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# Optimize your FCC OPEX

Cut your wet gas scrubber's operating costs leveraging SOx reduction additive solutions by up to $100k+/ year

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Inspiring science, enhancing life

## Opportunity of using SOx reduction additive in conjunction with your scrubber to reduce FCC OPEX:

The best available technologies for Fluid Catalytic Cracking (FCC) flue gas SOx reduction include in-situ SOx reduction additives as well as wet gas scrubbers (WGS). Both require operating costs: costs of additives for the SOx reduction additives option, and cost of austic soda, power and wastewater treatment for the WGS option. SOx reduction additives can be used in conjunction with WGS to reduce the overall FCC OPEX, especially when caustic soda prices are high. Using both solutions simultaneously allows reduction of scrubber caustic expenses. There are more than 20 cases where commercial FCC units with a WGS successfully used Johnson Matthey's SOx reduction additives to reduce their scrubber's OPEX.

## Savings on caustic soda costs, when is it worth it?

There is a break point above which caustic soda prices are high enough that using SOx reduction additives leads to overall cost savings. Johnson Matthey has developed a proprietary in-house model to help you identify this break point. This model also provides estimates of overall cost savings by optimizing the SOx additives usage rate based on your specific operation. Figure 1 shows an example of simulation cost saving using **SUPER SOXGETTER™ II** in conjunction with a WGS. Optimum SOx reduction additive addition rate at a given caustic soda price can easily be calculated. The greatest cost savings by using SOx reduction additives in FCC units equipped with wet gas scrubbers is gained when caustic soda prices are high.

SOx reduction additive usage can be varied as conditions or caustic prices change so that optimum operating costs can be maintained. Adding SOx reduction additives via a separate addition system enables this flexibility and hence continuous minimization of FCC costs. State-of-the-art additive addition systems accurately load SOx reduction additives 24/7. Since their introduction in the late 1980's, Johnson Matthey's INTERCAT™ addition systems have rapidly become the industry standard. Today there are over 300 units installed in refineries throughout the world!

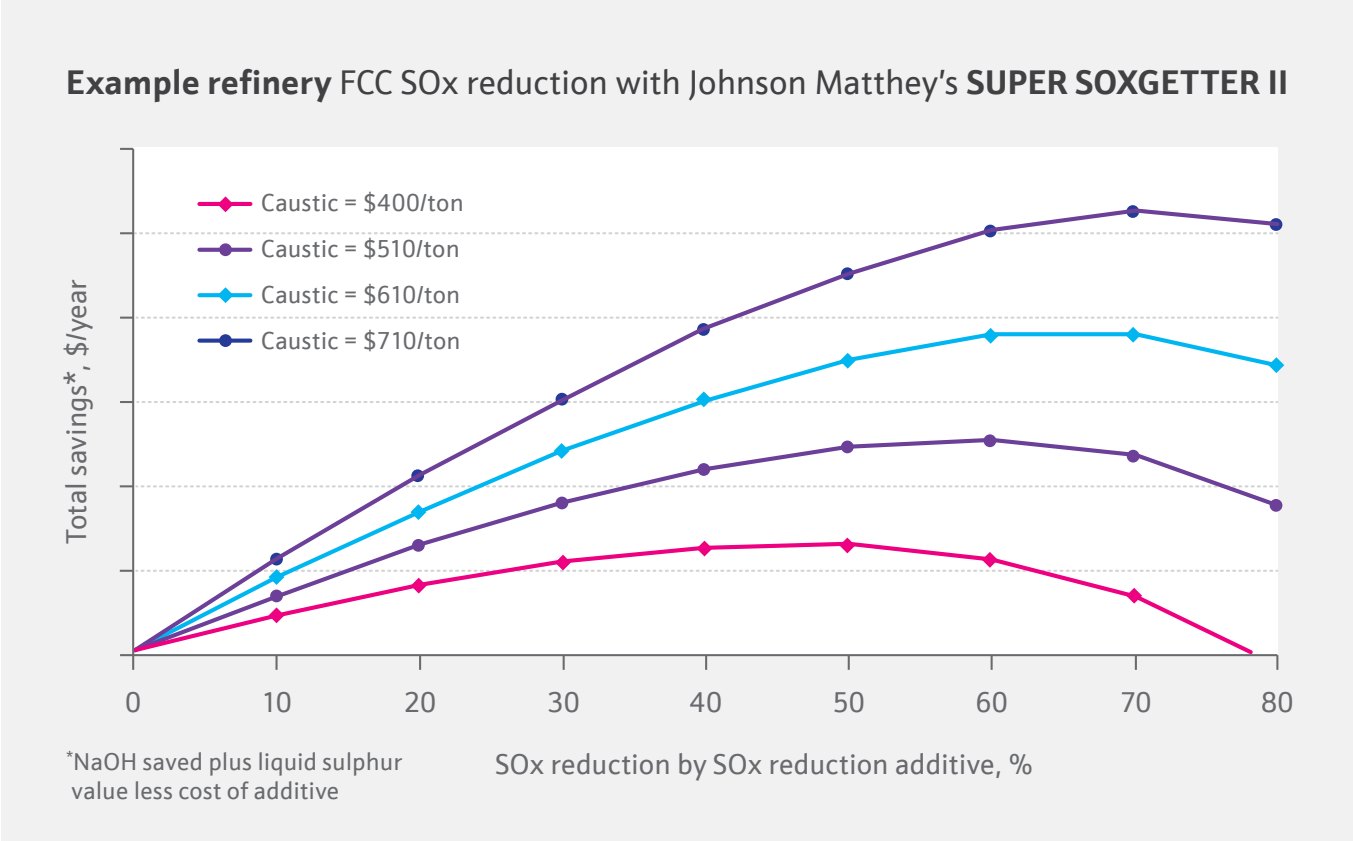


Figure 1: Simulation of WGS OPEX cost savings by using **SUPER SOXGETTER II**. Maximum overall savings increases and moves to higher SOx reduction% by using SOx reduction additives as caustic price increase.

## Additional savings and benefits

On top of reducing costs associated with caustic soda, using SOx reduction additive in conjunction with WGS also brings about additional savings. SOx reduction additive usage in the regenerator reduces the quantity of SOx fed to the WGS, and thereby also decreases the sulphate content of WGS wastewater. Consequently, there is less solid waste generated by the WGS crystallization unit. If wastewater sulphate levels can be reduced sufficiently, it may be possible to eliminate the need for a crystallization unit, for the refiners considering investing in a scrubber. In addition, this also reduces environmental issues associated with disposal of solid wastes (sodium sulphate cake). Finally, SOx reduction additives can also be used to supplement scrubbers when they are overwhelmed due to abnormal operational issues (e.g., when there is an outage in upstream feed hydrotreater or the scrubber itself).

## Example of a refinery where SOx reduction additive was used to reduce FCC OPEX

A North American refinery with a WGS to control its FCC SOx emissions started using SOx reduction additive to reduce its caustic soda expenses. SOx reduction additive loading was increased in a stepwise fashion from 0% to 2%, and then from 2% to 4% of fresh catalyst additions. Cost savings were calculated for each increment of SOx reduction additive usage.

Direct annual cost savings of $228K were achieved when 4% SOx reduction additive was used (table 1). Actual annual cost saving were much higher, as these direct savings did not include additional maintenance cost savings or savings from improvements to wastewater treating.

Following this study the refinery was equipped to adjust SOx reduction additive addition rate based on caustic soda price evolution, and hence maximize unit's profitability. Johnson Matthey's proprietary models and SOx reduction additive solutions are available to help optimize your FCC OPEX costs.

**Please contact Johnson Matthey for more information.**

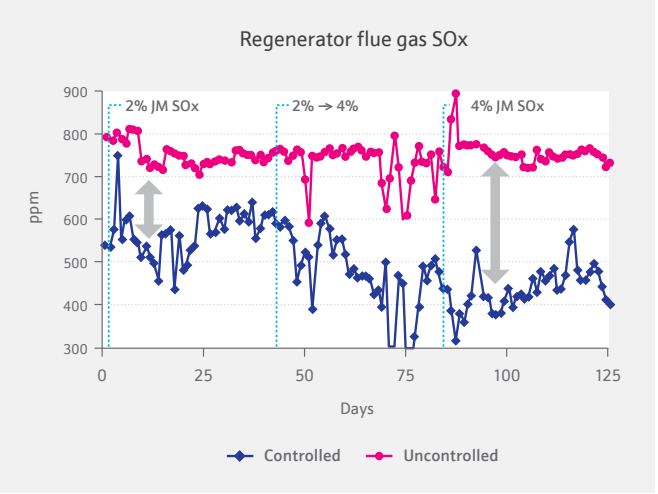


Figure 2: Greater FCC regenerator flue gas SOx reduction at higher SOx reduction additive usage rate.

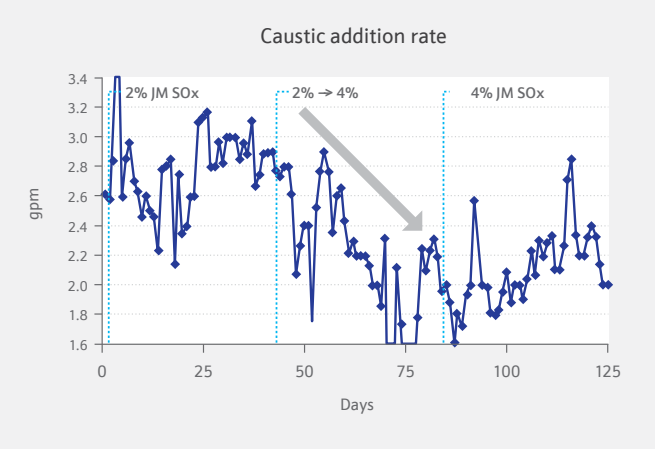


Figure 3: Caustic soda addition rate decreased as SOx reduction additive usage rate increased

| | | No SOx additive | 2% JM SOx additive | 4% JM SOx additive |
|---|---|---|---|---|
| Caustic Rate | gpm | 3.74 | 2.78 | 2.18 |
| JM SOx additive | $k/year | $0 | $291 | $564 |
| Caustic Soda | $k/year | $1,901 | $1,416 | $1,109 |
| Total expenses | $k/year | $1,901 | $1,707 | $1,673 |
| **Expense reduction** | **$k/year** | **$0** | **$194** | **$228** |

Table 1: Savings generated by the unit for different % SOx reduction additive used

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