Southern Company's Views on Advanced Coal Technology

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February 8, 2007

Advanced Coal Technology

- Supercritical and ultrasupercritical pulverized coal
- Integrated gasification combined cycle (IGCC)
- Oxy-fueled combustion

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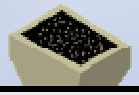
IGCC: Innovative Technology



Coal, Water and Oxygen

Advantages of IGCC

- Provides a **fuel price hedge** for NGCC
- **Design cycle can be shorter** than PC due to standardization to fit gas turbine
- Allows coal to benefit from **gas turbine technology improvements**
- **Easier to permit** than new pulverized coal
- **Versatile** - feedstock flexibility and multiple products (electricity, chemicals - including hydrogen, transportation fuel, or "synthetic" natural gas)
- 20% less CO_2 emissions than existing fleet; potential to **reduce incremental cost of CO_2 capture**

Electricity

Solids and Co-Products

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Southern Company's IGCC

- Transport Reactor Integrated Gasification -- TRIG™ technology – developed at Power Systems Development Facility –Wilsonville, Alabama
- Technology to be further demonstrated at Orlando

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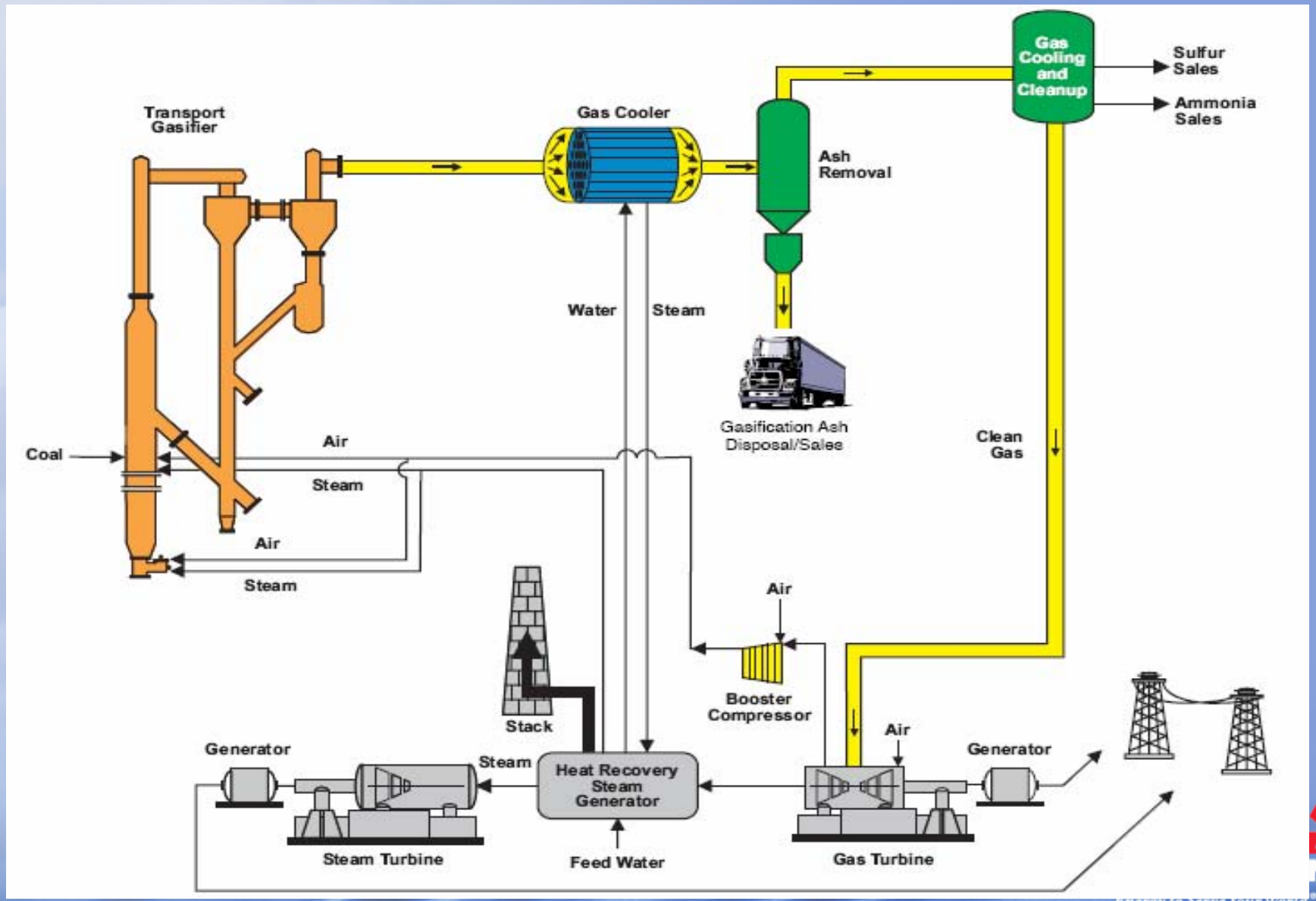
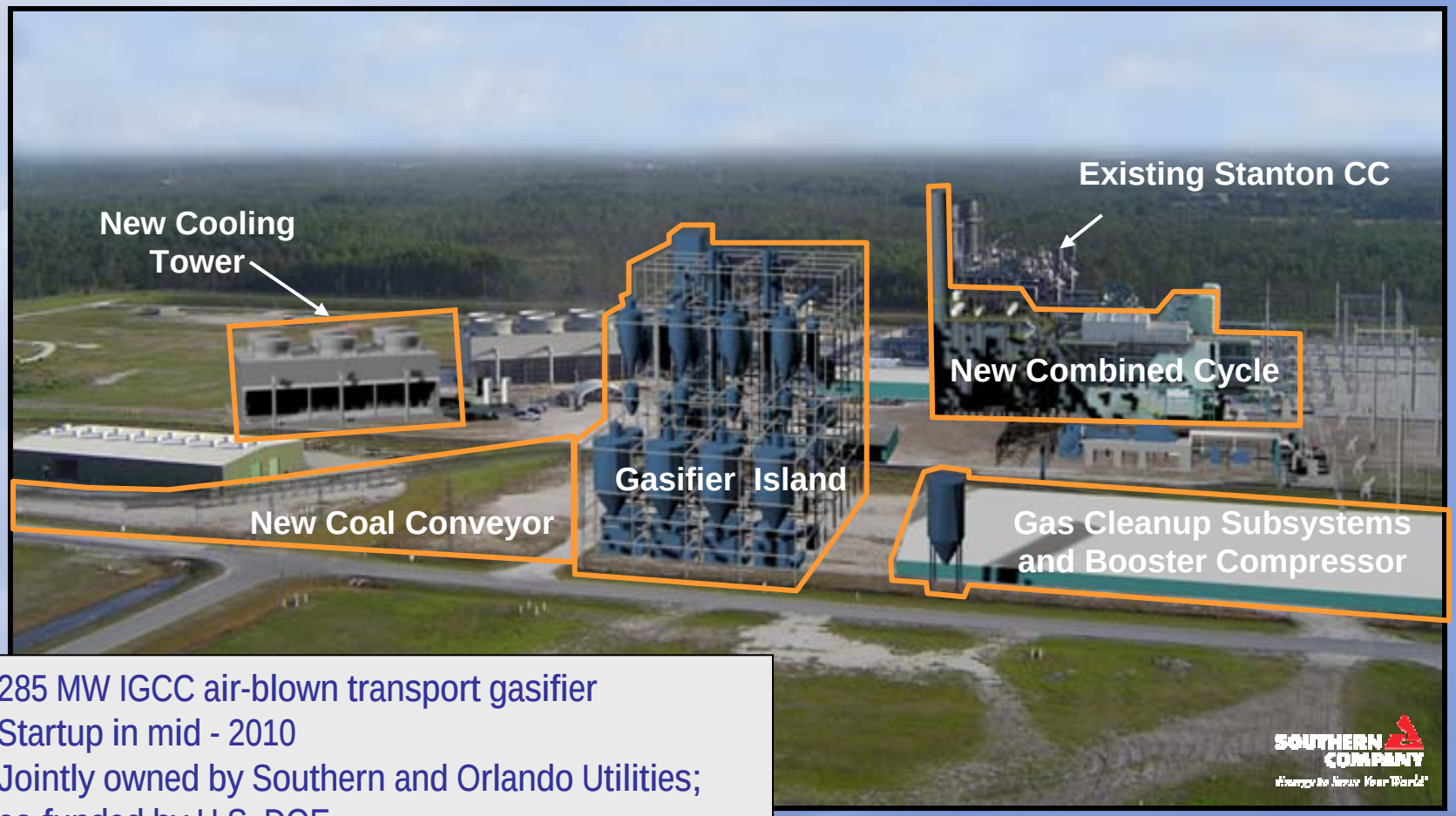
Schematic of TRIG Gasifier



TRIG™ at Orlando Utilities' Stanton Energy Center



- 285 MW IGCC air-blown transport gasifier
- Startup in mid - 2010
- Jointly owned by Southern and Orlando Utilities; co-funded by U.S. DOE

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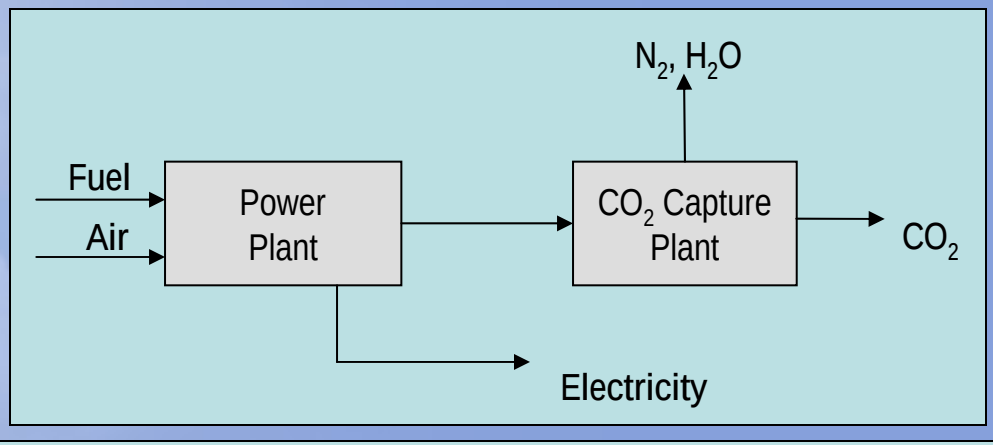
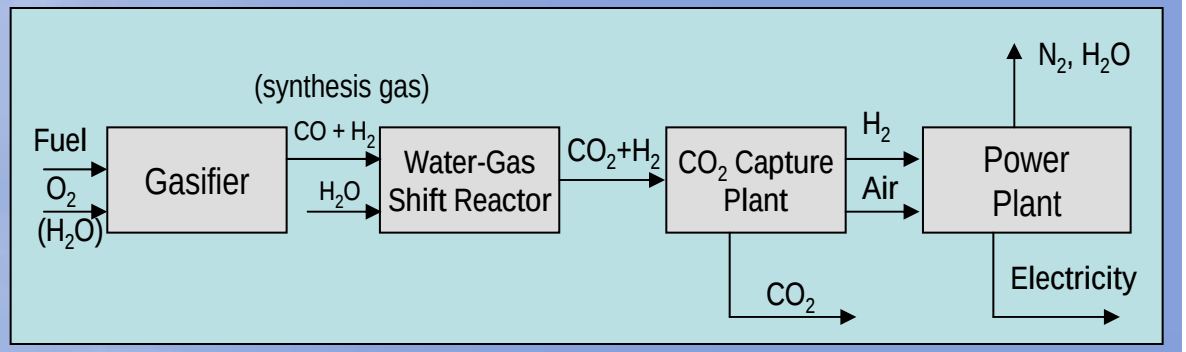
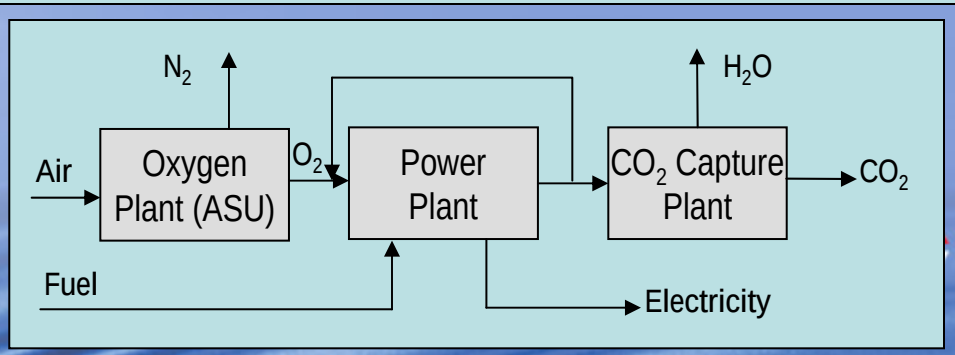
CO_2 Capture -- Fossil-Fired Power Plants

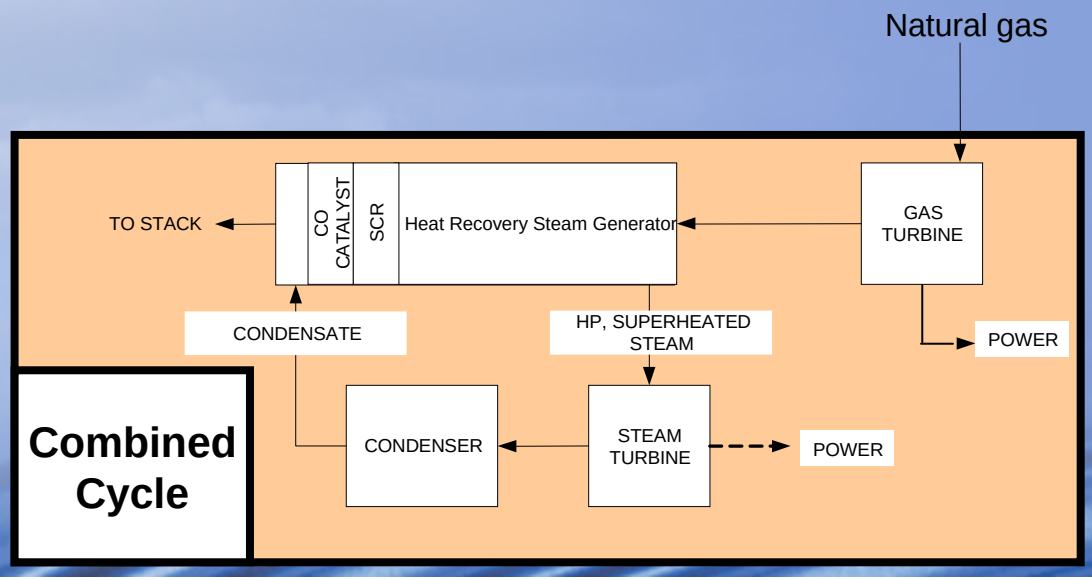
- Post-Combustion
  - Applicable for PC or NGCC
  - At or near atm pressure
  - Low [CO_2]/large scfm leads to large/expensive equipment
  - Add'l flue gas clean-up req'd
- Pre-Combustion
  - Applicable for IGCC
  - CO_2 in higher concentrations and at elevated pressures, 20 atm (higher driving force)
- Oxy-Fuel Combustion
  - Combustion with pure O_2; avoids large volumes of N_2
  - [CO_2] > 90%
  - Recycle req'd to reduce flame temp
  - Expensive ASU for O_2 supply







Transitioning from NGCC to IGCC Adds Cost and Complexity



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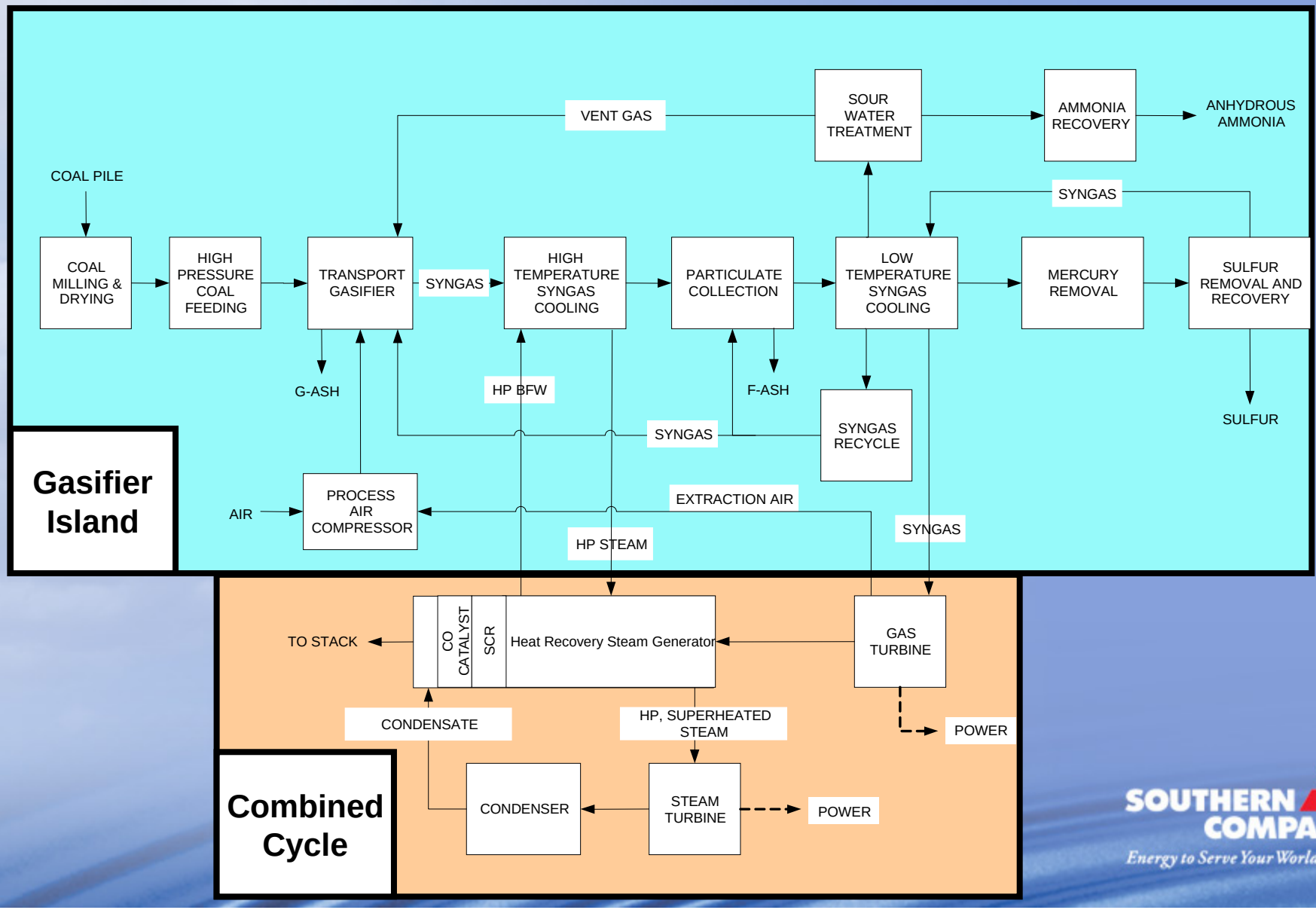
TRIG™ Simplified Flow Diagram



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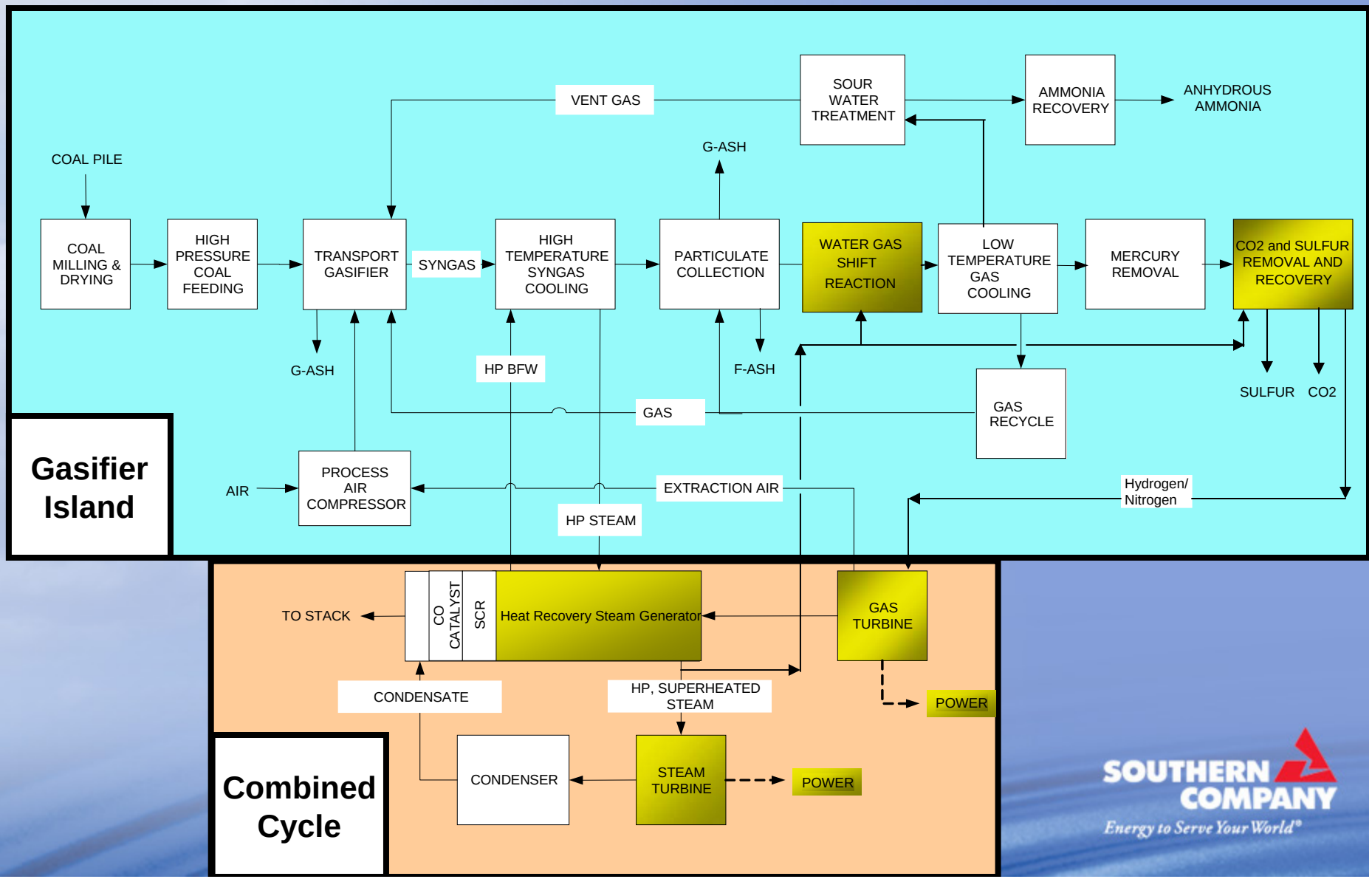
TRIG™ with Carbon Separation Technology Added



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Transportation

- CO_2 source/sink location dependent
- Scale - size of natural gas pipeline
- Cost - $5/ton (200 mi)
  - Small component of CCS total cost
  - Depends on terrain, population density, etc.
- Need to monitor for leaks as the CO2 is heavier than air and would settle in low places

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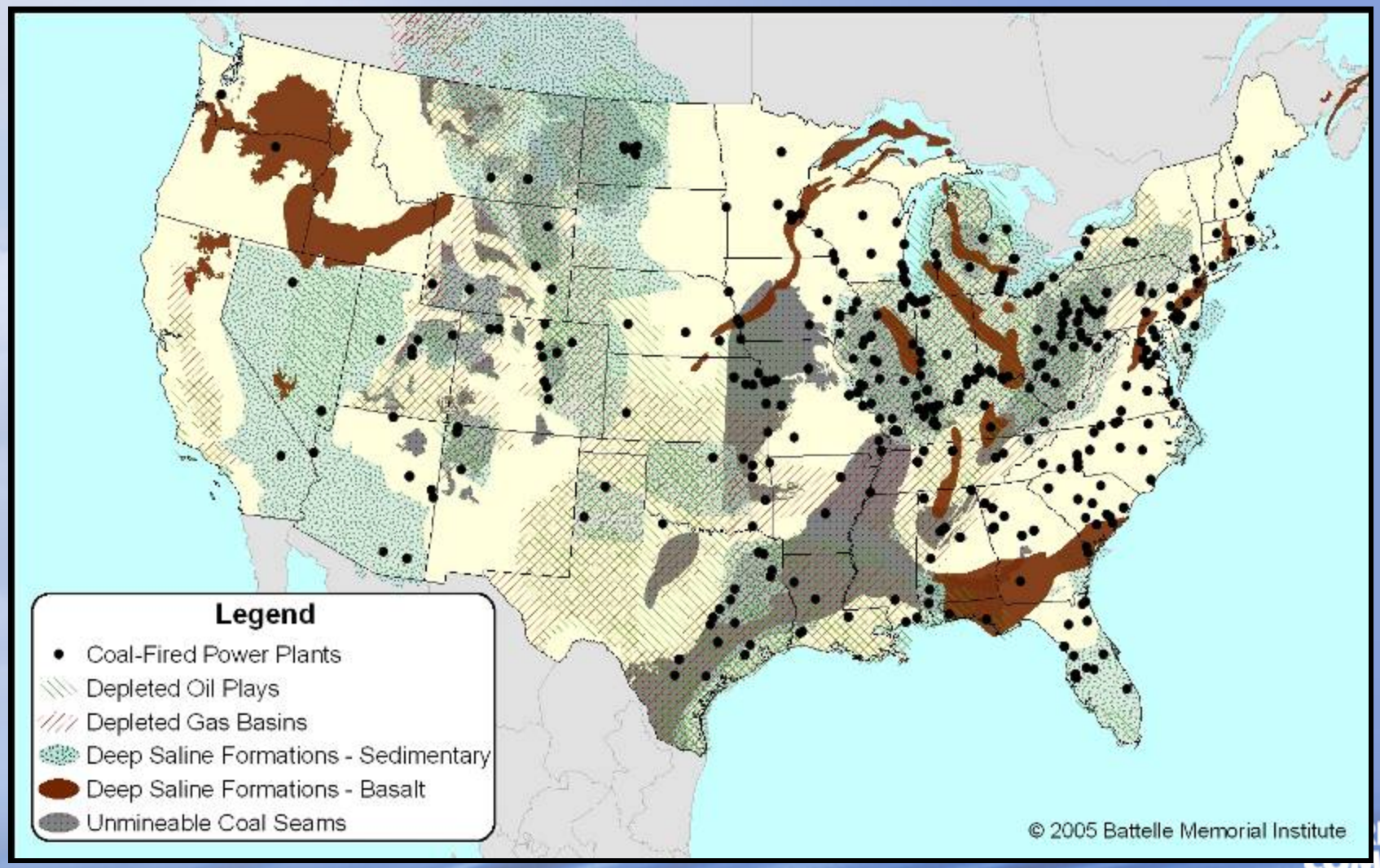
CO_2 Sequestration Geology



DOE Regional Carbon Sequestration Partnerships

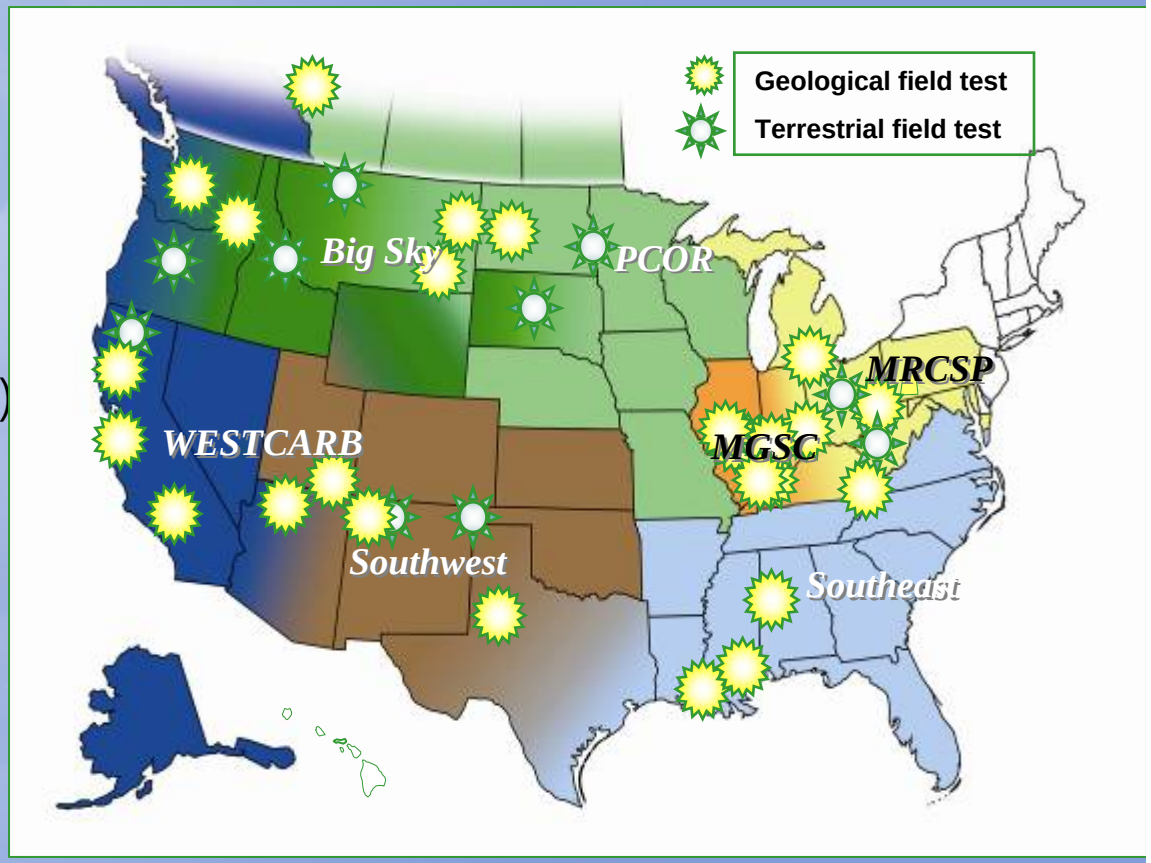
Phase 1 – CO_2 sources and sinks data collection

Phase 2 – CO_2 storage pilots

- SECARB: 3 pilots
  - Saline reservoir (MS Gulf Coast)
  - Coal Seam (AL & VA)
  - Stacked EOR/saline (TX/LA)

Phase 3 – Large capacity CO_2 storage demonstrations

- Integrate with CO_2 capture pilots



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Commercialization Pathway

Emerging Commercial IGCC → IGCC w/Carbon Capture & Storage

Challenges:

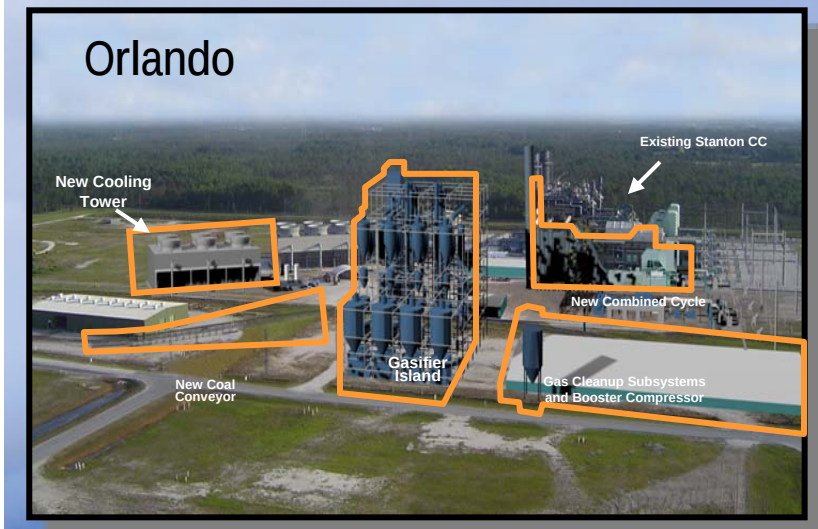
1. Verify Capex / OpEx
2. Prove electricity costs
3. Validate design decisions
4. Verify operability

Carbon Capture Challenges:

1. Incremental Capex and OpEx costs
2. Additional design and operational complexity

Sequestration Challenges:

1. Uncertainty in sequestration science
2. Permitting and compliance for long-term.



FutureGen Project

Key Features

- $1 billion project
- Commercial-scale 275-MW plant, startup planned in 2011
- 1 million tons/year CO_2 captured and sequestered
- “Living laboratory” to test and validate cutting-edge technologies
- Public-private partnership
- Stakeholder involvement
- International participation

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Source: Adapted from NETL and DOE

The FutureGen Alliance

- An international, non-profit consortium of some of the largest coal and utility companies in the world
- Partnering with US Department of Energy to design, construct and operate the facility

Advanced Coal Technology: challenges and opportunities

- Challenges:
  - Cost, cost, cost
  - Successful demonstration at full-scale achieving utility-required reliability
  - Permitting
- Opportunities
  - Continued research, development, and demonstration to address technical issues (which add costs) and demonstrate reliability
  - State and federal regulators help facilitate permitting
    - Air
    - For CCS applications, underground permitting, acquisition of mineral rights, and liability issues

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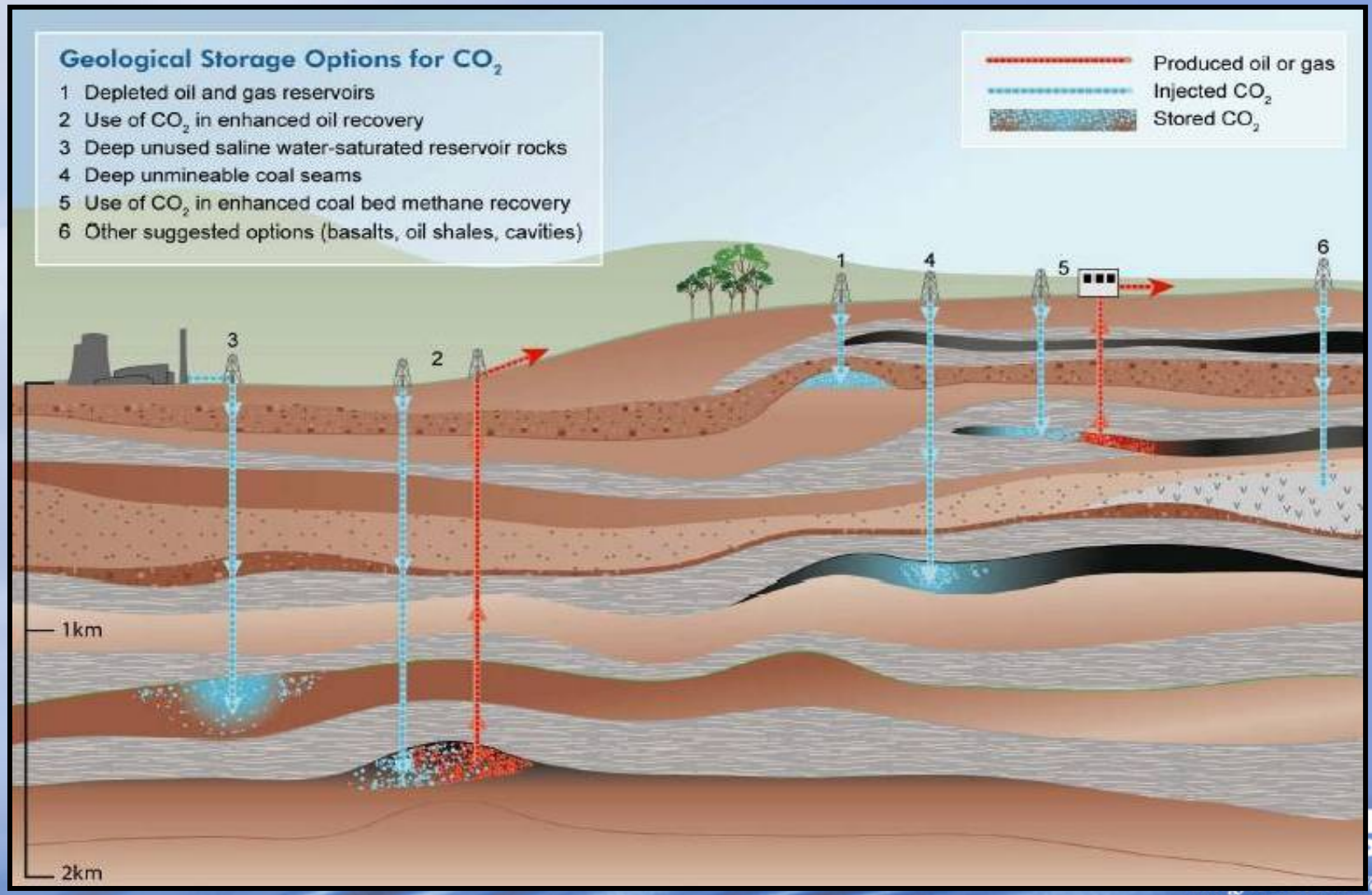
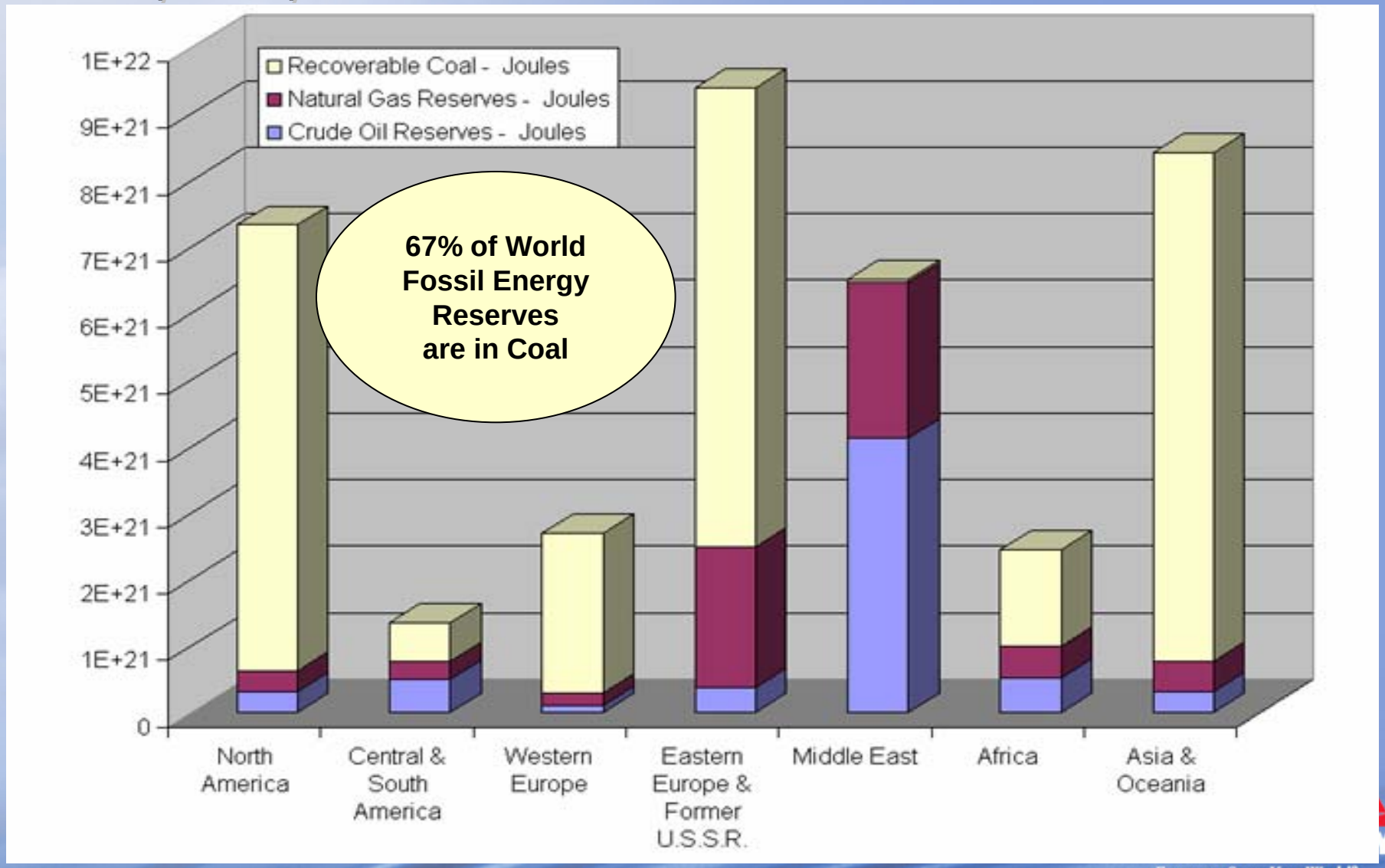
CO_2 Sequestration



World Energy Reserves

Oil, Gas, and Coal Reserves in Joules



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Source: Energy Information Administration/ International Reserves Data