

INFLUENCE OF SULFUR REMOVAL ON IGCC PERFORMANCE AND COST

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Rough estimates have been made of the impact of the level of sulfur removal on the plant performance and cost of IGCC power generation. The results relate to the use of Eastern bituminous coal having relatively high sulfur content (2-4 wt%).

Several IGCC process studies and technology assessments provide information relating to this influence of the IGCC sulfur removal on the plant performance and cost, although a definitive evaluation of this has not been reported. References used here are listed.

The current commercial, coal-based IGCC plants use primarily MDEA acid gas removal (AGR) technology, with COS hydrolysis, to meet moderate levels of sulfur removal (about 98% removal) with the clean fuel gas sulfur content being greater than 100 ppmv. Other gasification plants for refinery coke applications and for fuels /chemicals production apply other technologies (Selexol, Rectisol, Sulfinol) to meet more stringent gas desulfurization requirements. Selexol is proposed for use in several, future coal-based IGCC plants.

It appears that the limits of practical use of the AGR technologies might be:

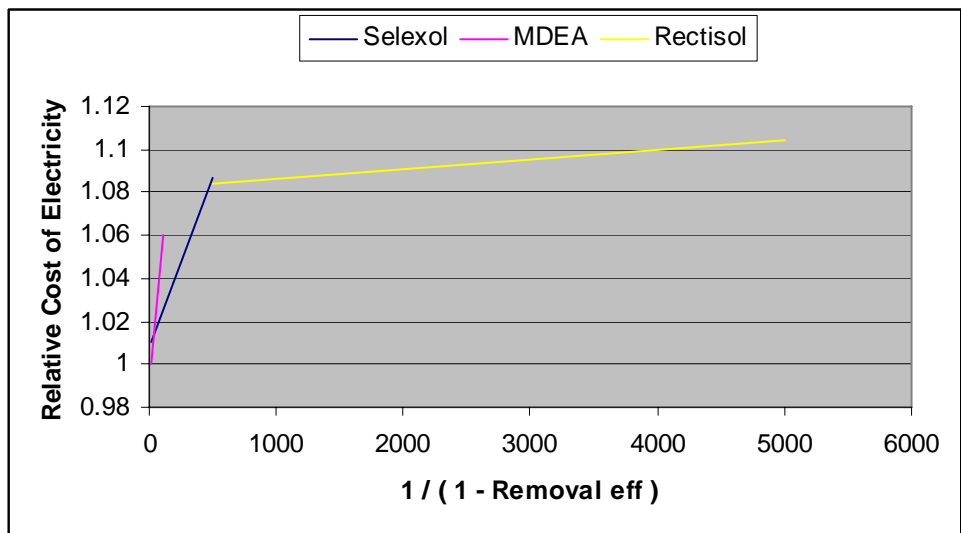
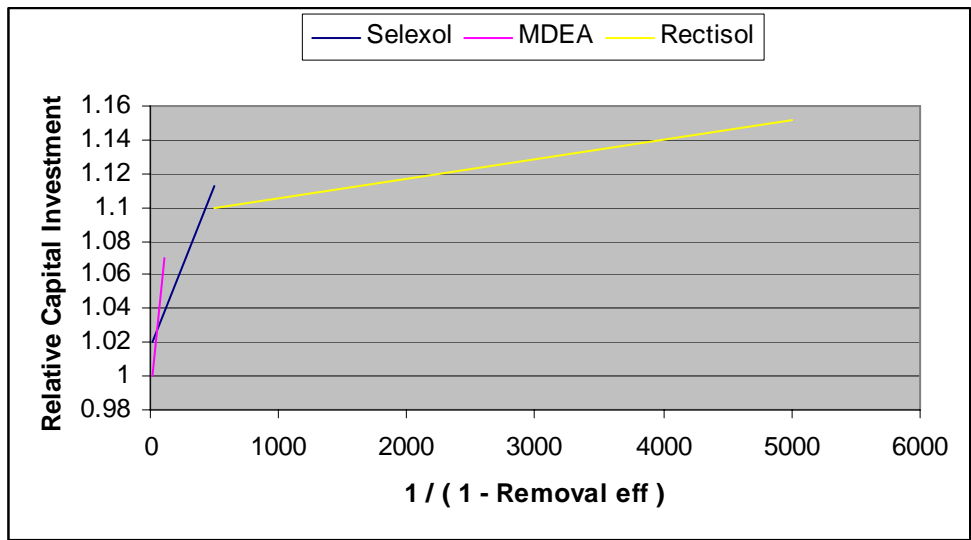
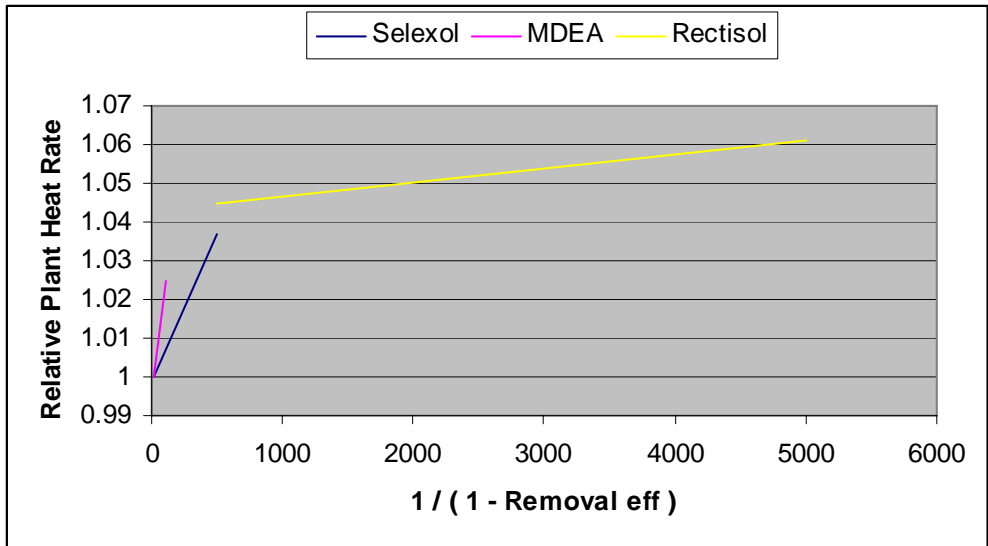
- MDEA (with COS hydrolysis): 99% sulfur removal, about 100 ppmv total sulfur in gas,
- Selexol (with COS hydrolysis): 99.9% sulfur removal, about 10 ppmv total sulfur in gas,
- Rectisol: 99.98% sulfur removal, about 2 ppmv total sulfur in gas.

The results presented depend on several factors that have additional influences: gas pressure, coal properties, plant application (hydrogen production, F-T liquids production, CO₂ removal and sequestration).

It is important to note that the gas cleaning system in IGCC represents a relatively small portion of the total power plant capital investment, 10-15%, combined with the influence of increased sulfur removal on increased power plant heat rate – increased sulfur removal efficiency results in a moderate increase in the power plant total investment, and a lower power plant thermal efficiency leading to an overall significant increase in the \$/kW power plant investment and cost-of-electricity. The quantitative results from two evaluations put in terms of relative performance and cost factors are listed below. These results have been plotted and scaled to give rough correlations for the impact of sulfur removal on performance and costs in the attached figures.

| Study | Sulfur removal (%) | AGR Technology Used | Sulfur content of clean gas (ppmv) | Relative Plant Heat Rate | Relative Capital Investment | Relative Cost of Electricity* |
|-------|--------------------|--------------------------|------------------------------------|--------------------------|-----------------------------|-------------------------------|
| Fluor | 89.0 | Selexol | 1,463 | 1 | 1 | 1 |
| | 99.8 | Selexol | 25 | 1.037 | 1.091 | 1.076 |
| SWPC | 99.1 | MDEA with COS hydrolysis | 128 | 1 | 1 | 1 |
| | 99.98 | Rectisol | 2.8 | 1.035 | 1.076 | 1.042 |

* III #6 coal cost \$1/MMBtu



References

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