

Abstract

Our designed plant produces 114,000 pounds per hour of methanol. It has an overall CO₂ conversion of 64%. The total capital cost of this plant is \$110.6 million. There is an estimated \$263.3 million annual operating cost.

Projected Project Site

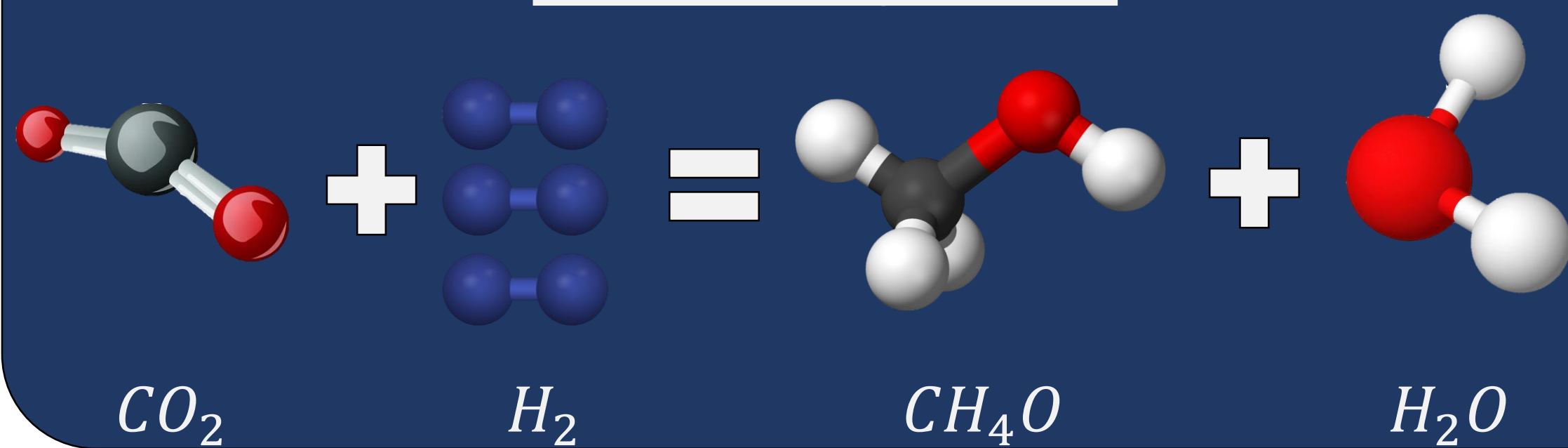


Plant Site Location: Gary, IN



Carmeuse Plant Site

Chemistry Used



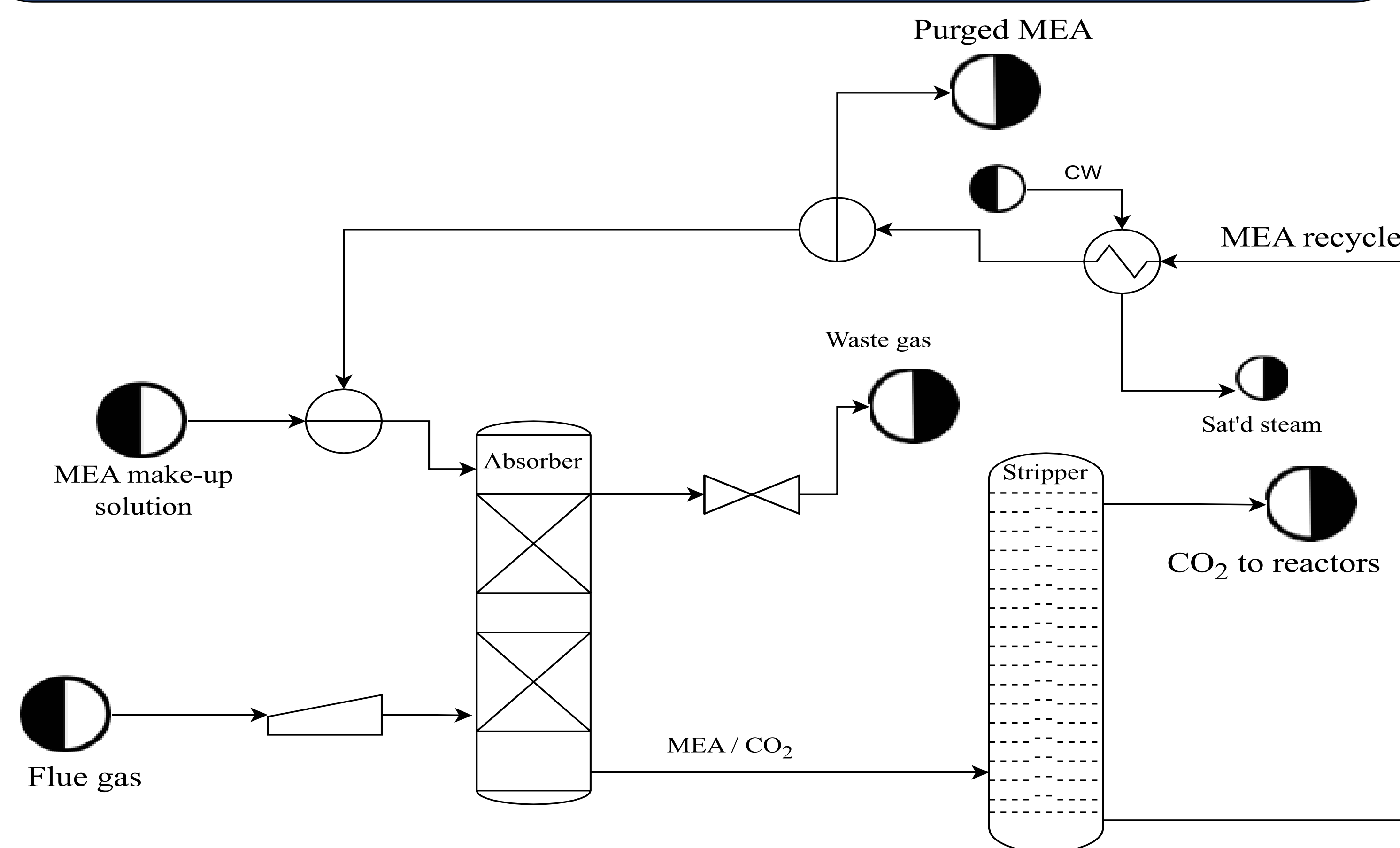
Process Summary

- Absorption of carbon dioxide.
 - Monoethanolamine (MEA) is used to pull the carbon dioxide into the liquid stream.
- Stripping Columns.
 - The liquid stream is sent to a distillation column and the carbon dioxide is evaporated out of the MEA.
- Reaction of carbon dioxide and hydrogen.
 - The rich carbon dioxide stream is mixed with hydrogen gas. The mixture is sent to a reactor with copper, zinc oxide, and aluminum oxide catalyst. These catalysts help the reaction create methanol and water. The methanol will then be used as a fuel source.

The Process Description

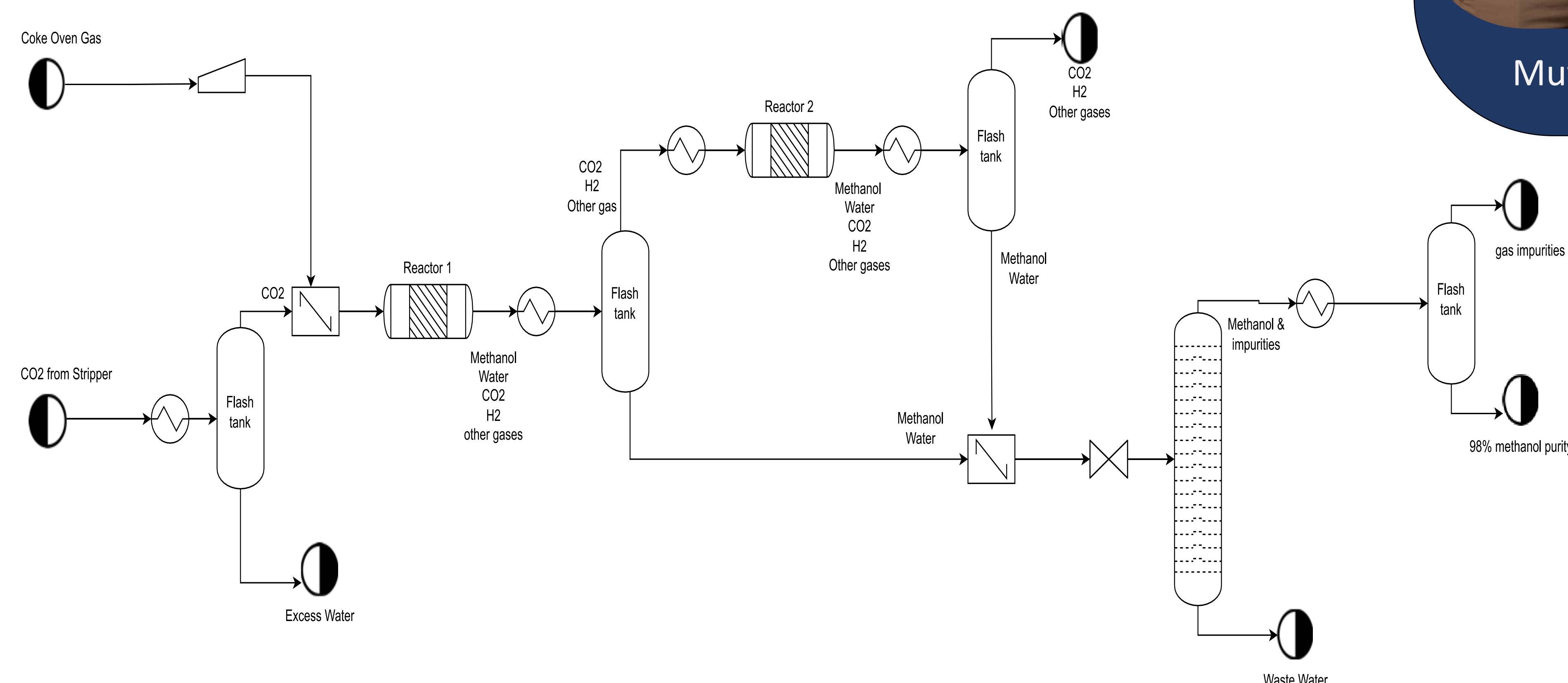
CO₂ Separation Stages

The first goal of our design is to isolate the waste carbon dioxide from the flue gas feed. This was accomplished by using a monoethanolamine (MEA) and water solution to strip out the carbon dioxide. After this initial step, the carbon dioxide had to be separated from the water and MEA. The water and MEA are then recycled to the first column. Overall, 99.9% of the carbon dioxide from the flue gas feed is sent to the reactor system.



Methanol Reaction Stages

After the carbon dioxide is separated from the nitrogen, it is pressurized and fed to a reactor system to generate methanol. The reaction converts 64% of the carbon dioxide fed into methanol. A flow of 114,000 pounds per hour of methanol was generated. This system utilizes two reactors in order to help convert more of the carbon dioxide. The second reactor converts an additional 60,000 pounds per hour of carbon dioxide.



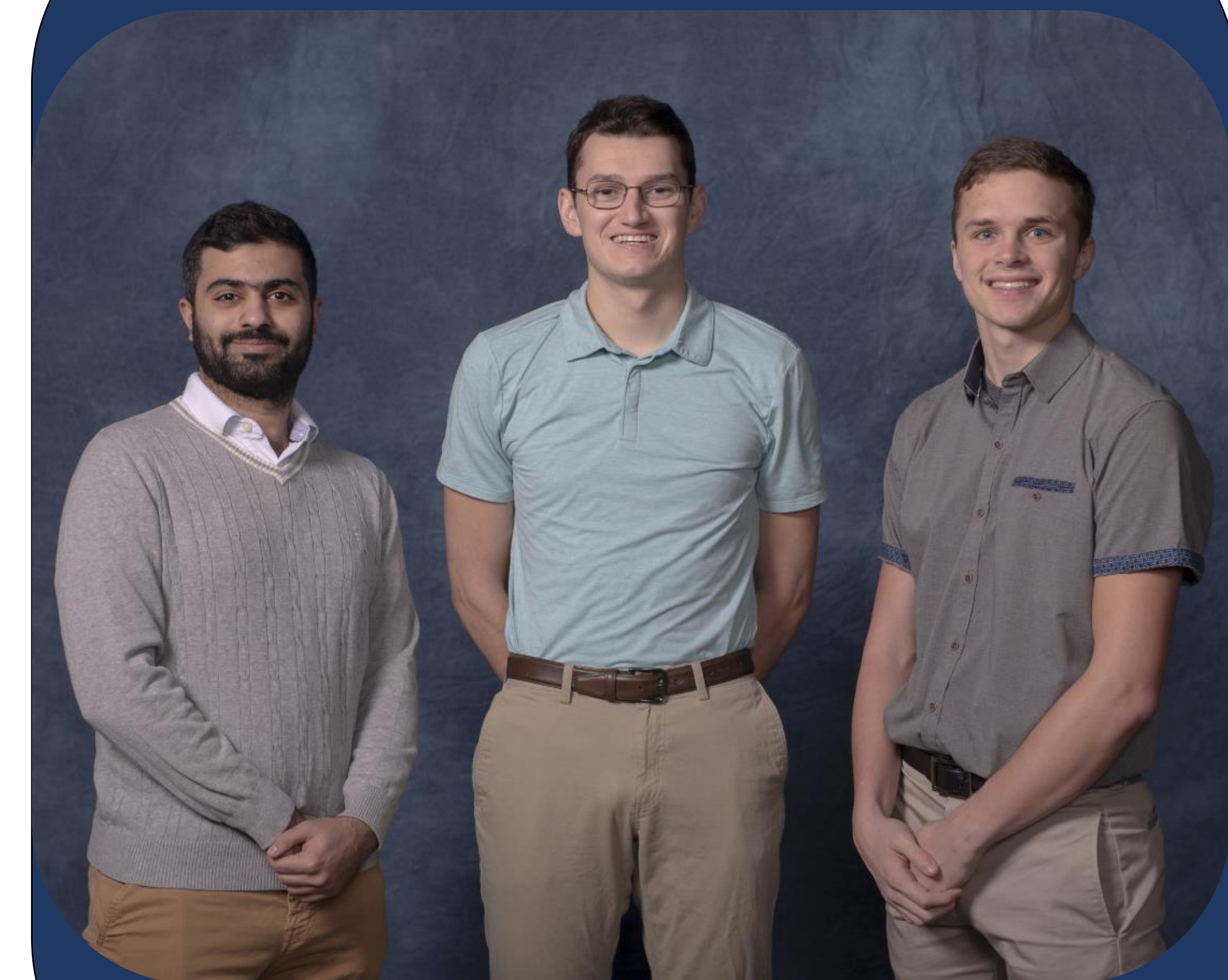
Pricing

Fixed Costs	\$M
Fixed Capital Investment	\$100.5
Working Capital	\$10.1
Total Capital Investment	\$110.6

Operating Costs	\$M/yr
MEA	\$241.1
Coke oven gas	\$23.7
Catalyst (Cu/ZnO/Al2O3)	\$22.3
Electricity	\$15.7
Labor	\$5.3
Net Steam Credit	\$44.8

Economic Analysis	Sale Price
Break Even Point	\$0.264 per pound
20-year 20 % Rate of Return	\$0.286 per pound

Our Team



Mutlaq

David

Adam

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- Carmeuse
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- Dr. Wagner
- Dr. Borden
- Jeff Raymond