



Design and Optimization of a Sustainable Methanol Production Process in Saudi

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Introduction

Methanol, a versatile compound used in fuel production and chemical manufacturing, is undergoing a transformation towards sustainability. By utilizing green hydrogen and CO₂ as feedstock, green methanol production minimizes carbon emissions and reduces reliance on non-renewable resources.

01 Problem Statement

Saudi Arabia, with its goal of achieving net-zero carbon emissions by 2060, faces a significant challenge in the current methanol production process. The conventional methods used in the country rely heavily on non-renewable resources and contribute to carbon emissions. It is imperative to explore and implement sustainable alternatives, such as green methanol production, to align with Saudi Arabia's sustainability objectives and reduce the environmental impact of methanol production.

02 Constraints

Hydrogen Must Be Green

On-site Availability of Hydrogen and CO₂

03 Target Specifications

50% reduction in CO₂ emissions compared to conventional methanol production

20% improvement in energy consumption compared to industry benchmarks

Accommodate a production capacity increase of at least 30% without a proportional increase in costs

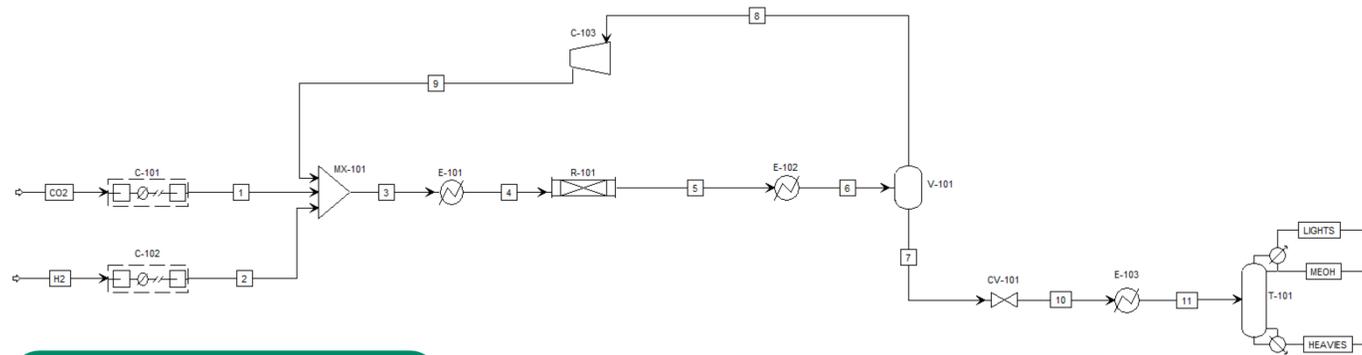
Maintain a product purity level of at least 98.0% methanol by weight

04 Project Impact

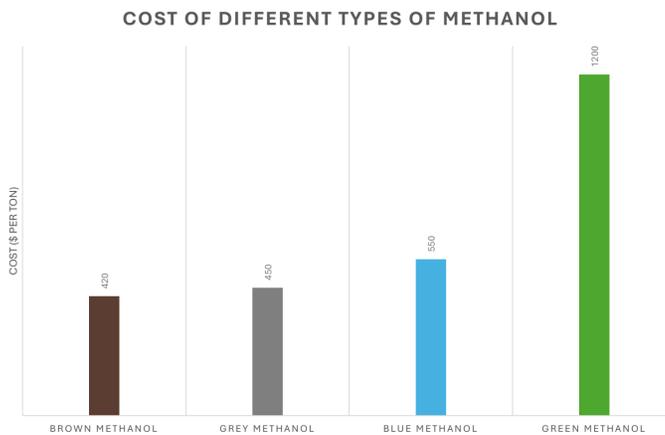
By designing a sustainable methanol production process, our project aims to achieve significant positive impacts. It will drive economic growth through cost-effective production, create a cleaner environment by reducing carbon emissions, and contribute to societal well-being by supporting Saudi Arabia's transition towards a sustainable and future.

Prototype Design

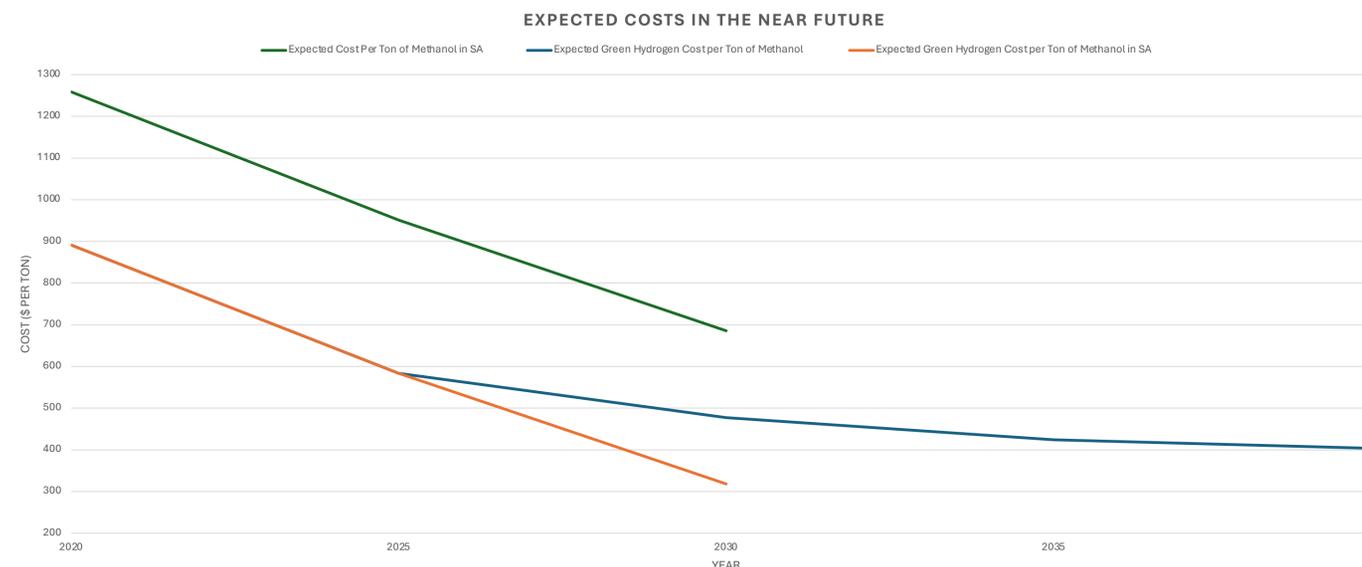
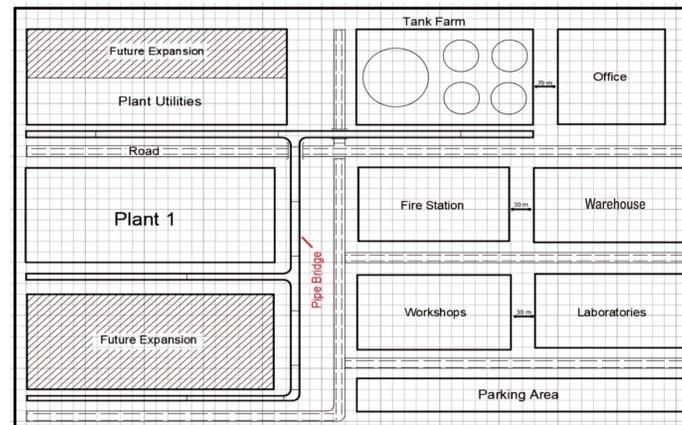
01 Process Flow Diagram



02 Economic Analysis



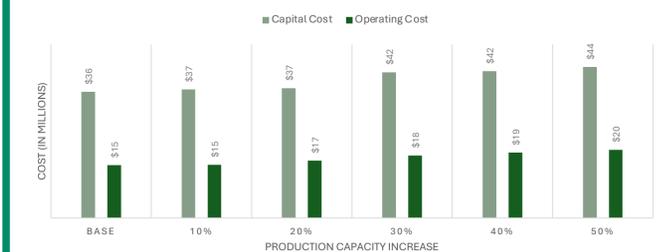
03 Plant Layout



Validation

- 160%-210% reduction in CO₂ Emissions ✓
- 21%-160% Improvement in energy consumption ✓
- 30% Production capacity increase ✓
- 98.3% Purity of Methanol ✓

PRODUCTION CAPACITY INCREASE (%) VS. COST (\$)



Conclusion

The project aimed to address the pressing challenge of transforming Saudi Arabia's methanol production process towards sustainability. By designing and optimizing a sustainable methanol production process, the project aimed to achieve economic viability, reduce carbon emissions, and contribute to societal well-being. Successful implementation of such a process would support Saudi Arabia's sustainability goals, foster economic growth, and promote a cleaner and prosperous future for the country.

Future Work

- Explore advanced catalyst materials and reactor designs
- Investigate methods for capturing and utilizing additional sources of CO₂
- Explore the integration of renewable energy sources