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Techno-Economic Analysis of Bioconversion of Methane into Biofuel and Biochemical

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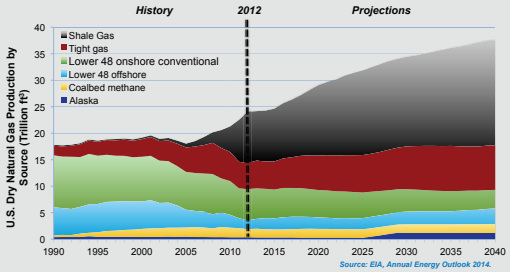
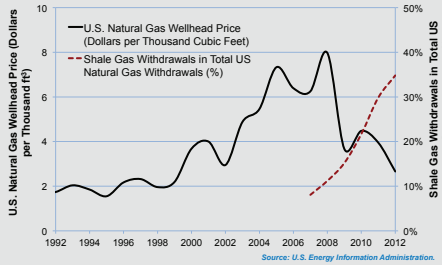
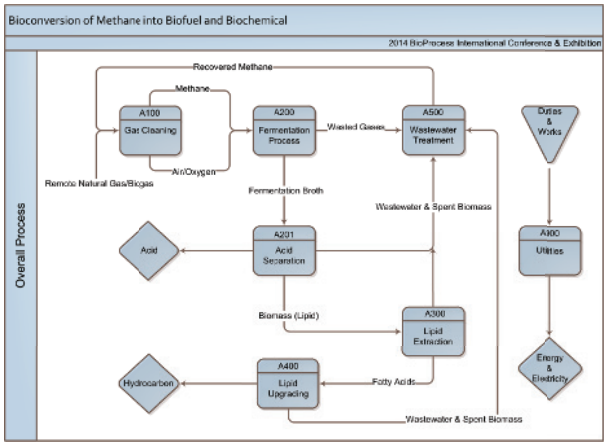
Introduction

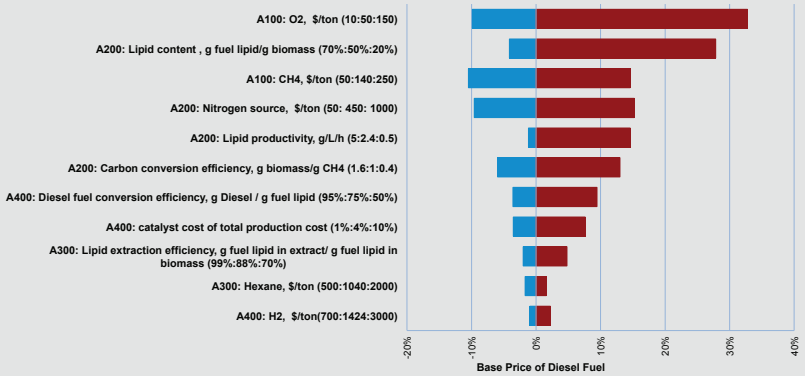
In light of the relatively low price of natural gas and increasing demands of liquid transportation fuels and high-value chemicals, attention has begun to turn to novel biocatalyst for conversion of methane (CH_4) into biofuels and biochemicals [1]. A techno-economic analysis (TEA) was performed for an integrated biorefinery process using biological conversion of methane, such as carbon yield, process efficiency, productivity (both lipid and acid), natural gas and other raw material prices, etc. This analysis is aimed to identify research challenges as well provide guidance for technology development.

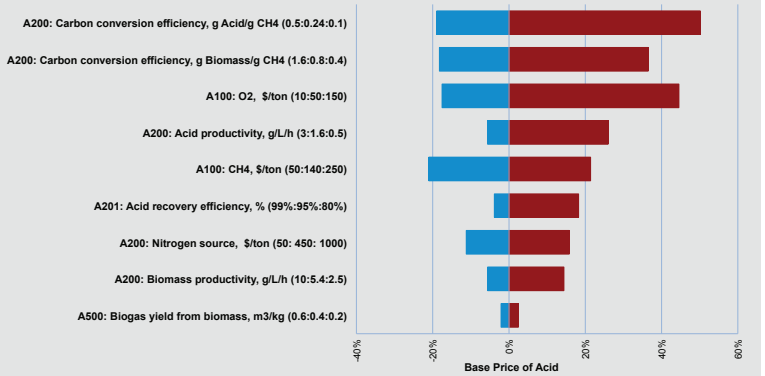




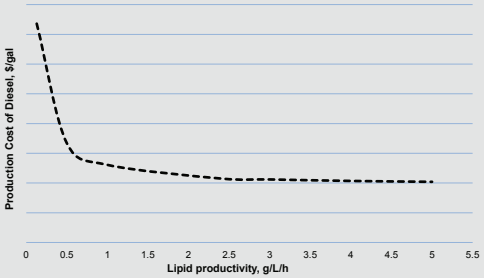


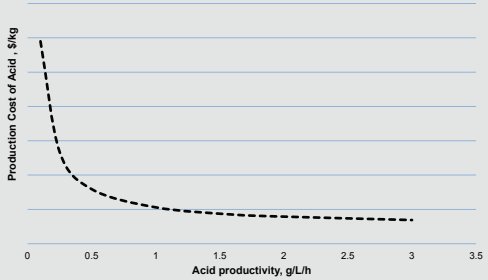
Tornado Charts for Sensitivity Analyses Based on Impacts from Identified Key Parameters





The Effects of Productivity on The Production Cost





Conclusions

1. *A conceptual BioGTL&C integrated biorefinery process design was developed as a framework for sensitivity analysis to identify key parameters for the process concept.*
2. *The cost of O_2 and lipid content are the major factors affecting the overall process economic of biologically converting natural gas to diesel*
3. *The carbon conversion efficiency (CCE) of acid and biomass production with CH_4 and the cost of O_2 are identified as the main cost drivers for acid production.*
4. *The methane-derived diesel fuel and acid can be economic and competitive when lipid productivity and acid productivity reach 2 g/L/h and 1 g/L/h, respectively.*

Reference: [1] Fei et al., Biotechnology Advances 32 (2014) 596

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