Texas Clean Energy Project

Coal Gasification with 90% Carbon Capture & Sequestration

NEPA Public Scoping Meeting

June 17, 2010

Odessa College, Odessa, Texas

Snapshot of TCEP

- 400 MWe gross IGCC project with 90% carbon capture
- Siemens: 2 gasifiers & 1 high-H_2 CT + 1 ST in combined cycle

Snapshot of TCEP

- Located at FutureGen “finalist” site directly atop Permian Basin; nearby opportunities for CO_2 enhanced oil recovery (EOR)
- Pre-FEED design engineering, optimization, and cost refinement for past 3 years (Summit, Siemens)
- Commercial components proven; “integration” of “IGCC” with carbon capture and storage (CCS) is new -- a reference plant
- Siemens to warrant long-term performance & availability
- 90% carbon capture rate yields ≈ 2.9M tons of CO2/year

Summit Power Group

- Founded by Donald Paul Hodel & Earl Gjelde
- Summit's traditional business = develop plants for others
- Principal business lines currently:
  - Wind power projects (including White Creek & its financial model)
  - Solar power (our utility-scale PV solar JV w/ REC: NorthLight)
  - Natural gas-fired power plants, principally Siemens CCCTs
  - Gasification with carbon capture (TCEP, others)
- These projects are clean, low- or no-carbon, & aid security

Why Texas?

- Environmental groups sought IGCC alternative to conventional coal-fired power plants in Texas & asked Summit to take a look
- Texas has excellent market for captured CO_2
- Project would not depend on (1) climate legislation, or (2) new long CO2 pipeline
- Suitable sites can also be found for “stacked storage” of CO_2
- Ex-FutureGen site has prior review & local support
- Midland-Odessa officials sought private-sector replacement project for FutureGen

Project Site

Former FutureGen finalist site at Penwell

Located 15 miles west of Odessa, 0.5 miles north of I-20, at FM 1601, which borders the property

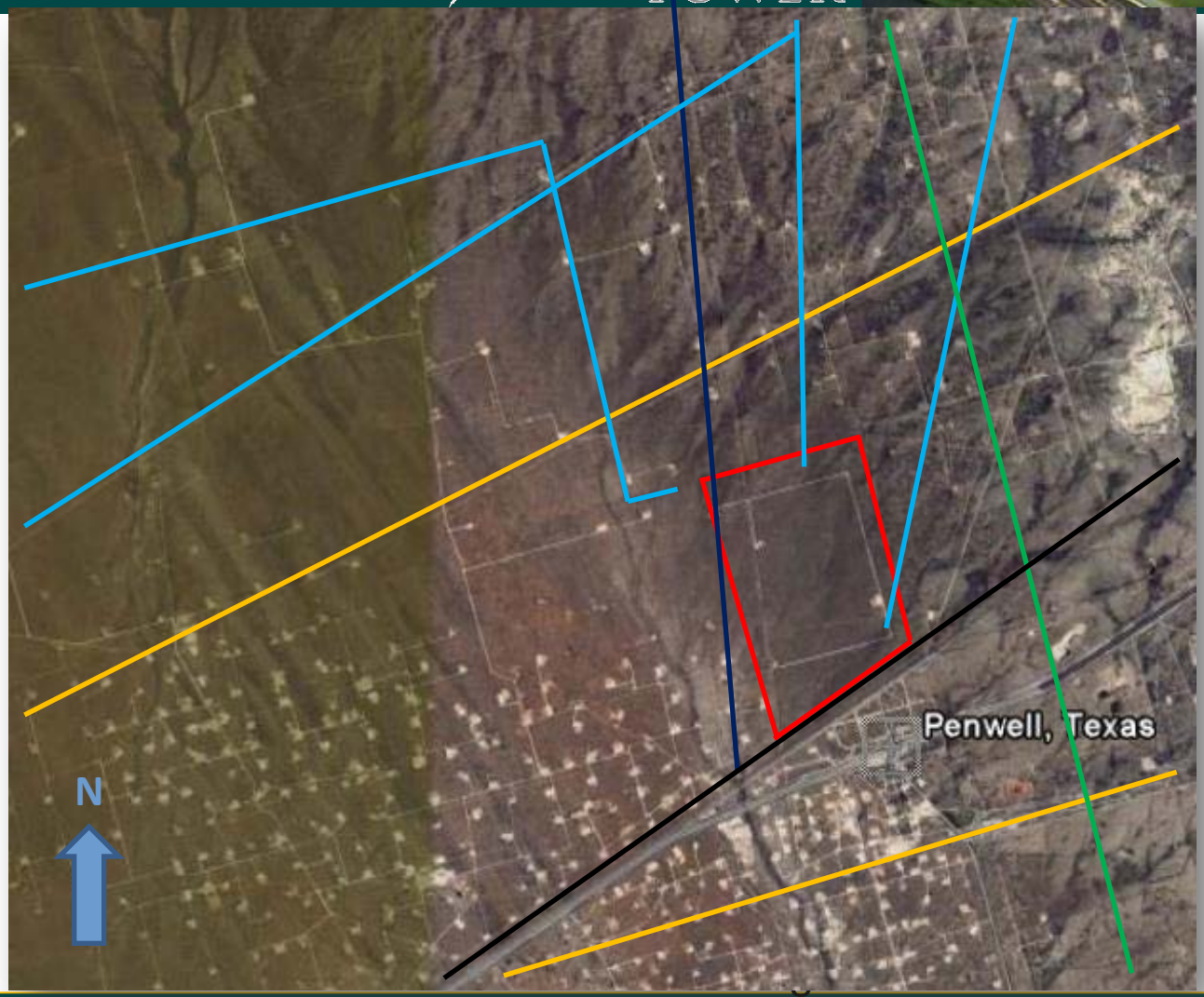
- 600 acres, flat land, stable geology
- Electricity transmission in vicinity of project is adequate
- Multiple water supply alternatives
  - zero liquid discharge
  - reduced water consumption: dry and wet cooling
- Natural gas: 2 nearby mainlines; 1 onsite small line
- CO_2 pipelines & EOR infrastructure exist nearby
- Railroad bordering site


Oneok Westex 24" Pip
866
West
Odessa
Moss S
Alt. Power
Transmission
Line #1A
Alt. Power
Transmission
Line #1B
Alt. Access
Rd. #1B
Proposed GCA to S
Alt. Water Supp
Project Site
8 kV Transmission
Existing 138 kV Transmission
Penwell
CO2 Pipeline
Alt. Access
Rd. #1A
Oxy Permian Pipeline
Alt. Water Supply Pipeline #2
20
Alt. Water Supply Pipe
Alt. Water

Project Location – Ector County

- Electric Transmission
- Natural Gas Pipeline
- Water Pipeline
- CO2 Pipeline
- Rail

(Note oil wells – many nearby oil fields are suited to CO2 EOR operations)



Design Basis

- "Polygen" IGCC design for multiple products:
  Electricity, CO_2, urea (fertilizer), sulfuric acid
- Powder River Basin (Cordero-Rojo) low-sulfur coal
- Natural gas for startup, backup & during maintenance
- Base load operation; includes some turn-down capability
- Warranted high availability of power block & gasifiers

Low Air Emissions

- NOx, SOx & PM far below lowest-yet limits permitted in Texas for fossil fuel power plants

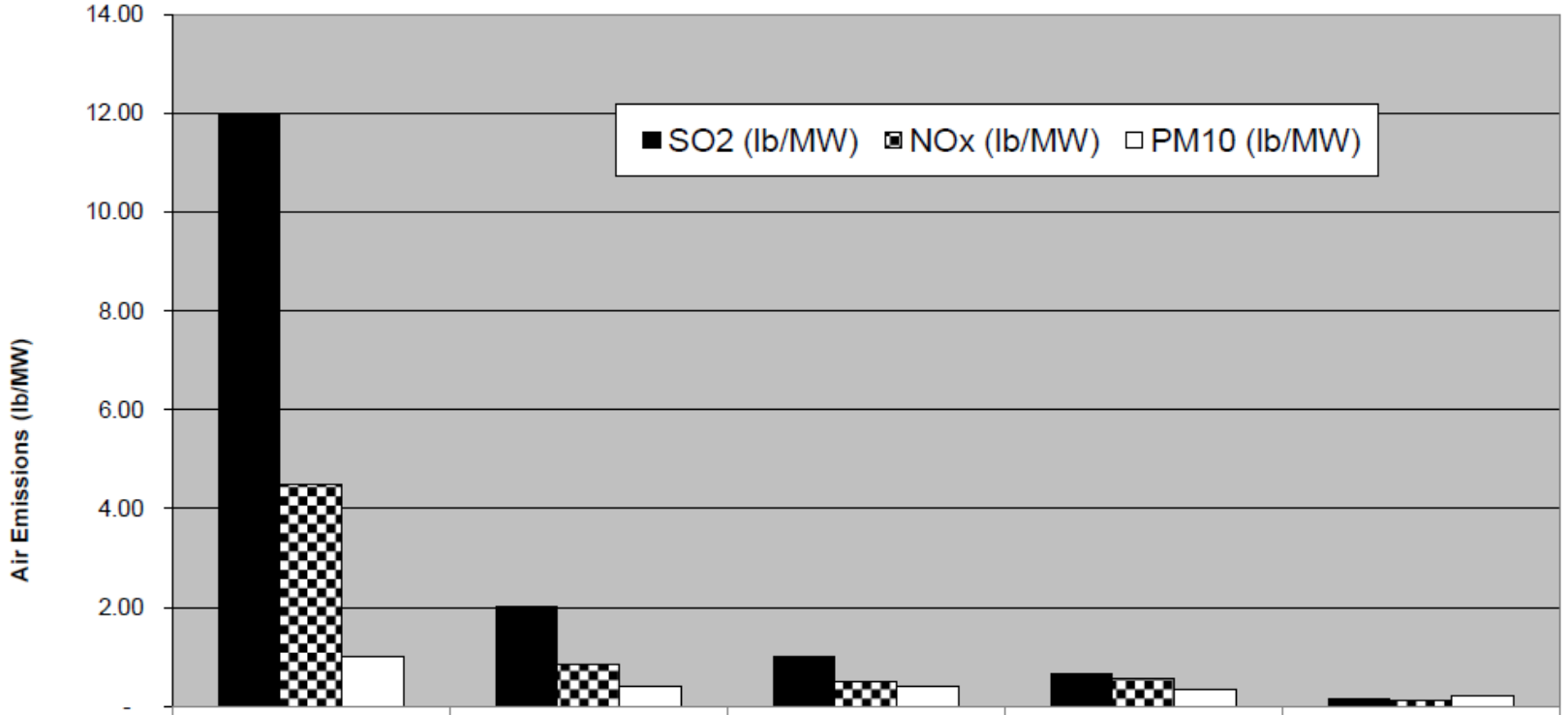
- Sulfur removal is 99% despite using low sulfur coal

- Mercury removal greater than 95%

- CO2 capture rate of 90%

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

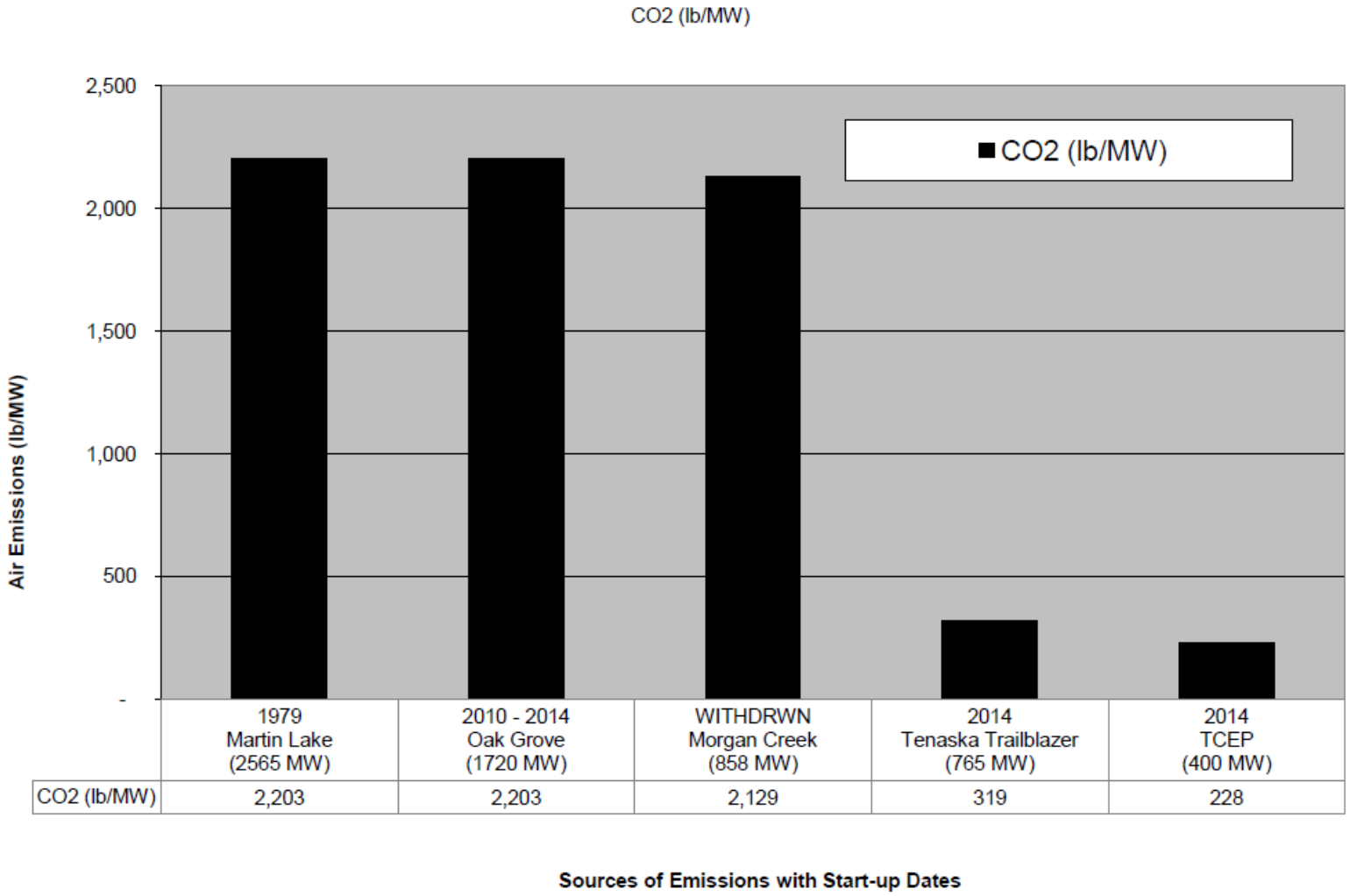
SO_2, NOx, PM10 Emissions



	1979 Martin Lake (2565 MW)	2010 - 2014 Oak Grove (1720 MW)	WITHDRWN Morgan Creek (858 MW)	2014 Tenaska Trailblazer (765 MW)	2014 TCEP (400 MW)
SO2 (lb/MW)	11.97	2.01	1.01	0.65	0.14
NOx (lb/MW)	4.49	0.84	0.50	0.55	0.13
PM10 (lb/MW)	1.00	0.42	0.40	0.35	0.22

Sources of Emissions with Start-up Dates

CO_2 Emissions



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CO2 (lb/MW)	2,203	2,203	2,129	319	228

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Texas Emissions Comparisons

Power Plant Emission Summary - Per MW Comparison

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Hg (lb/MW)	0.000214	0.000096	0.000021	0.000019	0.000007
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1. Permit limits for CO2 emissions are not required in the permitting process at this time.
2. Tenaska CO2 emissions are scaled from Morgan Creek and assume 85% capture.
3. Martin Lake CO2 emissions are scaled from Oak Grove.

CO_2 Management

- **Blue Source will manage most CO_2 matters**
  - Sale of CO2 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
  - 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

- **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)
- **CO_2 isn't the only EOR technique (oil <u>will</u> be extracted) – but it <u>is</u> the only EOR technique to sequester carbon**
- **CO_2/EOR is a bridge to other CCS in two key respects:**
  - Same infrastructure can be used for "stacked storage," cutting cost
  - Revenue helps make carbon capture projects like TCEP possible (without capture proven at scale, no large-scale CCS can occur)

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- See also:
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