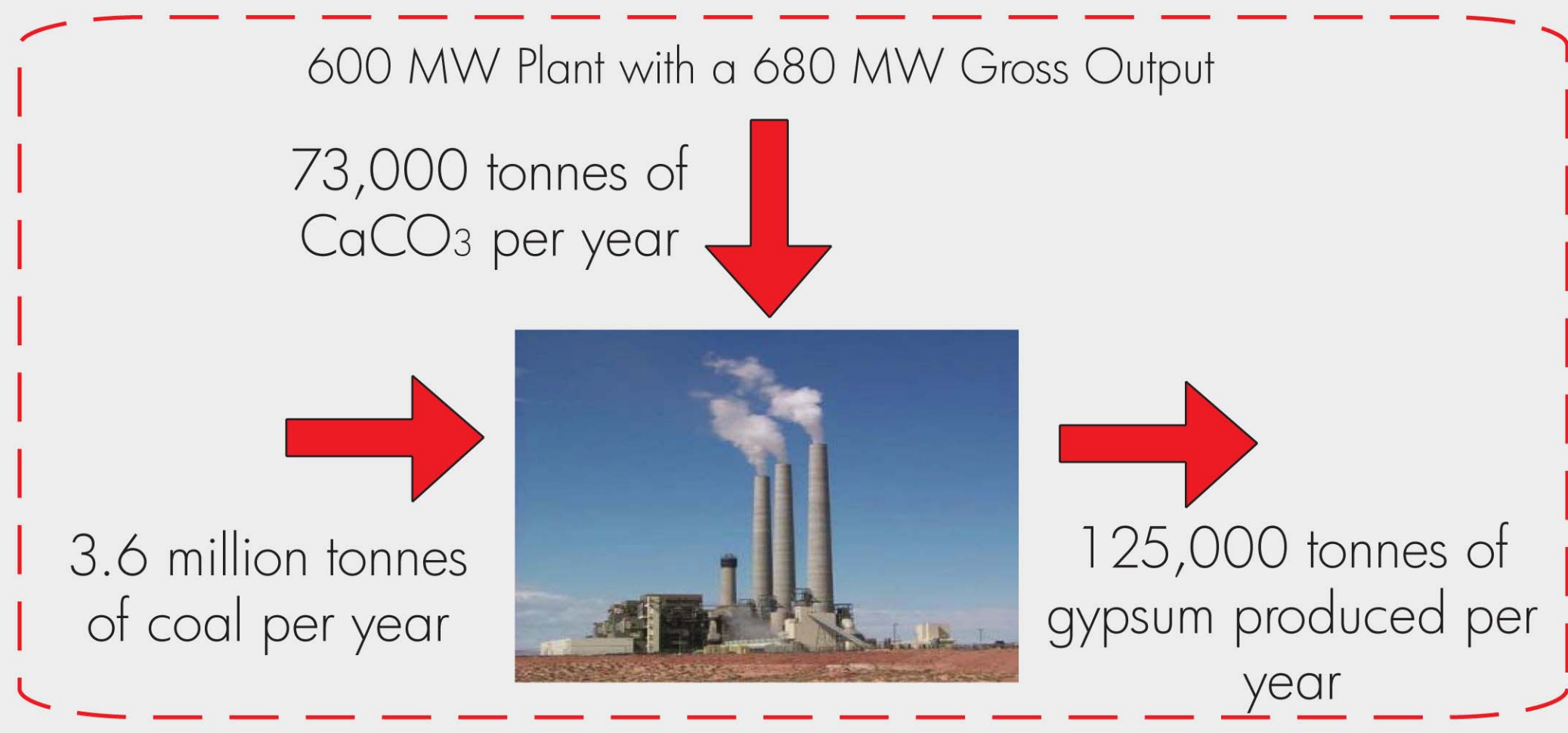


Chemical Process



Transportation and Disposal

	tonnes/yr	trips/yr	mi/trip	cost/trip	cost/yr
Limestone	73000	2920	200	\$250	\$730,000
Gypsum	125000	5000	430	\$538	\$2,700,000

Landfilling
- Environmental safe Waste
- \$20 per tonne

Average landfill site is 172 acres

	cost/tonne	cost/yr
Gypsum	\$20	\$2,500,000

Cost
- 25 tonnes per truck
- \$1.25 per mile

Wallboard (Gypsum) Market

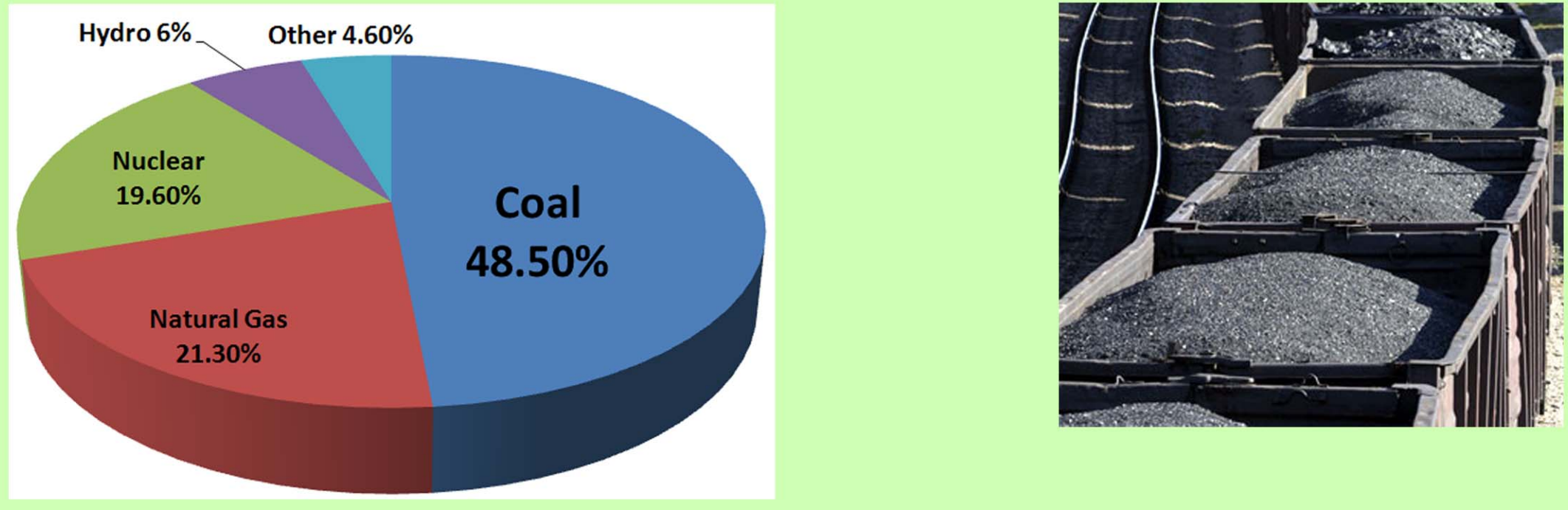
Profit

High: 14.6 Million

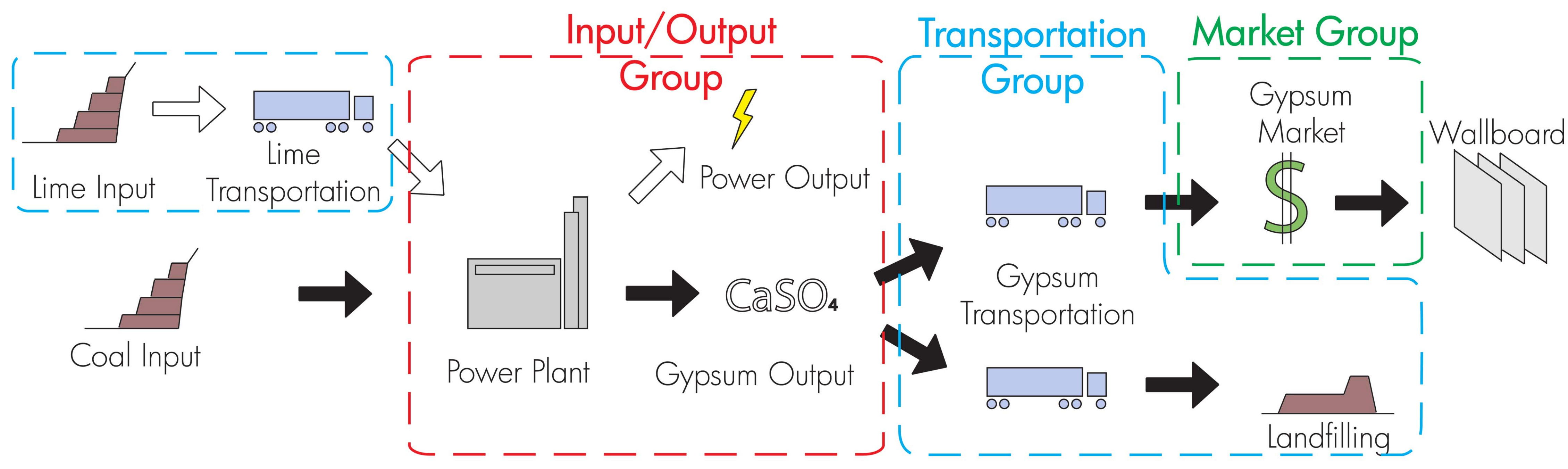
Current: 10.6 Million

Low: -2.5 Million

Sources of US Electricity



Pulverized Coal Process

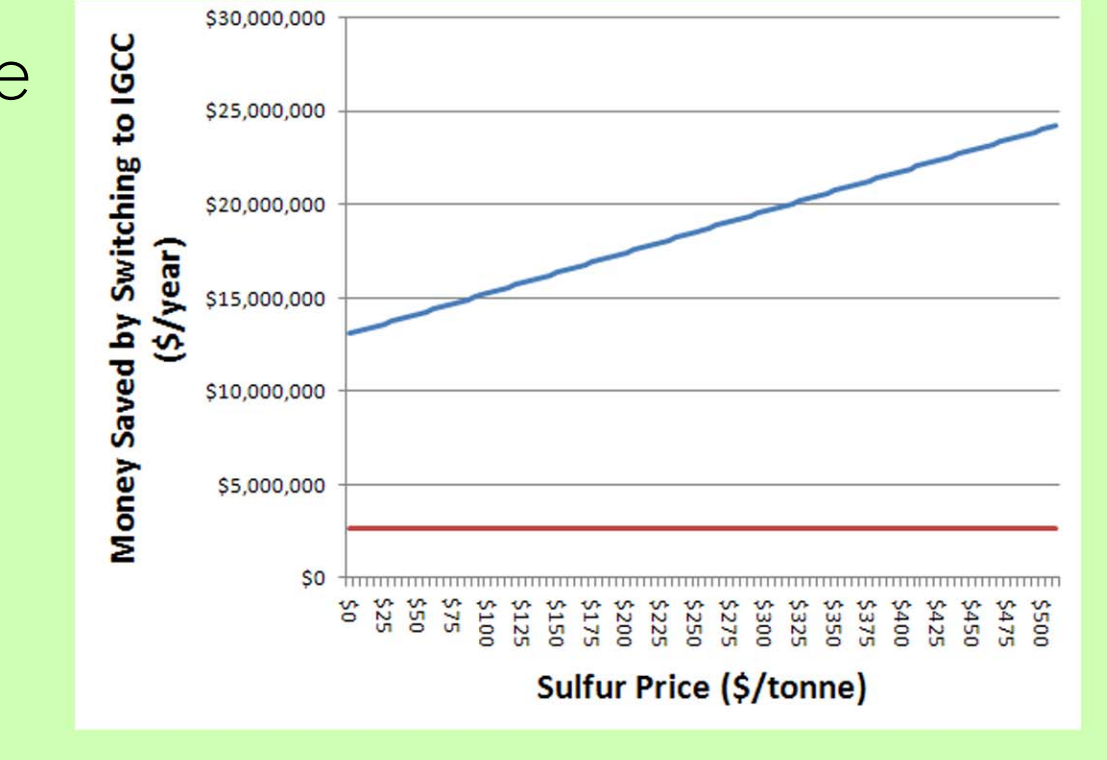


Problem

- Sargent and Lundy asked us to investigate sulfur capture technologies
- Impending environmental regulations may require a shift in the industry
- New technologies such as IGCC may fulfill these regulations

Results

- Gypsum market highly variable.
- Sulfur market also highly variable.
- No need to buy limestone with the IGCC process and saves 6 million dollars per year
- Lower coal usage increases IGCC profitability
- Cheaper to give sulfur and gypsum away than to landfill
- Operation and maintenance cost for sulfur removal units:
 - \$6 million for PC plant
 - \$2 million for IGCC



IPRO 302 Impact of Sulfur Capture Technology in Coal Power Plants



Pulverized Coal (PC): Traditional most widely used coal plant.

Integrated Gasification Combined Cycle (IGCC): Higher efficiency and easier to implement carbon capture.



- Untested emerging technology

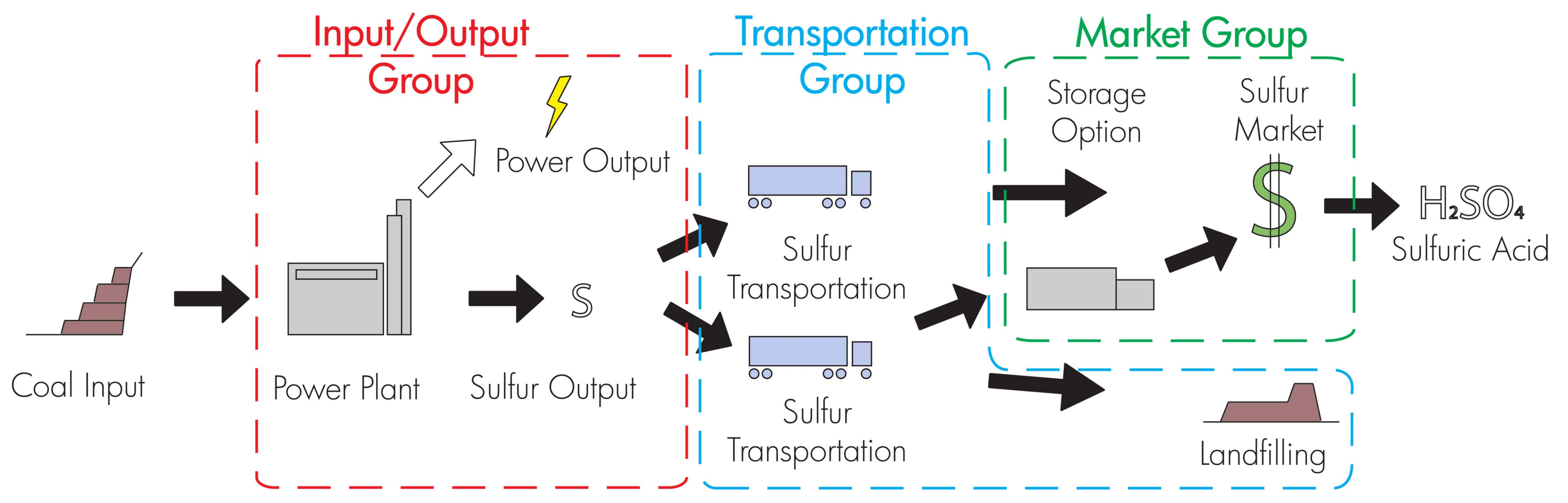
Initial Conditions

	PC	IGCC
Net Thermal Efficiency	36.10%	40.10%
Capacity Factor	85%	85%
Net Heat Rate	9449 Btu/KWh	8515 Btu/KWh
Net Output	600 MW	600 MW
Gross Output	680 MW	710 MW

New plant 200 miles south of Dallas, Texas



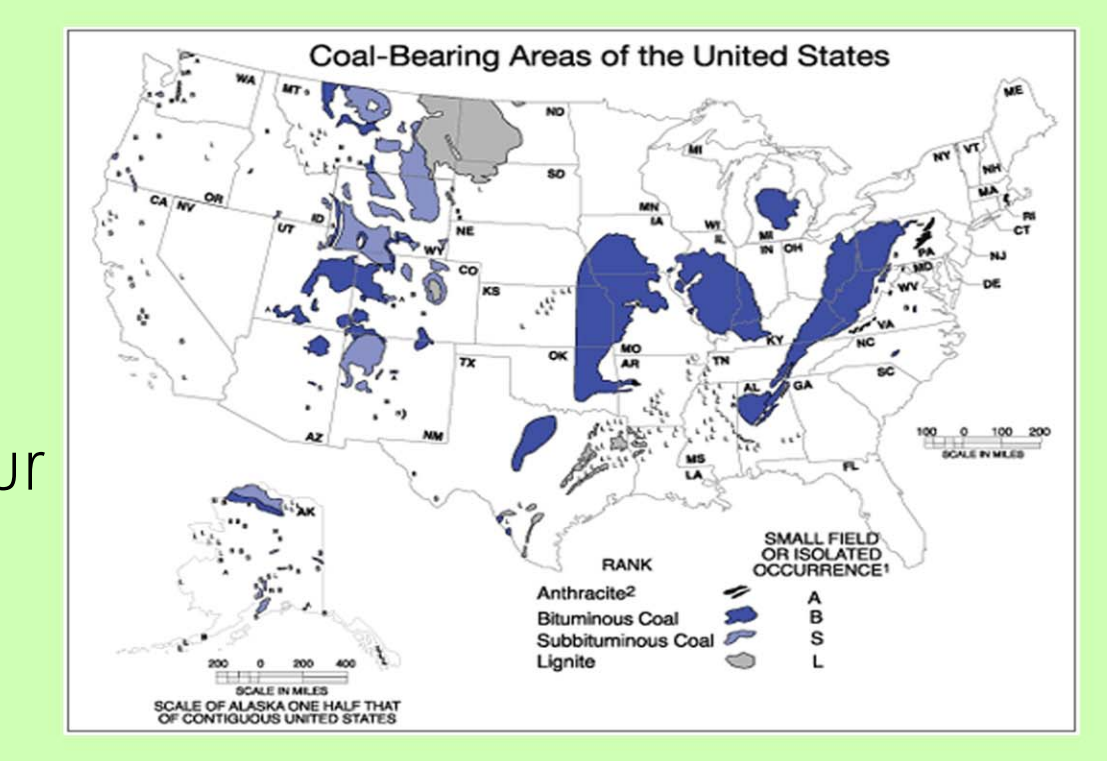
Integrated Gasification Combined Cycle Process



Hypothetical Scenarios

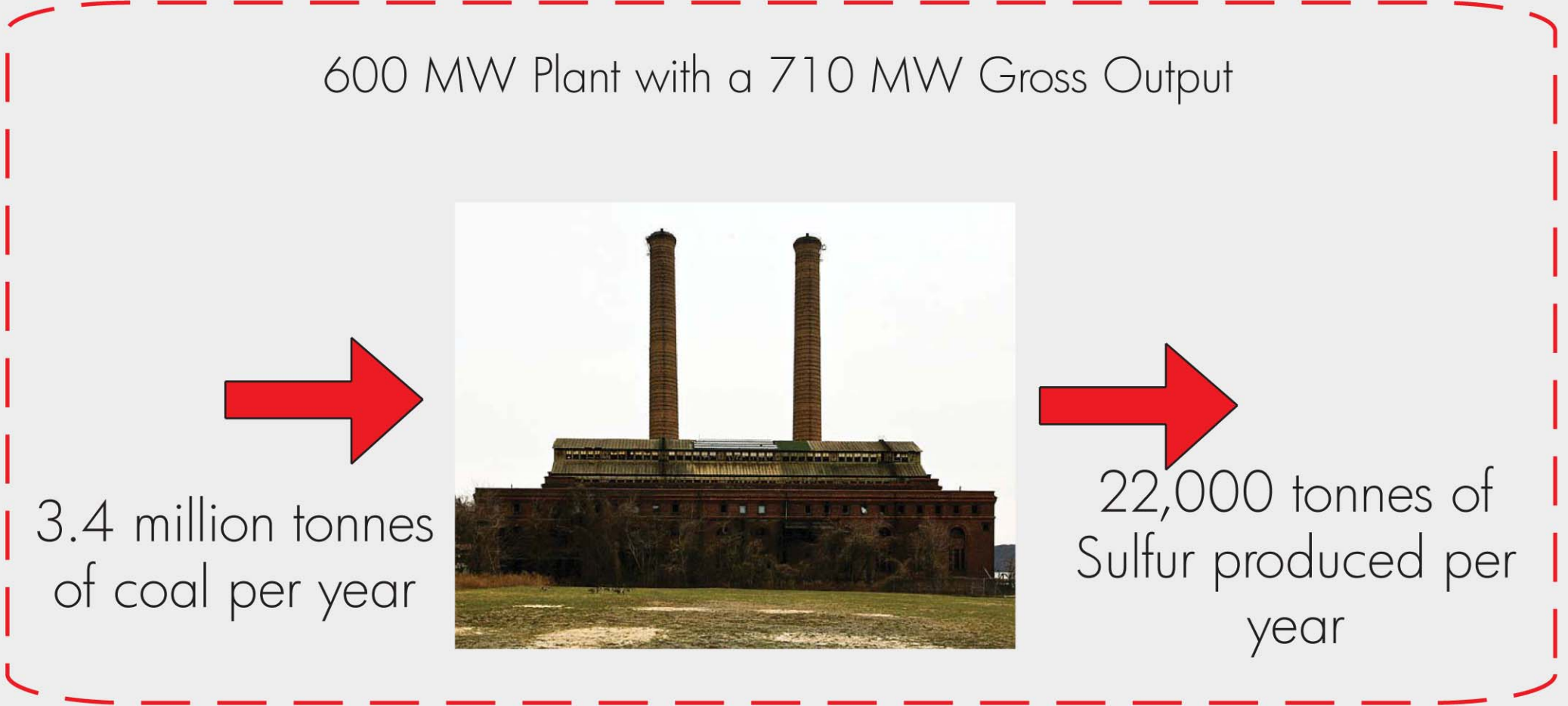
Texas Lignite: low sulfur content, low heat rate.

Illinois Bituminous: High sulfur content, high heat rate.



Coal Used	Texas Lignite		Illinois Bituminous	
Sulfur Content (Wt%)	0.0064		0.0233	
Heating Value (Btu/lb)	5968		10629	
Plant Type	PC	IGCC	PC	IGCC
Coal Required (tonne/yr)	3.6 million	3.4 million	2.0 million	1.9 million
Limestone Needed (tonne/yr)	125,000	N/A	255,000	N/A
Gypsum Produced (tonne/yr)	73,000	N/A	148,000	N/A
Elemental Sulfur (tonne/yr)	N/A	22,000	N/A	45,000

Chemical Process



Transportation and Disposal

	tonnes/yr	trips/yr	mi/trip	cost/trip	cost/yr
Sulfur	22000	846	200	\$280	\$240,000

Landfilling
- Special Waste
- \$46 per tonne

Storage Options
- Sulfur Tan
- Sulfur Pit
- Block Pouring

Cost
- 26 tonnes per truck
- \$1.45 per mile

	cost/tonne	cost/yr
Elemental S	\$46	\$1,000,000

Sulfur Market

Profit

High: 10.9 Million

Current: 420,000

Low: -1 Million