANCE
COAL MILLING & DRYING
GASIFICATION
FILTER CAKE CONVEYOR
FILTER CAKE TRANSFER TOWER
FILTER CAKE RECLAIM HOPPER
SLAG STORAGE
AUX BOILER
RECTISOL/ NOWASH
UREA LINE
PARKING
CONTROL ROOM
MAINTENANCE BLDG.
ANTENNA
SOUR SHIFT
NH3 UNIT
CO2 COMPRESSION
METHANOL STORAGE
NH3 STORAGE & ASSOCIATED EQUIPMENT
ANALYZER SHELTER
FLARE STACKS
TECH. SHELTER/LAB
RAW WATER/ WASTE WATER/ZLD TREATMENT
PUMPS
FIRE WATER TANK
RAW WATER TANK
WASTE WATER EQ TANK
SEPTIC TANK
RAIL CAR UNLOADING RAPID DISCHARGE BOTTOM DUMP 4,000 TPH
S 76°05'10" W 4,090.57'
COAL UNLOADING
COAL HANDLING WATER STORAGE
RETENTION BASIN
ACTIVE STORAGE PILE 52,000 TONS INCLUDING 13,000 TONS LIVE STORAGE
LOCOMOTIVE FUELING AREA
BAD ORDER CARS
SPARE EMPTY CARS
OSBL STORMWATER COLLECTION DITCH
SECURITY FENCE
S 14°25'25" E 7,111.18'
ADMIN & OPERATIONS
METERING NATURAL GAS
PLANT ENTRANCE
NATURAL GAS PIPELINE
EXISTING ROAD FM 1801
UNDER PASS & ROAD BELOW RAILROAD BY TXDOT
N 56°54'04" E 4,337.56'
OSBL STORM WATER/POTENTIALLY CONTAMINATED RETENTION BASIN
PLANT NORTH COORDINATE SYSTEM
N. 10,000.00'
E. 5,000.00'
DATUM
TEXAS NORTH CENTRAL STATE PLANE
N. 10,602,740.90'
E. 1,591,813.34'

Block Flow Diagram



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- See also:
  - www.summitpower.com
  - www.texascleanenergyproject.com