

# Solar Reduction of CO<sub>2</sub>

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## EXECUTIVE SUMMARY

This project involves the design of a process to convert carbon into carbon monoxide and oxygen using solar energy. The project is focused on the San Juan power plant in New Mexico, which is located in a region with a considerable amount of annual sunlight, and is also a sizable contributor to carbon dioxide emissions.

It was determined that the total capital investment for this process will be approximately \$49 million with a fixed capital investment of \$42 million. An annual net profit of \$23 million was estimated at a return of investment of about 46%. At this rate, the payout time for the process was determined to be about 1.65yrs with a net present worth of \$78.5 million.

The carbon dioxide reduction system will be connected to the existing plant via pipelines, processing over 277 tons/day of flue gas. The flue will be fed to a separation system which treats the flue gas for impurities and separates 120tons/day of 99% pure carbon dioxide for reduction. The pure carbon dioxide product is directed to an array of solar reactors where it is converted to carbon monoxide and oxygen. Based on a ten hour day, approximately 3.8 tons/day of carbon monoxide and 1.76 tons/day of oxygen are obtained. The process reduces the power plant's CO<sub>2</sub> emissions by 0.3%

The possibility of the carbon dioxide reduction system was also considered for alteration of the Martian atmosphere. It is concluded that solar reduction of CO<sub>2</sub> would not be an affective tool for altering the Martian atmosphere. It is, however, a possibility for long-term manned missions because it could supply O<sub>2</sub> to support a local contained habitat, and supply a CO as fuel.