Texas Clean Energy Project ("TCEP")

Pittsburgh Coal Conference Presentation
Project Update

Thursday October 18, 2012

Introduction to the Sponsor – Summit Power Group, LLC

Summit Power Group, LLC

Founded twenty-one years ago by former U.S. Secretary of Energy Donald Paul Hodel and Chief Operating Officer of the Department of Energy Earl Gjelde

- Headquartered in Seattle, Washington

Summit's traditional business is power project development for would-be project owners on a success fee basis:

- Over 7,000 MW of electric power plants in operation
- Over 2,000 MW in development or under construction
- Total Summit-led projects in service or under contract, including O&M agreements, represent over $7bn of investment

Summit's current principal business lines:

- High efficiency natural gas-fired power plants
- Carbon capture including from coal gasification
- Wind power projects
- Utility scale photovoltaic solar projects

Summit operates through three technology-specific divisions and subsidiaries:

i) Wind, solar, and other renewable resources

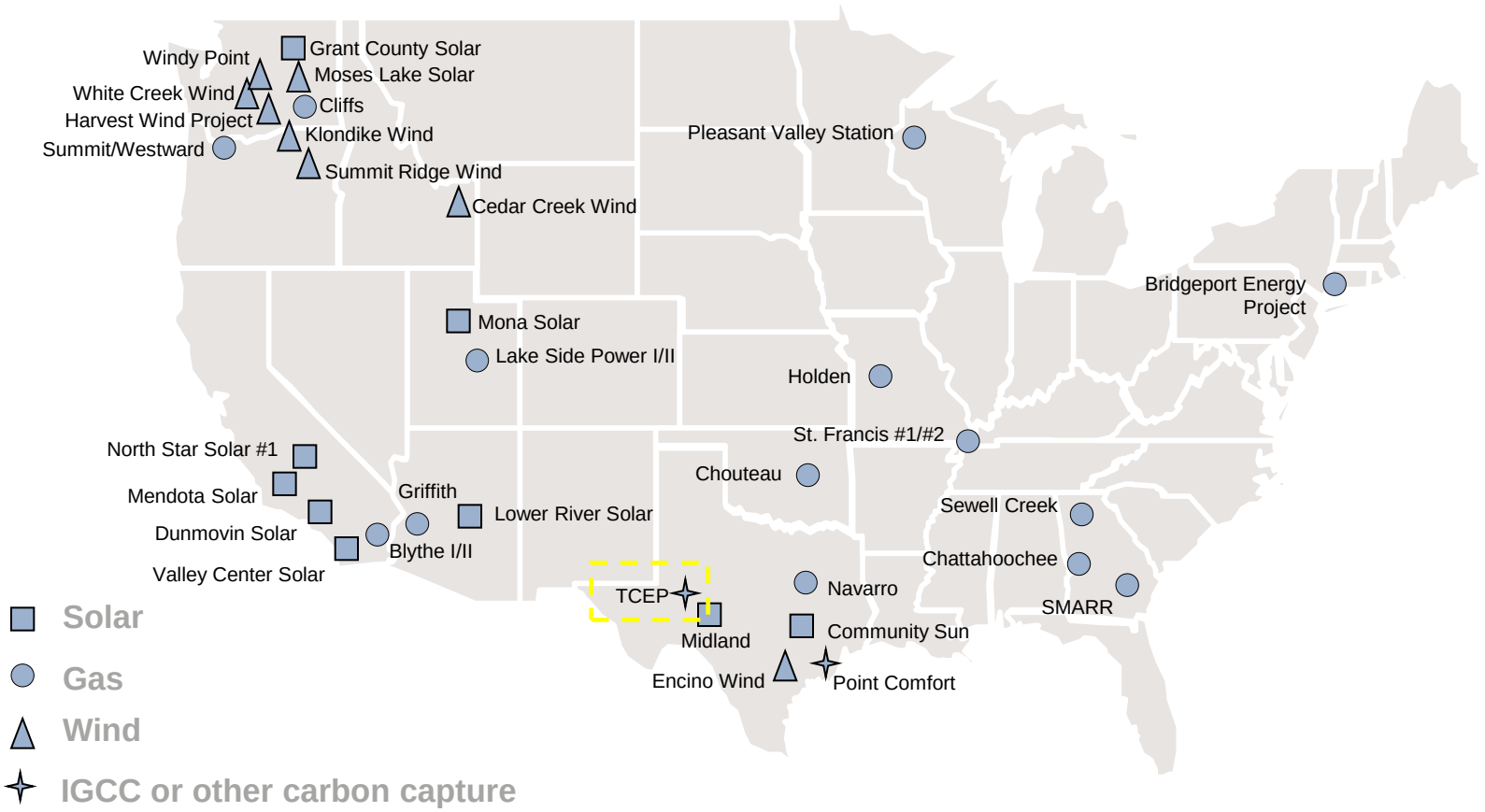
ii) Gas-fired power plants

iii) Carbon capture, including from coal gasification

- Each Summit project is led by the Summit principals and staffed by a deep bench of experienced full-time employees and specially-retained expert consultants

Summit projects in the United States

Summit Projects – Operating or in Development



Note: Map doesn't include Summit Fire Island wind plant located in Alaska

Introduction to the Project

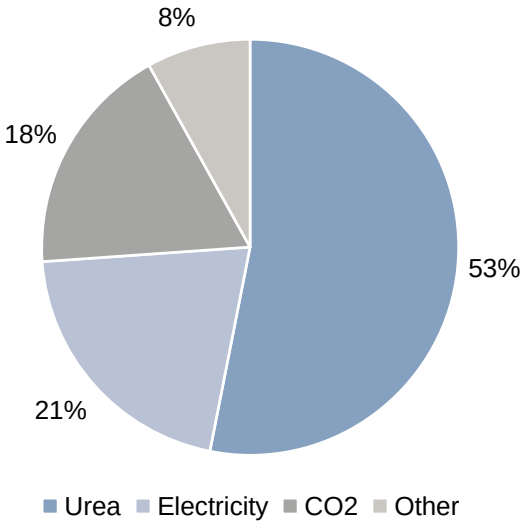
Project overview

Texas Clean Energy Project ("TCEP" or the "Project")

- An integrated gasification combined cycle ("IGCC") fertilizer and power plant sited in West Texas's Permian Basin
- Relies completely on technologies and components already proven in commercial operation
- Will integrate proven gasification and carbon capture technologies to achieve a carbon capture rate of 90%
- Will achieve state-of-the-art reduction in conventional pollutants such as Hg, NOx, SOx and particulate matter
- The Project utilizes every component of the coal and atmospheric air run through the plant to create revenues
- The Department of Energy granted TCEP a total of $450 million as a competitive cash award

- Produce the following commercial outputs (all of which are fully contracted):
  - **Urea Fertilizer**: expected to produce approximately 710,000 tons per year of granulated urea
  - **Electric power**: expected to be capable of producing approximately 400 MW of gross output, with power being consumed for plant use and onsite commercial loads, with the remainder sold to a municipal utility purchaser
  - **Carbon dioxide** ("CO2"): expected to capture 2.5 million tons of carbon dioxide annually to be sold for Enhanced Oil Recovery ("EOR") operations in the Permian Basin
  - **Other**: byproducts of the plant, including argon gas, sulfuric acid and slag

Revenue Split in 2020



Unique features of TCEP

Environmental support

- Summit went to Texas to develop TCEP at the request of national environmental groups
- Key motivation: 90+ percent CO_2 capture with sequestration
  - Resulting CO_2 emissions will be world's lowest for any commercial scale plant using fossil fuel
- Power block will be air-cooled, not water-cooled
- Water for gasifiers and urea will be from on-site desalinization
- TCEP itself will be a zero liquid discharge ("ZLD") facility
- Lowest air permit limits in the U.S. for SOx, NOx, particulates and mercury
- As a result, air permit was obtained in eight months; no one requested a hearing on the air permit (or any other permit)
- Commitment to establish an independent Carbon Management Advisory Board of top climate scientists and environmental group representatives is unique and important

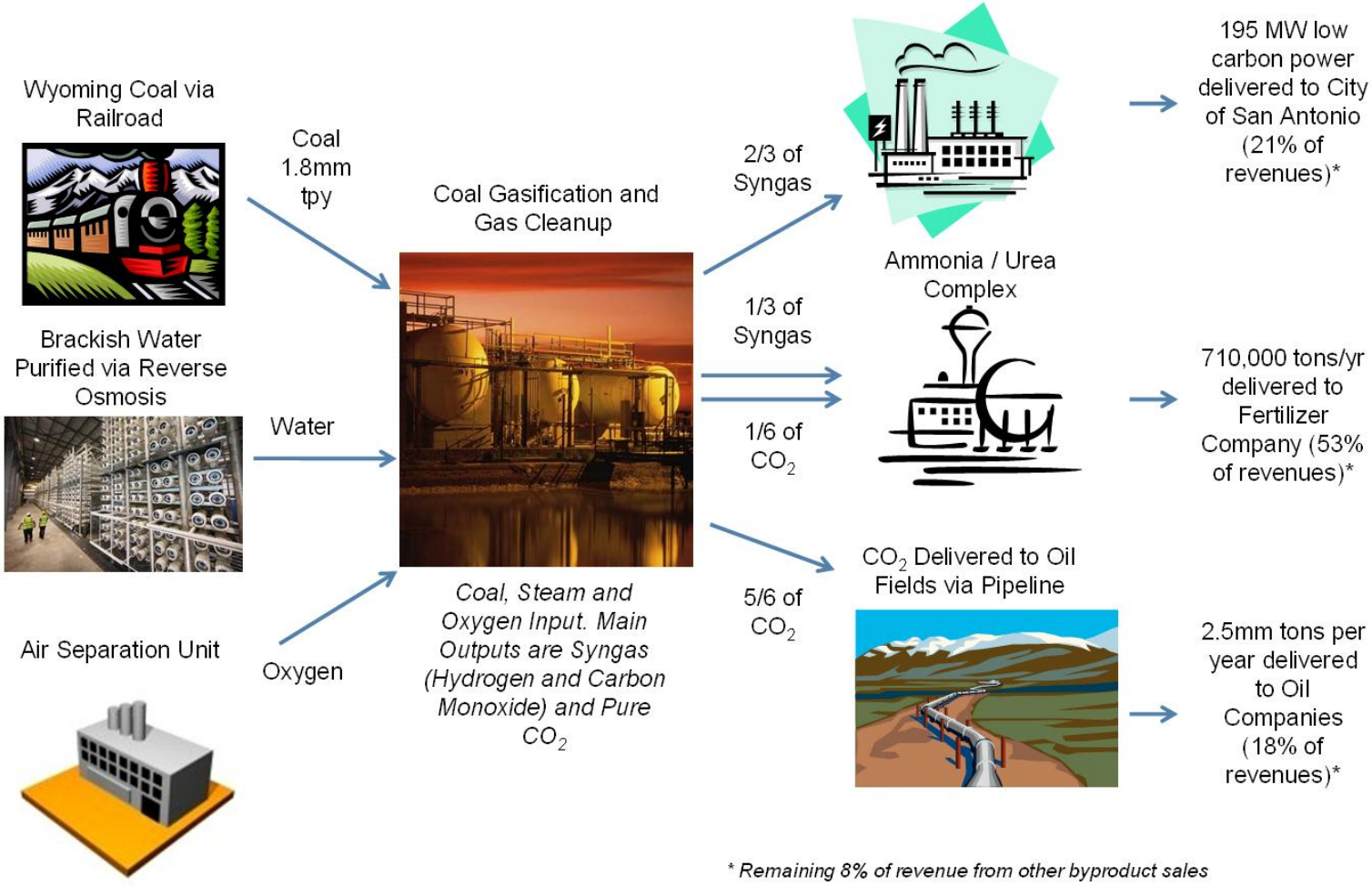
Unique features of TCEP … cont'd

Project finance discipline instead of "open checkbook"

- **"TCEP deserved government support because it was designed not to need it." – Ralph Carabetta, the then-head of U.S. Department of Energy's National Energy Technologies Laboratories**
- **What does this mean?**
  - Project intended from the outset to be financed in private capital markets
  - No experimental technology included – all is existing, proven and warranted (not quite "Soviet tractors bolted together," but nothing very novel either)
  - Integration of fully-warranted components is the only new project feature
  - High warranted level of availability is #1 priority, followed by efficiency
- **Three major revenue streams add revenue stability and reduce commodity risk**
  - Gasification plant is like a refinery; chemical transformation of the feedstock (and cleanup) before anything is burned
  - Even the slag is inert, non-leachable, vitrified: a commercial product for cement-making, road-building, etc.
- **Reference plant design means TCEP can be repeated and improved / scaled elsewhere**
  - This proved to be a valuable incentive for the suppliers / vendors / contractors
  - It turns out to be valuable for financing, too – TCEP is not just a "one-off" project
- **CO_2 is a profit center, not a cost to the project and is a key driver of returns**
  - Sales of both CO_2 and VERs (carbon credits) are highly valuable and important to financial performance
- **For urea, TCEP is superior to natural gas-based urea plants**
  - Buyer signed long-term take-or-pay contract because TCEP's urea is priced at a discount to market – and no buyer's capital at risk
  - This is also extremely low-carbon urea (lowest carbon possible, in fact) – most ammonia plants have massive CO_2 emissions
  - Profitability for new natural gas-based ammonia urea plants without CO_2 capture is expected to be low (some studies show negative ROI) – and such plants face major environmental pressure from EPA and activists

TCEP conceptual schematic

TCEP Conceptual Schematic



** Remaining 8% of revenue from other byproduct sales*

Recent project history

2005

TCEP began in 2005 as a joint Siemens-Summit concept

2007

Siemens acquired Sustec gasification technology in 2007

Siemens and Summit worked together on TCEP and a proposed twin in Montana

2008

Penwell site selected after it was fully vetted as finalist site for the FutureGen project. Site benefits include excellent logistical advantages, access to the Permian Basin CO_2 market and the fact that a full environmental impact study had been completed for FutureGen

2009

Received $450mm CCPI 3 Grant in 2009, which was implemented in early 2010

2010

Advanced Coal Program investment tax credit ("ITC") awarded in April 2010

FEED study competitively bid with scope defined and released to Siemens, Fluor, and Linde in June 2010

December 2010, TCEP received an uncontested air permit, with an uncontested EIS and Record of Decision under NEPA following in the fall of 2011 (building on earlier Futuregen full environmental impact study)

2011

Final FEED deliverables completed in July 2011

2nd half 2011 completed negotiations with all offtakers and executed O&M agreement with Linde / Siemens

Current EPC contract structure agreed and final contracts executed in December 2011 with Linde / SK E&C on chemical block EPC and Siemens on power block EPC. New EPC contract with Sinopec Engineering Group.

2012

Anticipated close of financing and start of construction

Key development tasks other than financing are complete

Site acquired ☑

Permitting ☑

- Record of Decision from US DOE on 9/29/10 (completes NEPA / EIS process)
- Air permit issued 12/28/10 (no greenhouse gas emissions limits)

FEED study ☑

Water rights ☑

- Secured water rights to a non-potable water supply in the Oxy-Permian Capital Reef from Massey Ranch

Offtake agreements ☑

- 100% of power sold to CPS Energy for 25 years (deal signed)
- 100% of CO_2 sold for 30 years (three different buyers; market very strong)
- 100% of urea sold for 15 years (buyer is a blue chip fertilizer / chemical company)

EPC contracts ☑

- Siemens, Linde, and SK E&C (Korean conglomerate) are the EPC contractors
  - Siemens EPC for power block
  - Linde EPC for chemical block
  - New EPC contract with Sinopec Engineering Group
- Lump-sum, fixed-price, turnkey EPC contracts for $2.21bn

O&M agreement ☑

- Provides 15-year warranties for project performance, including efficiency, reliability, availability, and pollution control
- Design review, pre-operations, commissioning and 15 year operations and maintenance agreement executed
- Joint venture planned for full plant operations by Linde and Siemens

Technology and Configuration

Gasification plants typically have four major subcomponents

Linde Air Separation Unit

Source: Linde

Siemens Gasifiers (SFG-500)

Source: Summit Power Group

Linde RECTISOL® Unit

Source: Linde

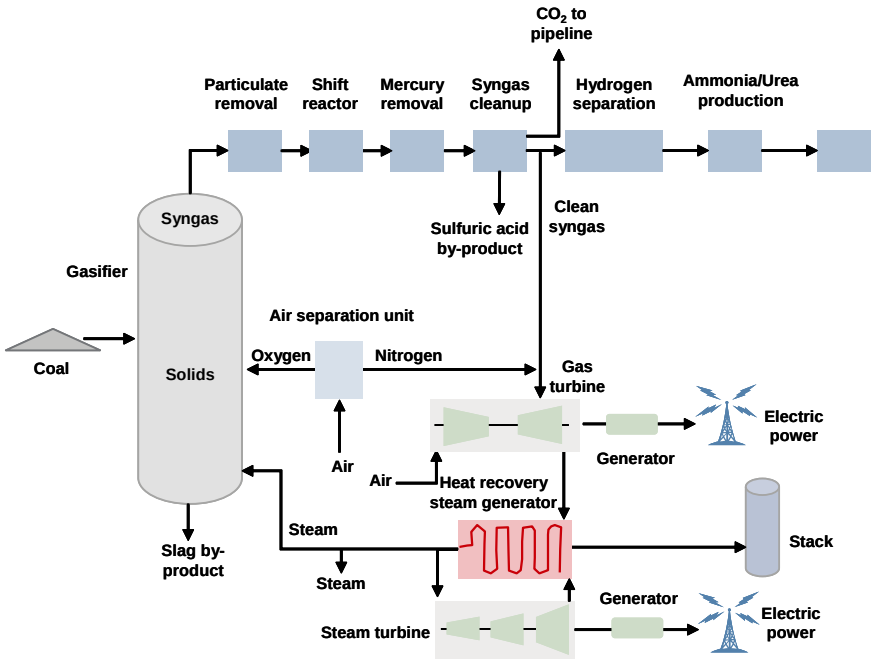
Ammonia Facility

Source: Linde

Gasification plants typically have four major subcomponents

- Air Separation Unit (needs pure oxygen for controlled gasification in most technologies) – typical providers Linde, AirLiquide, Air Products, etc.
  - Linde air separation technology is mature and widely used for commercial production of pure gas from air
- Gasifiers to gasify coal or pet coke – typical providers Siemens, ConocoPhillips, Mitsubishi Heavy, GE, Shell
  - Siemens gasification technology used in TCEP was proven in Germany before Siemens bought the technology and scaled it up to SFG 500 units
  - These have had numerous sales in the U.S. and China, and five such gasifiers are already operating in China
- Syngas cleanup (take H_2S and CO_2 out of gas stream to concentrate high BTU syngas) – typical providers Linde or AirLiquide (Rectisol ®), UOP Selexol
  - Linde Rectisol® gas cleanup process that removes acid gases like sulfur dioxide and captures the carbon dioxide has been deployed and used internationally for decades
- Inside the fence end user of syngas
  - Ammonia / urea processes are existing, licensed integrated technologies provided by third party expert vendors (Tecnimont and Ammonia Casale)
  - Dual-fueled workhorse Siemens F-class combustion turbine matched with a steam turbine in combined cycle operation, identical to a natural gas combined cycle power island with certain modifications, including special combustion turbine fuel nozzles, and burners

TCEP Process Flow

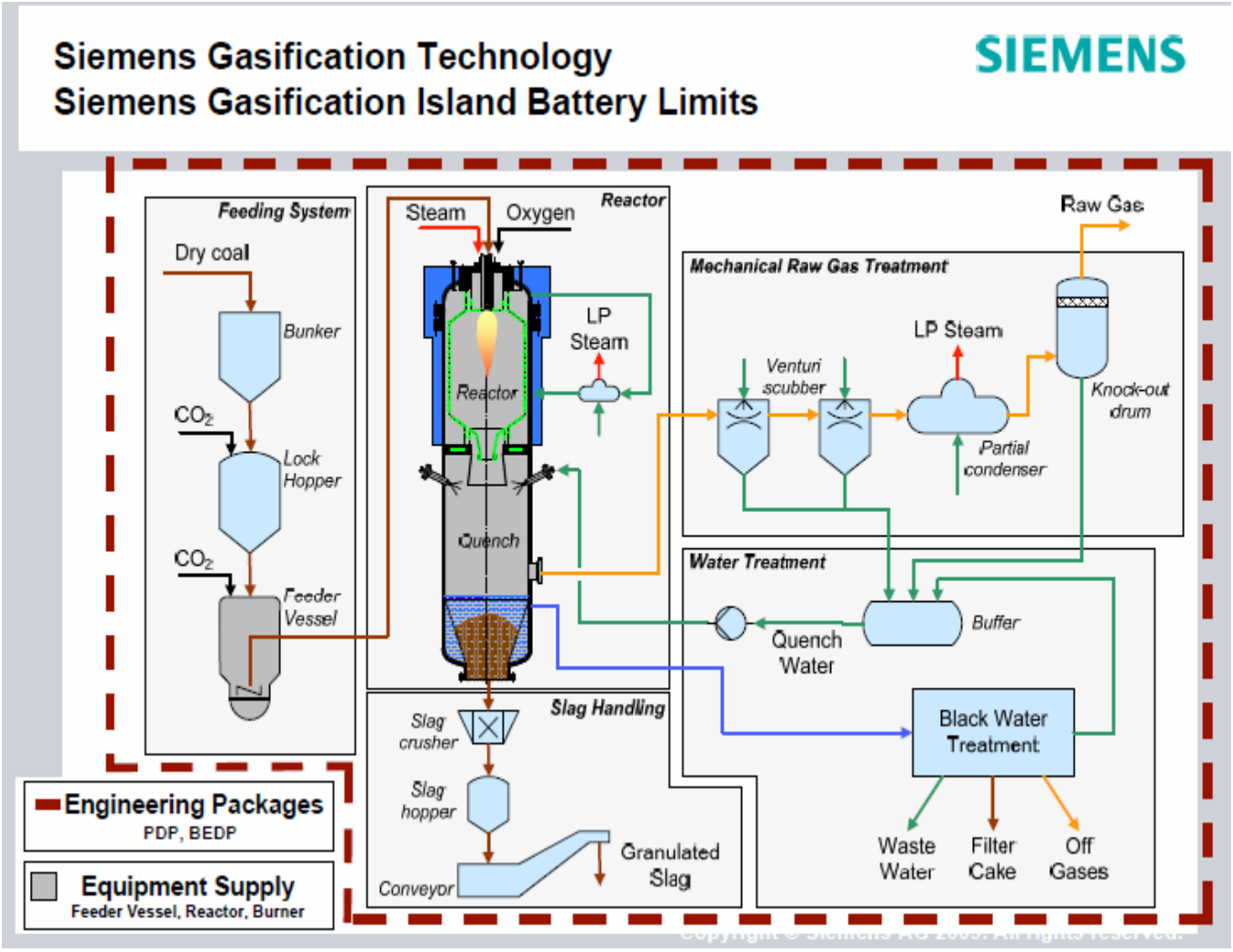


Proven technologies

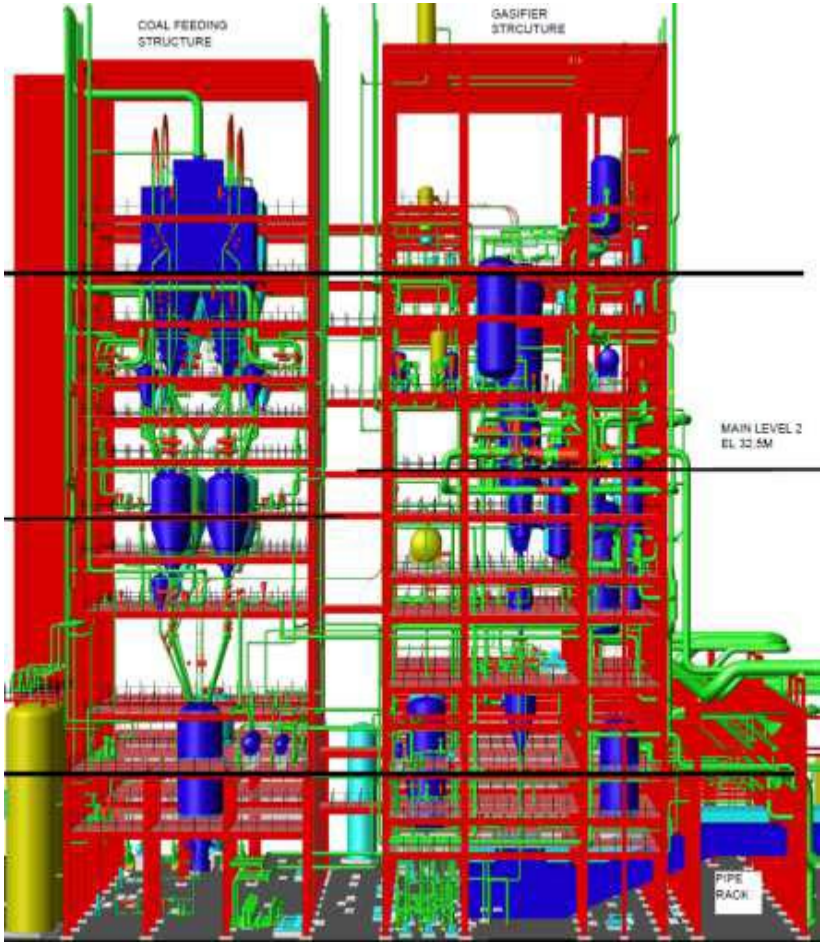
- Each individual technology has been in operation and proven in other installations across the world
- TCEP will rely on similar if not identical individual components in the TCEP configuration
- Integration and fuel supply for designed fuel have been the challenges in the past; TCEP will manage and mitigate those risks through a comprehensive and favorable EPC contract to the project with a strong EPC consortium as a counterparty

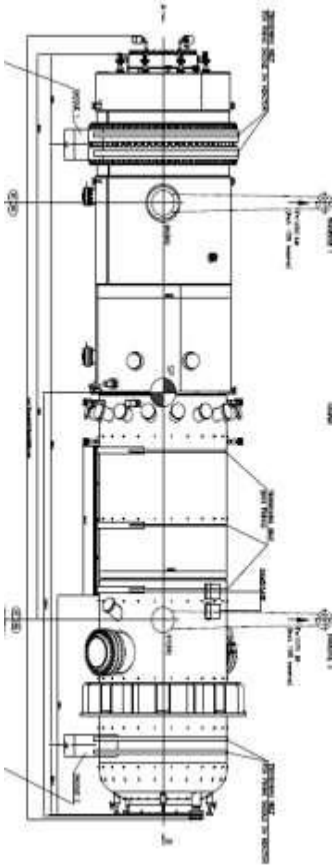
Plant	Status	ASU	Gasifiers	Syngas Cleanup	Use of Syngas
Shenhua Ningxia (one of 22 Shenhua gasification plants), China	Operating since 2011	Air Liquide	**5 Siemens SFG-500 using coal**	Air Liquide Rectisol	Methanol polypropylene
Coffeyville Fertilizer Plant, Oklahoma, USA	Operating since 2000	**Linde**	Dual train Chevron-Texaco pet-coke gasifiers	UOP Selexol	Ammonia, then upgraded to UAN
POSCO Gwangyang SNG Project, South Korea	COD 2014	Air Liquide	ConocoPhillips using sub-bituminous coal	**Linde Rectisol**	500 KTA of SNG
Southern Company Kemper IGCC	COD 2014	N/A	2 Transport Reactor Integrated Gasifiers (TRIG™)	UOP Selexol	524MW power (**Siemens 2 x SGT6-5000F**)

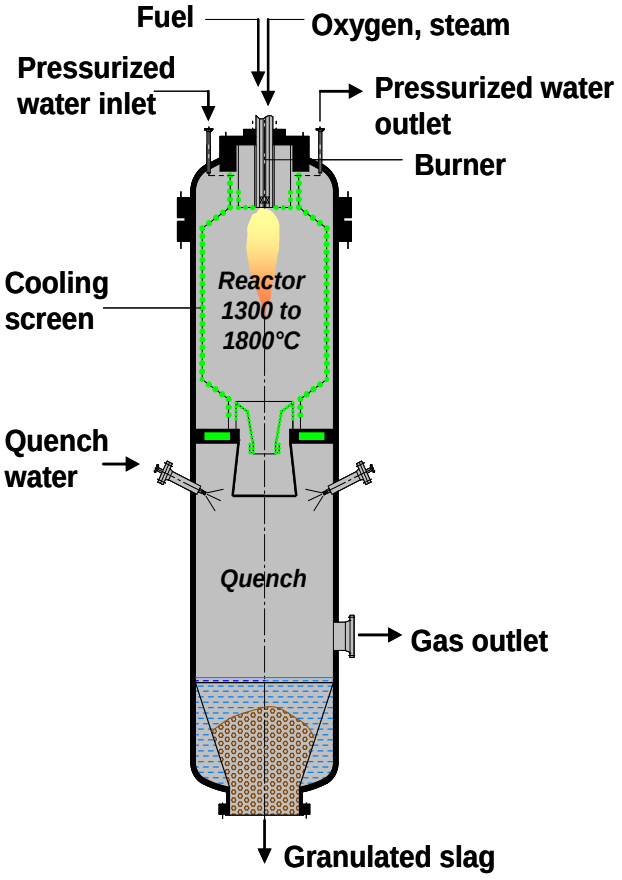
Gasification Island



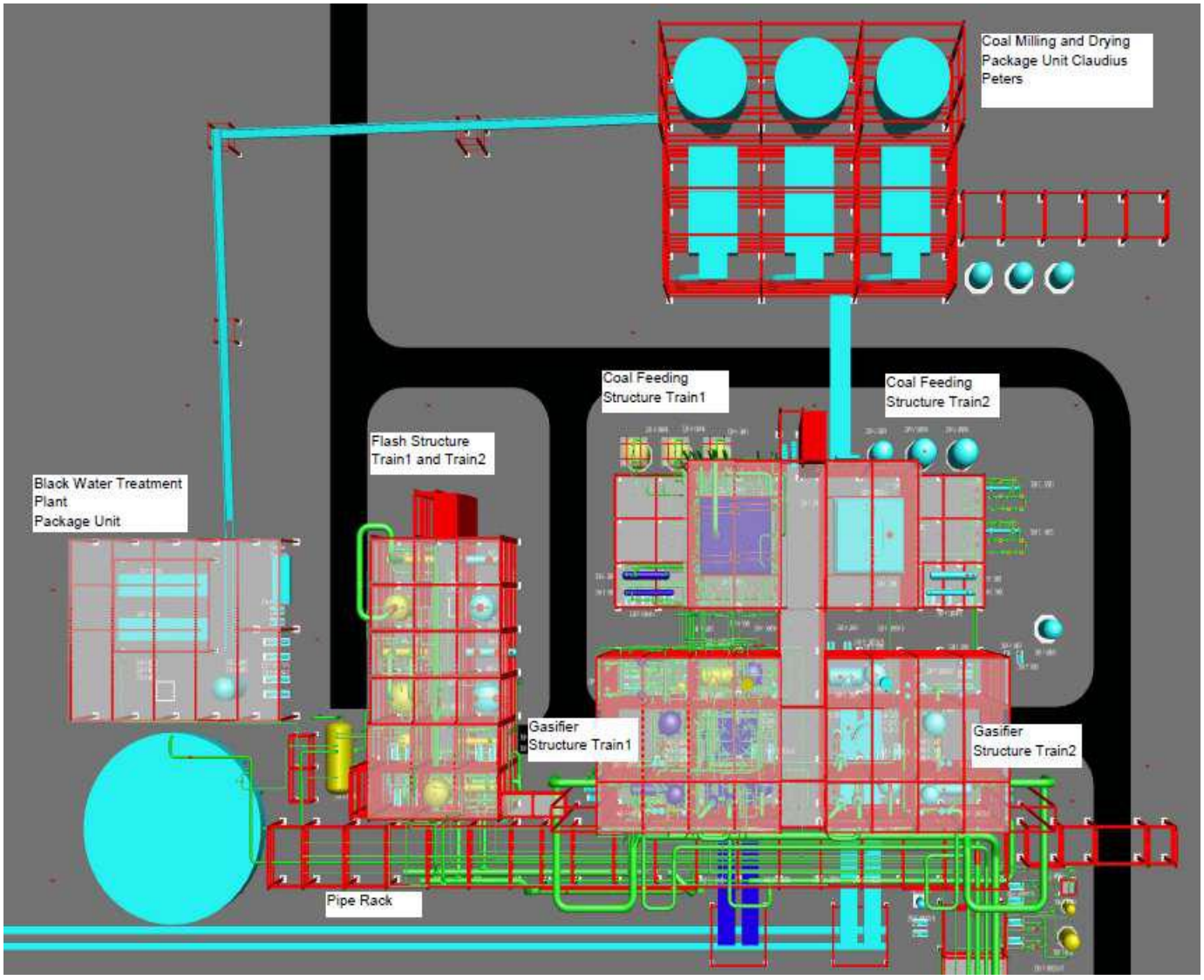
Gasifiers


COAL FEEDING STRUCTURE
GASIFIER STRUCTURE
MAIN LEVEL 2 EL 32.5M
PIPE RACK




Fuel
Oxygen, steam
Pressurized water inlet
Pressurized water outlet
Burner
Cooling screen
Reactor 1300 to 1800°C
Quench water
Quench
Gas outlet
Granulated slag

Coal Handling and Gasification Island



Access to near-limitless supply of on-spec coal

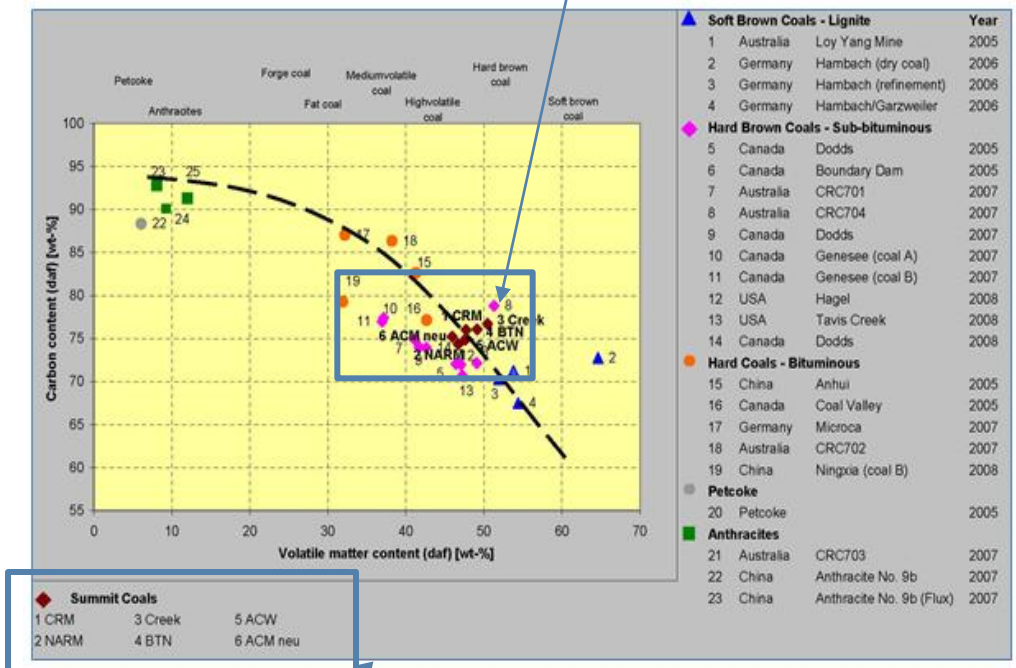
Using the exact PRB coal run (Cordero Rojo) for which the plant is designed will enhance the availability/reliability for this project; but uniform coals from multiple sources limits that mine owner's bargaining power.

- Plant designed for Powder River Basin ("PRB") coal from Cloud Peak's Cordero Rojo mines with annual demand of ~2mm tons
  - Use of Cordero Rojo coal, the intended fuel source for the plant, results in greater reliability and enhanced operations of the plant
  - Also examined North Antelope /Rochelle, Coal Creek Mine, Black Thunder Mine, Alpha Coal West, Caballo Mine.
- Gasifer warranted by Siemens to operate on any PRB coal

"TCEP's coal gasifier supplier – Siemens Energy – has determined those coals from the sources listed [see box to right] are suitable for their gasification technology. Coal from these sources is typical of the PRB – a high moisture, low ash, low sulfur, sub-bituminous product that is relatively consistent both among the mines and throughout the future resource base."

-JT Boyd, Feb. 15, 2012, page 4

Gasifiers have been tested on a range of coals. Warranted on any PRB coal

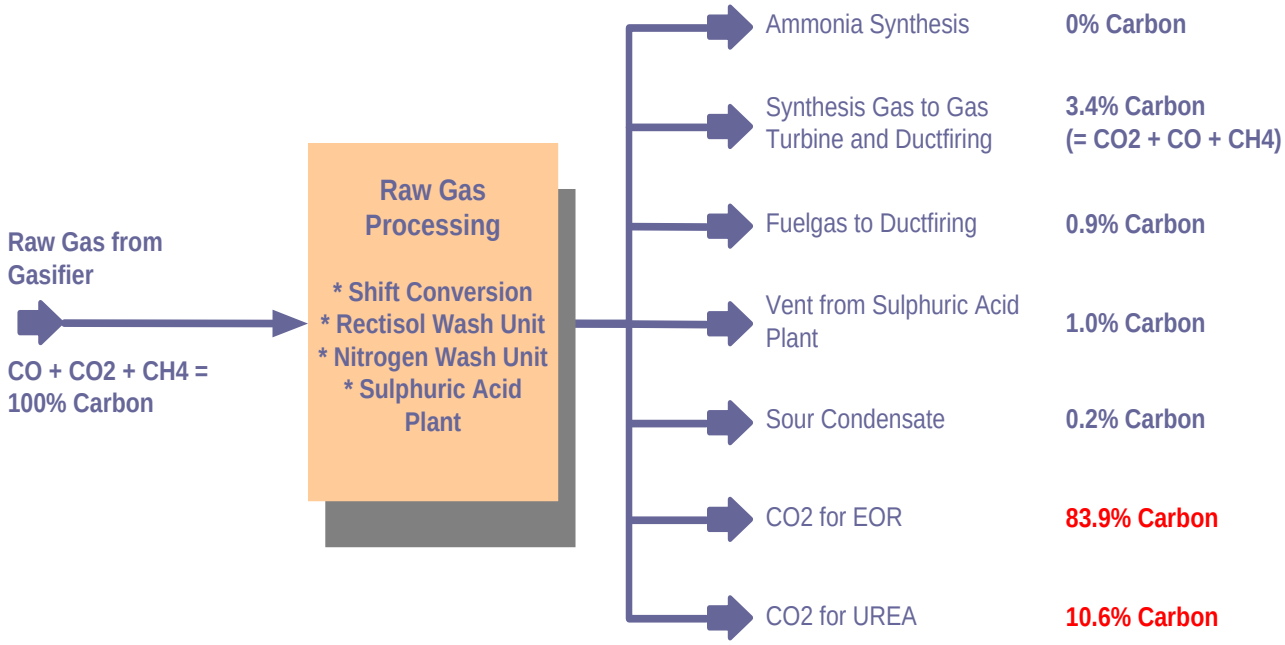


Six PRB coals analyzed, all work, all virtually indistinguishable

Gas Processing and Carbon Capture

Rectisol Wash Unit

- **Proven design by Linde with more than 50 operating units**
- **Designed for 90% carbon capture, on the basis of total carbon captured/total carbon in (coal, natural gas)**
- **Offgas used for coal drying, further reducing carbon input to the plant**



Ammonia and Urea Plants

Ammonia Processing Unit

- **Provided under license agreement with Ammonia Casale and Linde.**
- **Proven design using the Haber Process for ammonia production.**
- **The process begins with hydrogen compression, cooling, mixing with nitrogen and recycled, the gas then sent to the synthesis unit.**
- **Hot syngas is fed through an iron-based catalyst, cooled, and then separated. Liquid ammonia is collected at the bottom of the separator, and sent to the refrigeration section.**
- **Liquid ammonia is cooled, and separated, recycling ammonia vapor back into the process.**
- **Cooled ammonia is stored at low temperature in a pressurized storage tank.**

Urea Synthesis and Granulation Units

- **Provided under license agreement with Technimont/Stamicarbon and Linde.**
- **Proven design using the Bosch Meisner Process for urea production.**
- **The process begins with compressed CO2 combining with liquid ammonia.**
- **Urea solution is expanded and fed to a vertical film-type reactor and heated, releasing ammonia, CO2 and water.**
- **Urea solution is further expanded in a vacuum flash vessel removing dissolved ammonia, CO2 and water. The resulting solution is sent to a storage tank.**
- **The urea solution is combined with recycled steam and concentrated by evaporating water.**
- **The concentrated solution is sprayed into a fluid bed of growing particles in a granulator bed.**
- **Fluidization air control particle size. Upon reaching required size, the particles fall through a bottom grid for cooling.**
- **Cooled urea is conveyed to storage domes.**

Power Block

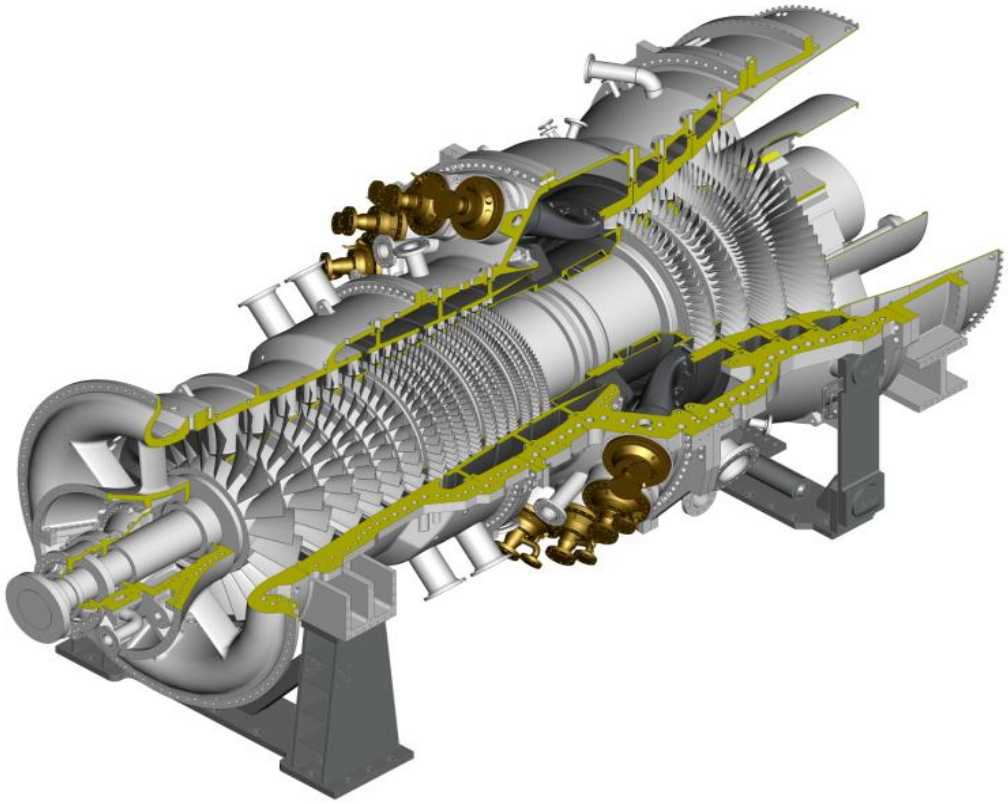


Diagram of Siemens STG6-PAC 5000F Combustion Turbine.
Courtesy of Siemens Energy, Inc. © 2011. All Rights Reserved.

Power Block

Overview

- **TCEP facility's power block centers on the proven Siemens combined cycle reference plant design used in conventional natural gas combined cycle plants, with certain modifications.**
  - **One Siemens SGT6-5000F gas turbine generator configured to utilize syngas,**
  - **One heat recovery steam generator (HSRG),**
  - **One reheat steam turbine generator**
- **Certain modifications to account for the IGCC application. These include larger gas turbine generators to accommodate the increased gas turbine output on syngas, a slightly larger steam turbine generator and a modified HRSG to better integrate with the gasification island.**

Combustion Turbine

- **Siemens modified the standard SGT6-5000F gas turbine to accept preheated syngas as the primary fuel (with natural gas as the back up fuel). Dilution nitrogen and steam aid the syngas combustion system in meeting the gas turbine emissions targets. A larger than standard generator for the combustion turbine accommodates the increased gas turbine generator output when operating with syngas.**

HRSG and Duct Firing

- **The HRSG provides superheating of the high-pressure (HP) steam and reheating of intermediate-pressure (IP) steam.**
- **The ST-G is also equipped with duct firing, which can add up to 60MW to the output of the STG if fired with either syngas or natural gas, at the plant's option. If market power is cheaper, the duct firing can be turned off**

Steam Turbine Generator and Duct Firing

- **The steam turbine generator (ST-G) is a Siemens ST-G comprised of an HP turbine and a combined IP and low-pressure (LP) turbine and totally enclosed, water-to-air cooled (TEWAC) generator**

History of Siemens' larger combustion turbines using syngas fuel & diffusion flame combustion

Customer / plant (location)	Electrical output (net)	Gas turbine	Main plant features	Key syngas combustion turbine features	Start-up
DOW Chemicals (Plaquemine, USA)	208 MW[1]	2 x SGT6-3000E	CC plant with integrated DOW coal gasification	85,000 operating hours on "can annular" syngas combustion configuration using diffusion flame combustion; dual fuel	1987
Nuon Power Buggenum (Buggenum, Netherlands)	253 MW	1 x SGT5-2000E	CC plant with integrated SHELL coal gasification (hard coal and biomass blend)	Used "silo" syngas combustion configuration, with diffusion flame combustion; dual fuel	1993[2] 1994/95
ELCOGAS (Puertollano, Spain)	300 MW	1 x V94.3	CC plant with integrated PRENFLO coal gasification (coal and petroleum coke blend)	Uses "silo" syngas combustion configuration, with diffusion flame combustion at F class conditions; dual fuel	1996[2] 1997/98
ISAB Energy (Priolo Gargallo, Italy)	521 MW	2 x SGT5-2000E(LC)	CC plant with integrated TEXACO heavy-oil gasification (asphalt)	Same as Buggenum but engine has modified compressor; dual fuel	1998[3] 1999
ELETTRA GLT (Servola, Italy)	180 MW	1 x SGT5-2000E(LC)	CC plant with steel-making recovery gas	Same as Buggenum but engine has modified compressor	2000
EniPower (Sannazzaro, Italy)	250 MW	1 x SGT5-2000E(LC)	CC plant fuelled with syngas from SHELL heavy-oil gasification	Same as Buggenum but engine has modified compressor	2006
Huaneng Tianjin IGCC Green Coal Power (Tianjing, China)	250 MW	1 x SGT5-2000E	CC plant with integrated TPRI gasification (coal)	Will use "silo" syngas combustion configuration, with diffusion flame combustion—same as Buggenum	2011
Mississippi Power Kemper IGCC Project (MS, USA)	582 MW	2 x SGT6-5000F	IGCC plant with TRIG gasifier and ~ 65% CO_2 capture High H2 syngas and air extraction (coal)	Same as TCEP – F Class Turbine using can annular system first proved at Dow Plaquemine, as re-tested	2014
Summit Power, Texas Clean Energy Project (Texas, USA)	400 MW duct firing	1 x SGT6-5000F	IGCC plant with co-production of UREA and 90% CO_2 capture with SIEMENS gasification (coal)	-	2015
EPCOR, Genesee IGCC Facility (Edmonton, Alberta, Canada)	270 MW	1 x SGT6-5000F	IGCC plant with carbon capture and SIEMENS gasification (coal)	Same as TCEP	TBD

1) 160 MW from syngas and 48 MW from natural gas—machine originally named W501D5; 2) Natural gas firing; 3) Oil firing;
SGT5-2000E = V94.2 (old name); V94.2K= SGT5-2000E(LC) (old name) => engine with modified compressor

The turbine in its configuration for TCEP is relatively new, but is the successor to existing technologies which have a proven track record and will be managed by the same team of experts

TCEP - Fuel/Water Supply

Coal Procurement

- **Plant designed for Powder River Basin ("PRB") coal with annual demand of ~2 million tons**
- **Powder River Basin is estimated to have ~640 billion tons or 100 years of reserves at current production levels.**
- **Commercial negotiations with PRB mining companies (Peabody, Arch, Cloud Peak, Alpha Natural Resources) have occurred**
- **Low risk: mine mouth coal price is approximately 10% of total revenue**

Coal Transportation / Handling

- **Served by Union Pacific on the site's southern border – UP has agreed to provide long-term transportation contract**
- **At full load, TCEP would consume ~5,800 tons per day of PRB**
- **Single coal receiving, storage and handling system would feed both coal gasification trains**

Natural Gas (startup, backup & during maintenance)

- **ONEOK's West Texas line is less than 4 miles away**
- **Facilities Agreement with ONEOK (under which ONEOK will build, own, operate, and maintain a gas lateral).**

Water Supply

- **Water supply from Capitan Reef not used for agriculture or domestic purposes**

TCEP - Operational Flexibility and Redundancy

Multiple Modes of Operation

- Combined Cycle Power Block capable to run on natural gas, syngas and a blend of both
- Duel-fuel duct burners offer power increase of 60MW with natural gas or syngas
- Chemical island operation without the power block possible by importing power, syngas aux boiler for steam seals
- Single gasifier operation, maintaining full urea production, and blended power block operation

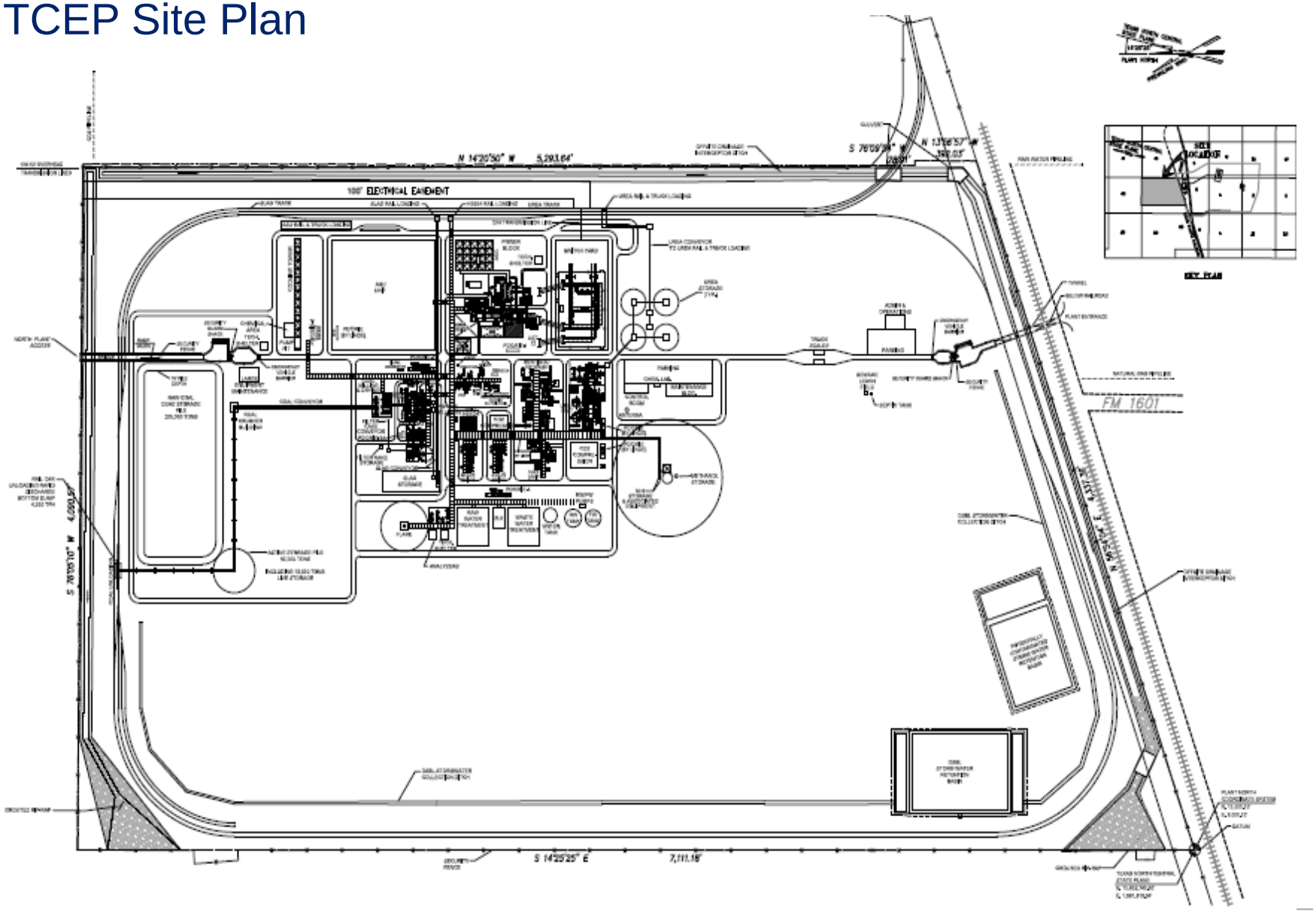
Redundant Systems = High Availability

- 3 x 50% coal milling and drying
- 2 gasifiers serving the power and chemical block
- 2 x 100% sour water stripper
- 2 x 50% sulfuric acid plants negate total plant shutdown in case of single acid unit outage.
- LOX and LIN storage maintain O2 and N2 supply in case of forced outage.
- Ammonia storage tank maintains urea production in case of ammonia system outage

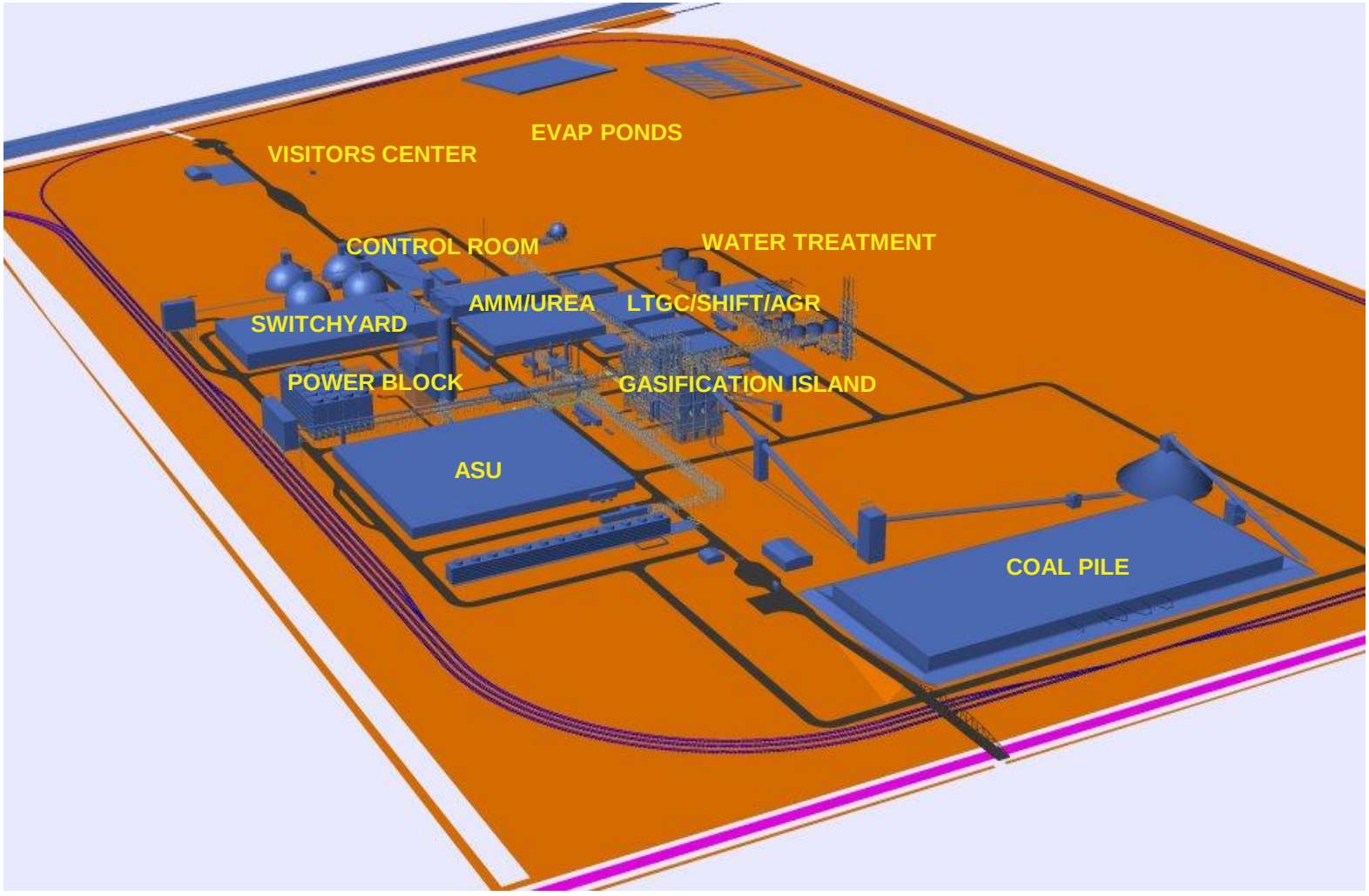
Expected Availability

- Urea priority > 92% AF
- Power priority > 92% AF (natural gas), > 90% AF (syngas)
- CO2 priority > 88% AF

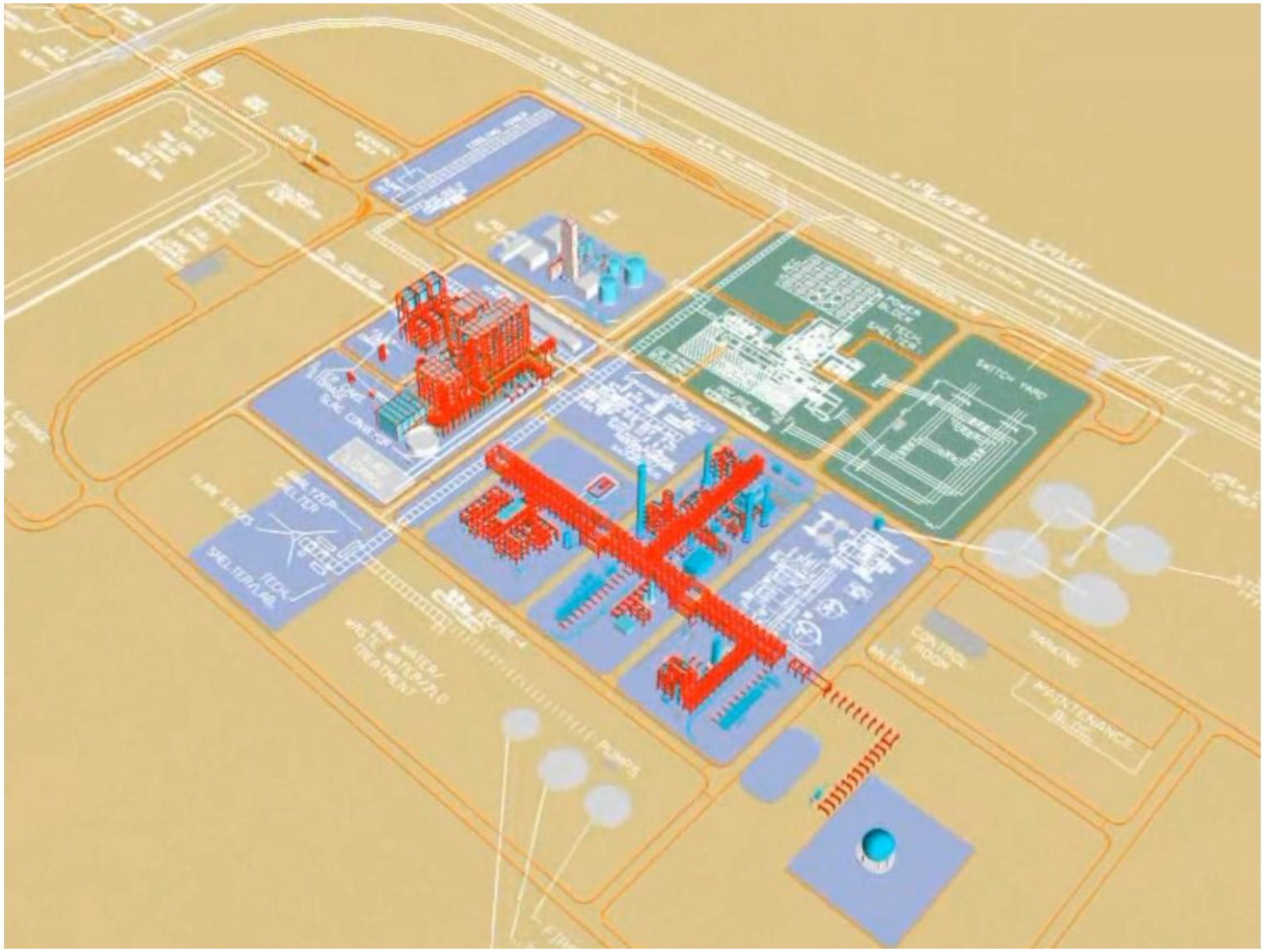
TCEP Site Plan



Plant Rendering



Plant 3-D Model



Construction and Turnkey EPC Contracts

Risk mitigation for TCEP plant construction and operation

Fixed price, lump sum turnkey ("LSTK") EPC contracts with two industrial giants

Plant configuration, components selection, design and commercial deal terms are all structured to support risk mitigation for the owner

- Highly respected EPC contractors (Siemens, Sinopec, Linde, SK)
- Integration of proven technologies with facility performance and schedule warranties, both EPC and long-term O&M
- Single 15-year O&M contract structured to include joint venture operation by Siemens and Linde

Warranties at commercial operation

- Capital cost
  - Power and Chemical Block, firm, fixed price EPC
- Completion, unlimited must fix requirement
- Schedule (provisional acceptance / COD and tuning period before Final Acceptance)
- Capacity (power output, CO_2 capture, fertilizer production, argon)
- Heat rate (fuel conversion efficiency)
- Emissions – satisfy low permit requirements

O&M agreement warranties

- Cost and performance (excludes some variable costs)
- Annual availability, performance and reliability of entire project and the outputs from project

Contractor direct investment

- EPC contractors will invest equity

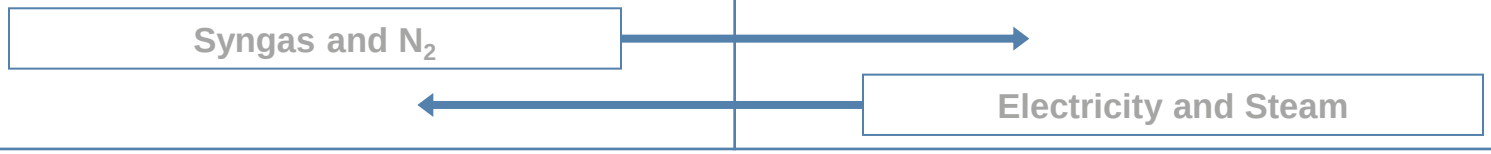
Key project participants have clearly defined roles and responsibilities

- Owners' scope of work is quite limited and focused around providing support infrastructure to the project
- The Project is governed by two distinct and separate EPC arrangements with clearly defined roles and responsibilities
- Physical interconnection between the Chemical and Power Block very well defined
- Performance testing has been designed to mitigate integration risk by measuring combined facility performance

Owner's Scope; Project Manager - CH2M Hill

- Raw water pipeline
- Natural gas interconnect
- Power interconnect
- CO_2 interconnect

Chemical Block – Sinopec	Power Block – Siemens
• Rail loop • Reverse osmosis for water • Gasification • Gas cleanup • CO_2 • Ammonia • Urea	• Syngas dilution equipment • Combustion turbine • HRSG with duct firing • Dry cooling systems



Questions?

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See also:
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www.texascleanenergyproject.com