IPRO 302 Impact of Sulfur Capture Technology in Coal Power Plants

**Pulverized Coal Process**

- **Input/Output Group**
  - Coal Input
  - Lime Input
  - Transportation
  - Power Output
  - CaSO₄

- **Transportation Group**
  - Gypsum Transportation
  - Gypsum Market

- **Market Group**
  - Gypsum Market
  - Wallboard

**Chemical Process**

- 600 MW Plant with a 710 MW Gross Output
- 3.4 million tonnes of coal per year
- 22,000 tonnes of sulfur produced per year

**Transportation and Disposal**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>tonneryr</th>
<th>inp/yr</th>
<th>m3/tr</th>
<th>cost/tr</th>
<th>cost/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur</td>
<td>22,000</td>
<td>640</td>
<td>200</td>
<td>$260</td>
<td>$240,000</td>
</tr>
<tr>
<td>Landfilling</td>
<td>Environmental waste</td>
<td>$20 per tonne</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost: 25 tonnes per truck</td>
<td>$1.25 per mile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sources of US Electricity**

- Coal 48.50%

**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.

**Integrated Gasification Combined Cycle (IGCC)**

- Higher efficiency and easier to implement carbon capture.
- Untested emerging technology.

**Initial Conditions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>PC</th>
<th>IGCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Thermal Efficiency</td>
<td>36.10%</td>
<td>40.10%</td>
</tr>
<tr>
<td>Capacity Factor</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td>Net Heat Rate</td>
<td>9449</td>
<td>8515</td>
</tr>
<tr>
<td>Net Output</td>
<td>600 MW</td>
<td>600 MW</td>
</tr>
<tr>
<td>Gross Output</td>
<td>680 MW</td>
<td>710 MW</td>
</tr>
</tbody>
</table>

**Hypothetical Scenarios**

- **Texas Lignite**: Low sulfur content, low heat rate.
- **Illinois Bituminous**: High sulfur content, high heat rate.

**Chemical Process**

- 600 MW Plant with a 868 MW Gross Output
- 73,000 tonnes of CO₂ per year
- 125,000 tonnes of gypsum produced per year

**Sulfur Market**

- **Profit**
  - High: 10.9 Million
  - Current: 420,000
  - Low: 1 Million

**Wallboard (Gypsum) Market**

- **Profit**
  - High: 14.6 Million
  - Current: 10.6 Million
  - Low: 2.5 Million