Sustainable Nitrogen Fertilizer

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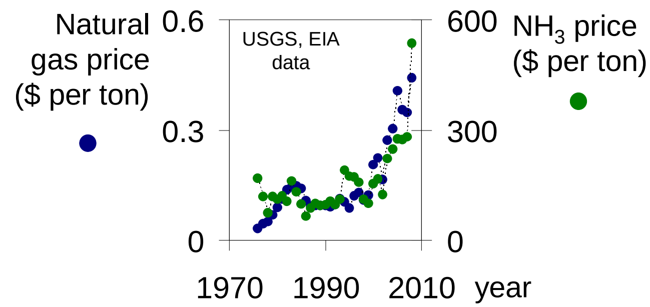
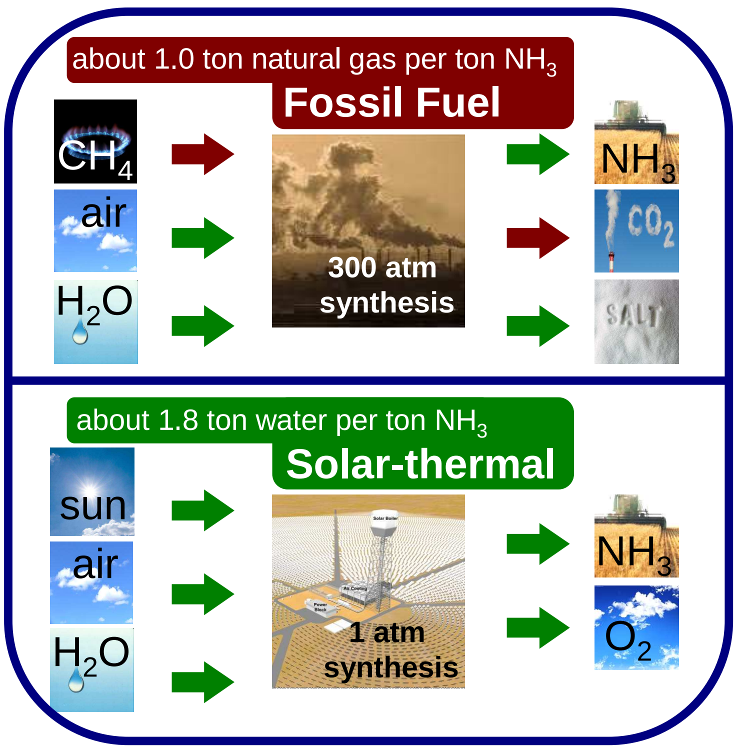
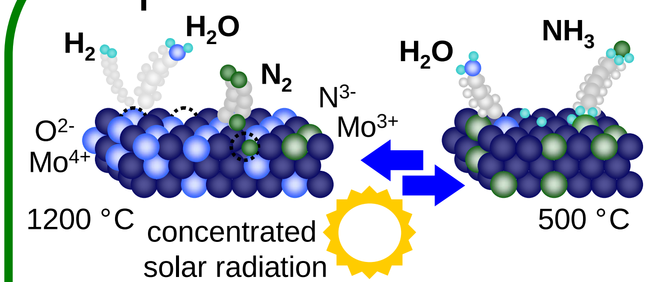
Motivation and impact

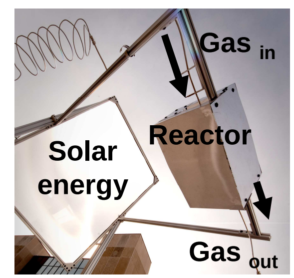
- About 50% of the global food supply depends on ammonia (NH_3) fertilizer that is synthesized industrially (about 130 million tons/year) with 5% of the global natural gas production.
- This work proposes ammonia production from sunlight, water and air and analyzes its technical (experimental reaction yield and kinetics studies) and economic feasibility (mass and energy balance based process modeling and net present value analysis).

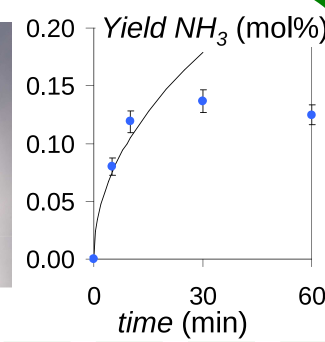




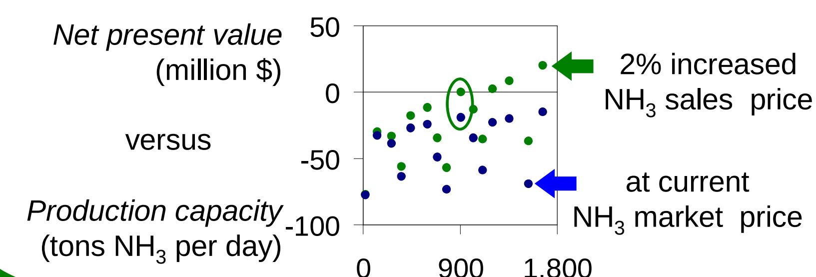
Experimental

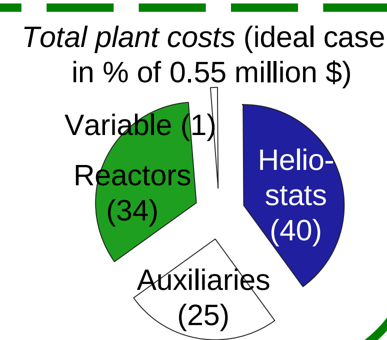






Economic analysis





Conclusions and Outlook

- The process is technical feasible with a molybdenum reactant. To increase the 13 mol% yield of NH_3 and the 25 mol% nitride yield further work optimizing the reactant composition is needed.
- Under conservative assumptions the process may sell NH_3 for 534 $ per ton (i.e., near the current market price), producing at a capacity between 160 to 900 tons NH_3 per day at optimum.

Acknowledgments

This material is based upon work supported by National Science Foundation Grant # 0903701: “Integrating the Socioeconomic, Technical, and Agricultural Aspects of Renewable and Sustainable Biorefining Program, awarded to Kansas State University.” Funding by the Center for Sustainable Energy, Kansas State University is kindly acknowledged.