Outputs and Inputs
The power plant produces 22,000 tons of sulfur per year from 3.4 million tons of coal. The amine process costs up to $2 million per year.

Disposal
The disposal cost would be $46 per ton. It would cost $1,022,851 to dispose of all the sulfur produced by one plant.

Transportation
The maximum truckload is 20 tons, which is shipped at a rate of $1.40 per mile. This shipping price is slightly higher because sulfur is considered a hazardous material and needs to be heated. The total cost to transport sulfur is $240,000.

Sulfur Market
As the graph above shows, the price of sulfur has been steadily declining for decades. However, there has been a spike increase in its price recently which shows that the market can be erratic. $10 million of revenue can be made from the most recent sulfur price.

Findings
From our analysis, elemental sulfur has the potential to be cheaper or more profitable than gypsum. Also, if a coal with a higher concentration of sulfur is used, the effect of sulfur costs on the operating system could be even greater. These findings alone though do not do enough to justify one type of power plant over another.

The markets for coal power generation byproducts are highly variable and not a good source for a stable income. The sulfur and gypsum byproducts have the potential to make money for power plants, but not reliably. Byproduct markets have no base cost, since there are minimal production costs. Also the supply of the byproducts cannot be easily controlled.

Applied to the nation at large, this analysis could have very different answers. If 100 percent, or even fifty percent, of the country’s coal power production were switched to gasification, the sulfur market would be flooded with more sulfur than could be sold, and the price of sulfur would drop. At the same time, gypsum prices could rise in accordance with lower gypsum production.

Our IPRO is part of a larger analysis being conducted by Sargent and Lundy. Our results cannot recommend one technology over the other, but they will be combined with others to create a more complete picture.

IPRO 302
IPRO OFFICE
3424 South State Street
Central Building, 4th floor

Phone: 312.567.3986
Fax: 312.567.3950
E-mail: keplinger@iit.edu
Coal is and will still be a viable fuel source for our nation’s power system. Coal is abundant within the United States and can be purchased cheaply. The newest issue in coal power is the control and capture of CO₂ emissions. The Environmental Protection Agency (EPA) already has standards set up with the removal of other byproducts produced by the power plants, but may start regulating CO₂ output as well.

All coal contains sulfur that must be removed before entering the atmosphere. The current coal power plants pulverize the coal to be burned as its fuel source which needs high concentrations of oxygen. The pulverized coal power plant produce sulfur oxides (SO₂) when the coal is burned which must be collected. These are collected by submitting the SO₂ to a limestone slurry (CaCO₃) based in a Flue Gas Desulfurization (FGD) tower. The SO₂ and limestone react together to form large quantities of gypsum (CaSO₄).

A new type of power plant has come about recently that uses a gasification process to burn the coal. This is an Integrated Gasification Combined Cycle (IGCC) power plant where the coal is burned at extremely high pressures and has limited or controlled availability of oxygen. The partially burned coal turns into a gas that is fully burned later. The sulfur is removed from the gas by combining with hydrogen, which is later removed, called the Claus Process. The byproduct is in the form of elemental sulfur. This process is around 10% more efficient than the conventional coal power plant. Also, the CO₂ produced by this plant can be easily captured and stored underground if required by federal regulations in the future.

The differences between the two types of power plants are raising questions about which type will be better off in the long run. Sargent and Lundy is currently analyzing the costs and benefits of the two types of power plants in order to determine which type is more economical to build and operate. They are an energy consulting firm based in Chicago, and work with all different forms of energy production.