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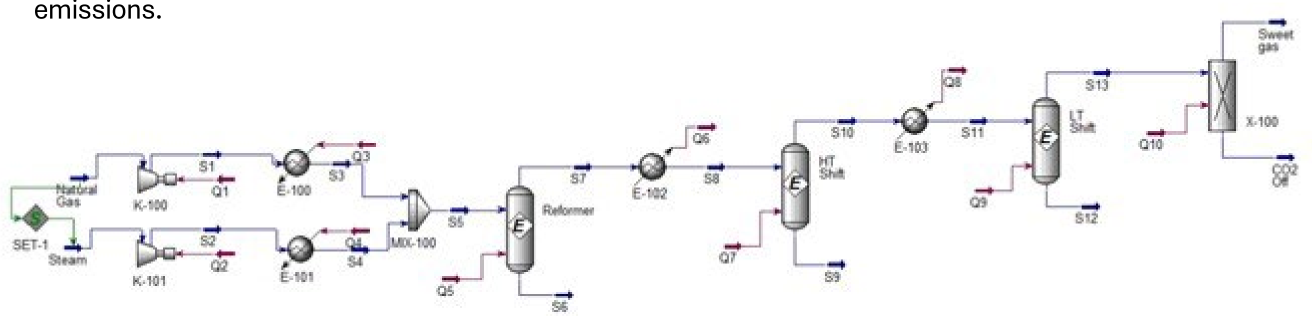
DECARBONIZATION OF METHANE INITIATIVE CASE STUDY PROPOSAL ON HOW/WHAT TO MODEL OF METHANE CONVERSION TO HYDROGEN

Decarbonization is the process of reducing carbon dioxide emissions from the atmosphere, primarily using low-carbon energy sources. Methane (CH_4), classified as a greenhouse gas, plays a substantial role in the phenomenon of global warming and climate change. Methane can be converted into valuable products, and hydrogen (H_2) is an emerging energy product recently under investigation. Hydrogen can be generated from methane using several methods, such as Steam Methane Reforming (SMR). Hydrogen production can be divided into two categories: fossil fuels, renewable resources, and biomass or water. Understanding decarbonization is of utmost importance in mitigating the adverse impacts of greenhouse gas emissions and, at the same time, fostering a sustainable energy practice. The Earth's temperature has risen by over 1°C in the past 120 years, contributing to global warming. The concentration of carbon dioxide in the atmosphere reached a record high in 2021, highlighting the need for decarbonization to reduce emissions.



Process flow diagram of the base case

Name	Type
K-100	Compressor
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E-100	Heater
E-101	Heater
MIX-100	Mixer
Reformer	Reformer reactor
E-102	Cooler
HT Shift	High temperature shift reactor
E-103	Cooler
LT Shift	Low temperature shift reactor
X-100	Pressure swing adsorption unit

Nomenclature for equipment used.

Methane, with 21 times more greenhouse gas potential than carbon dioxide, can be converted into valuable products. Our study explores CH_4 decarbonisation and the process simulation model of CH_4 conversion to H_2. It has significant implications for addressing climate change. Our research using Aspen HYSYS on CH_4 decarbonisation and its conversion to H_2 through SMR found that the steam-to-carbon ratio, reforming temperature, and pressure significantly influence CH_4 conversion, H_2 yield, and purity. Higher temperatures were found to enhance CH_4 conversion, while higher pressures were beneficial for industrial applications. The findings provide valuable insights into optimising reformer reactors for efficient H_2 production and contribute to decarbonisation and sustainable energy solutions. Implementing decarbonisation measures via SMR is a promising step towards meeting global emissions reduction targets and fostering a cleaner, greener energy landscape.

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