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## **Question 7: Is your company either considering, or actually implementing, FCC projects that include reduced CO2 emissions (greenhouse gas reduction-GHGR) as an offset/credit?**

WARDINSKY (ConocoPhillips)

We do not have any current FCC projects that plan on utilizing some form of CO2 offset or credit in the emissions analysis. ConocoPhillips has performed a limited modeling study to evaluate the effect of operational changes on CO2 emissions from the FCC. Also, the study indicated that there is very little you can do to reduce overall emissions without also overall significantly reducing unit throughput or conversion. One obvious adjustment is to increase feed preheat to reduce coke yield and get back conversion by increasing equilibrium catalyst activity. However, the increased CO2 emissions from the feed heater nearly offset the reduced CO2 emissions from the regenerator flue gas stack. FCC energy efficiency improvement projects that we have been implementing recently within ConocoPhillips include replacement of steam turbines with electric motors and optimization of feed preheat furnaces. Other opportunities to improve FCC energy efficiency include recommissioning out-of-service flue gas expanders and increasing heat integration between the main fractionator and gas plant reboilers.

As an informational note: In the 1980s, Air Products reported on an FCC process utilizing O2 enrichment for coke combustion with CO2 recycle and sequestration. This process presents several technical and economic challenges to FCC operations.

HEATER (BASF Catalysts)

As Mike mentioned, it is important to remember that the FCC runs in heat balance. All the heat needed to run the process will eventually come out as CO2 either in the flue gas, the CO boiler or the feed heater. Two main sources of CO2 generation are from the combustion of coke and from the CO boiler/feed preheater stack gas. Optimum design of the CO boiler and feed heater burners can mitigate CO2 production. CO2 from the flue gas, when looked at in the big picture, is very minor compared to the CO2 generated from the fuel produced by the FCC; for example, gasoline and diesel fuel. When in petrochemical mode (C3s and C4s are going to petrochemical market), that CO is reduced. Likewise, when slurry goes to carbon black, that CO2 is reduced.

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