

Eco-Methanol: Sustainable Methanol From Biomass and Green Hydrogen



SCHULICH
School of Engineering



Sponsored by:
HATCH

Schulich School of Engineering, University of Calgary

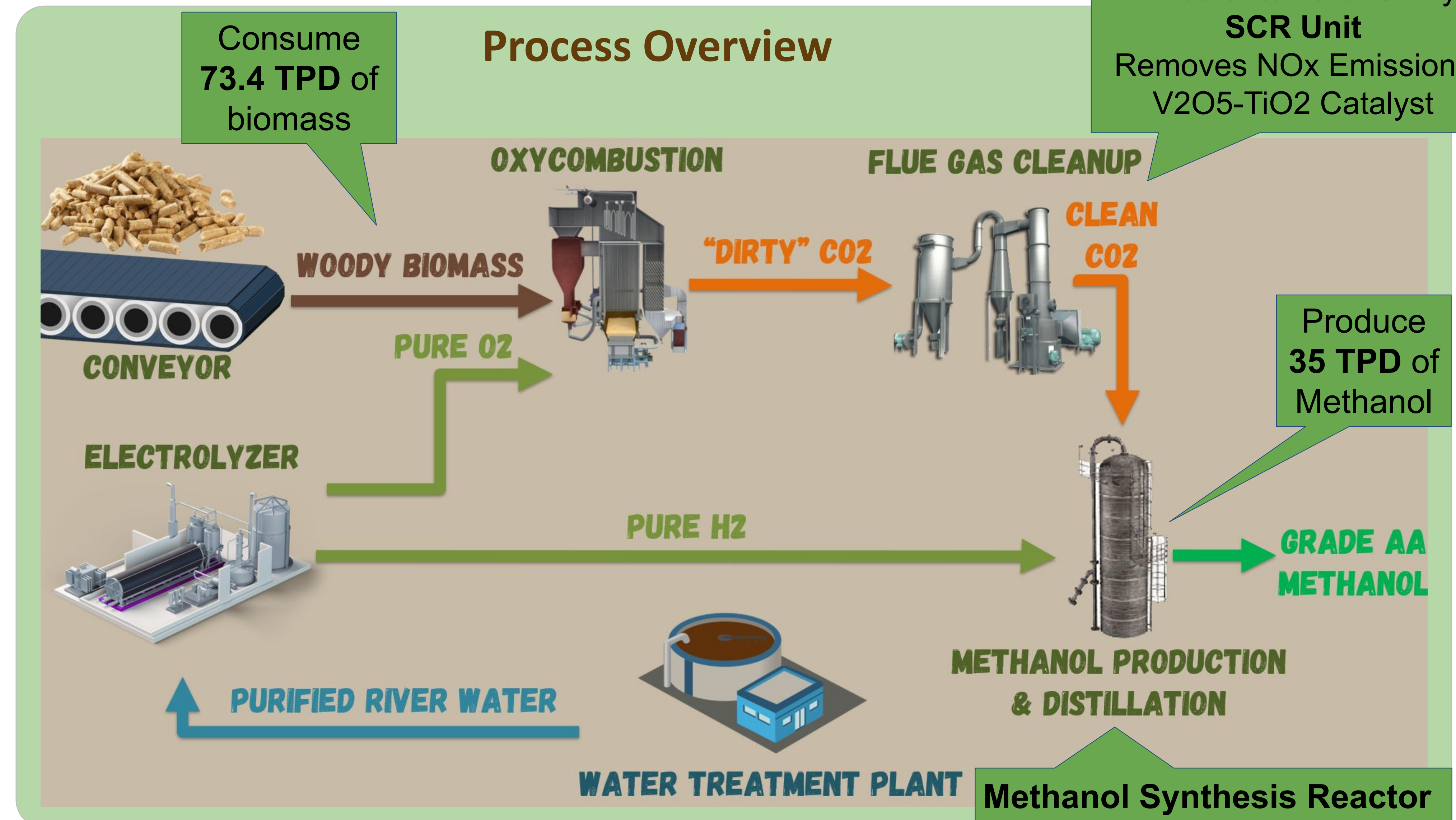
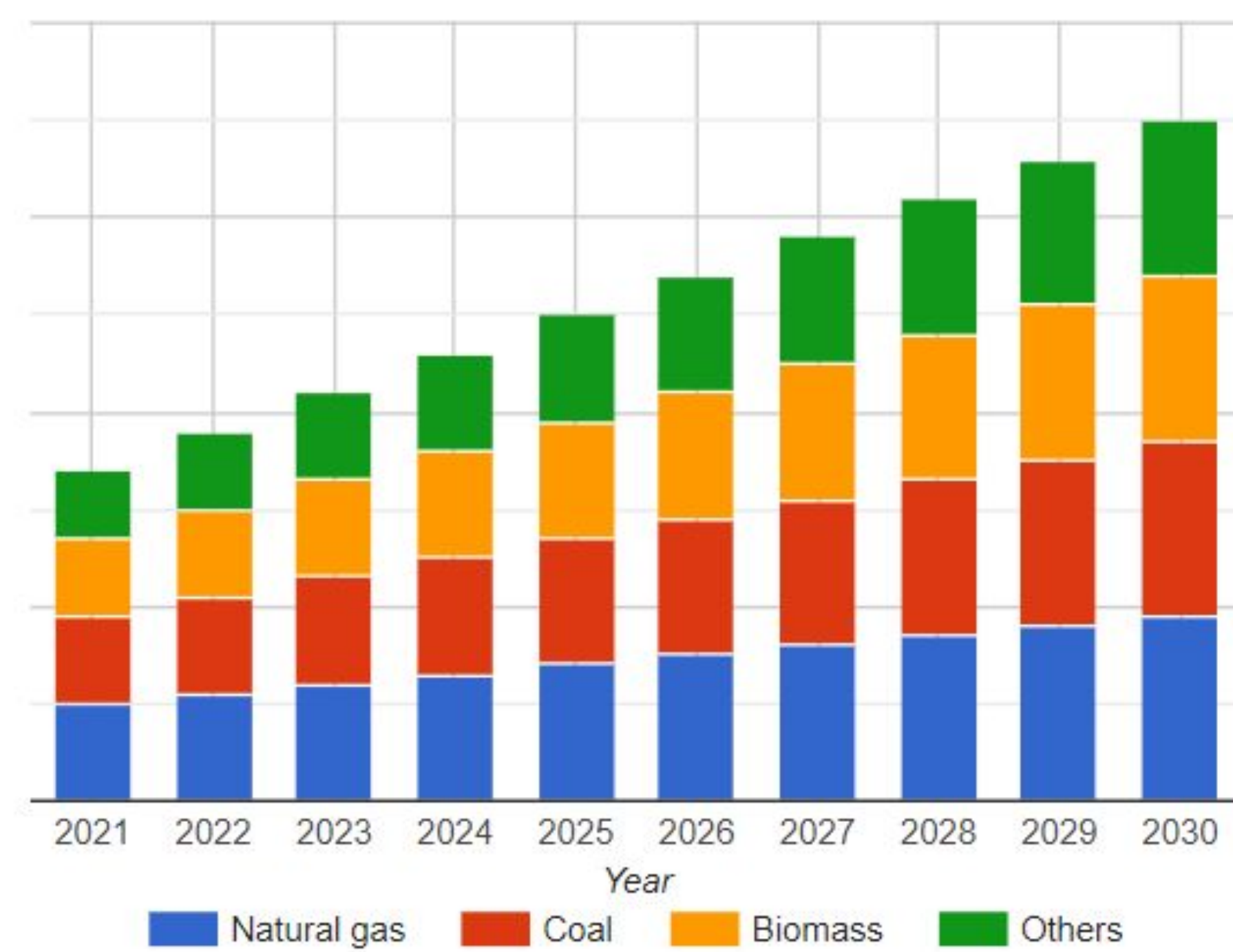
Members: Jan Rehak, Neel Kulkarni, Yousef Abdallah, David Svoboda, Amr Emara

Supervisor: Dr. Hua Song

Problem

- 90% of global methanol production utilises natural gas - a **NON-RENEWABLE** resource - as a feedstock
- Biomass in the form of tree slash is burnt, contributing to **EMISSIONS**

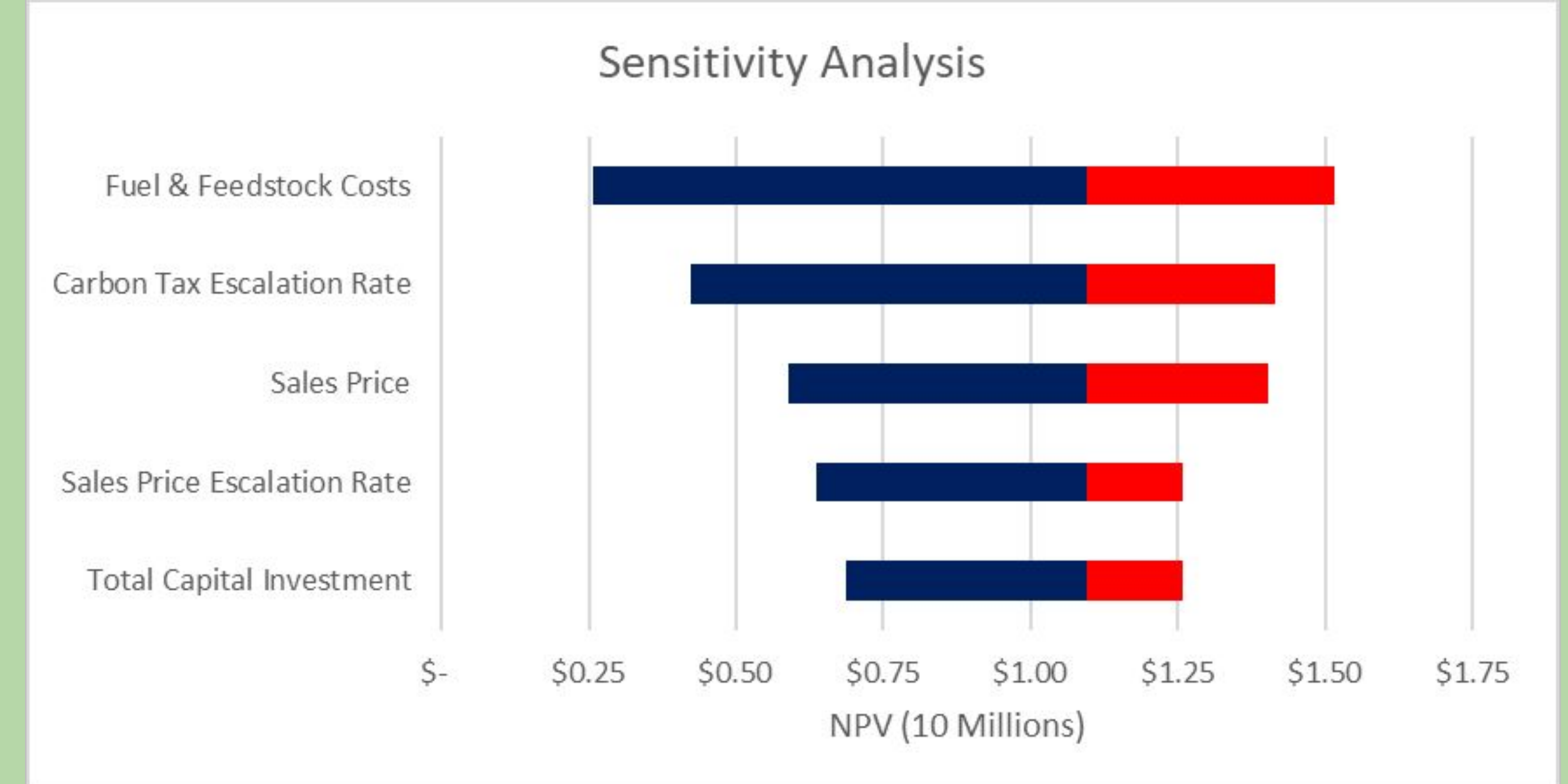
Global Methanol Market Size By Feedstock 2021-2030 (\$ Bn)



Electrostatic Precipitator
Removes particulates
Wet FGD Absorber
Removes SOx Emissions
Limestone/Water Slurry
SCR Unit
Removes NOx Emissions
V2O5-TiO2 Catalyst

Is It Feasible?

Economic Indicator	Value
Total Equipment Cost (\$MM)	105
Total Capital Investment (\$MM)	192
NPV (\$MM)	13
ROR (%)	13
Years to Break-Even	7
Discounted Payback Period (Years)	17
Annual Operating Costs	115



Our Solution

- Oxy-Combustion **eliminates CO production** which reduces hazards and unwanted side reactions
- Unique Electrolyzer use case** utilizing the oxygen produced from water electrolysis for Oxy-Combustion
- Heat from combustion used for **steam generation** which powers equipment
- Methanol** is an important intermediate product useful for making **fuels, insulation, and plastics**



Biomass

Torrefied Pine Wood Pellet Compositional Analysis	
Proximate Analysis (wt%)	Value
Moisture	2.5
Ash	0.4
Volatile Matter	68.6
Fixed Carbon	28.5
VM/FC Ratio	2.41
Ultimate Analysis (wt% dry ash free)	Value
Carbon	60.43
Hydrogen	5.70
Nitrogen	0.16
Sulphur	0.02
Chlorine	0.02
Oxygen	33.66

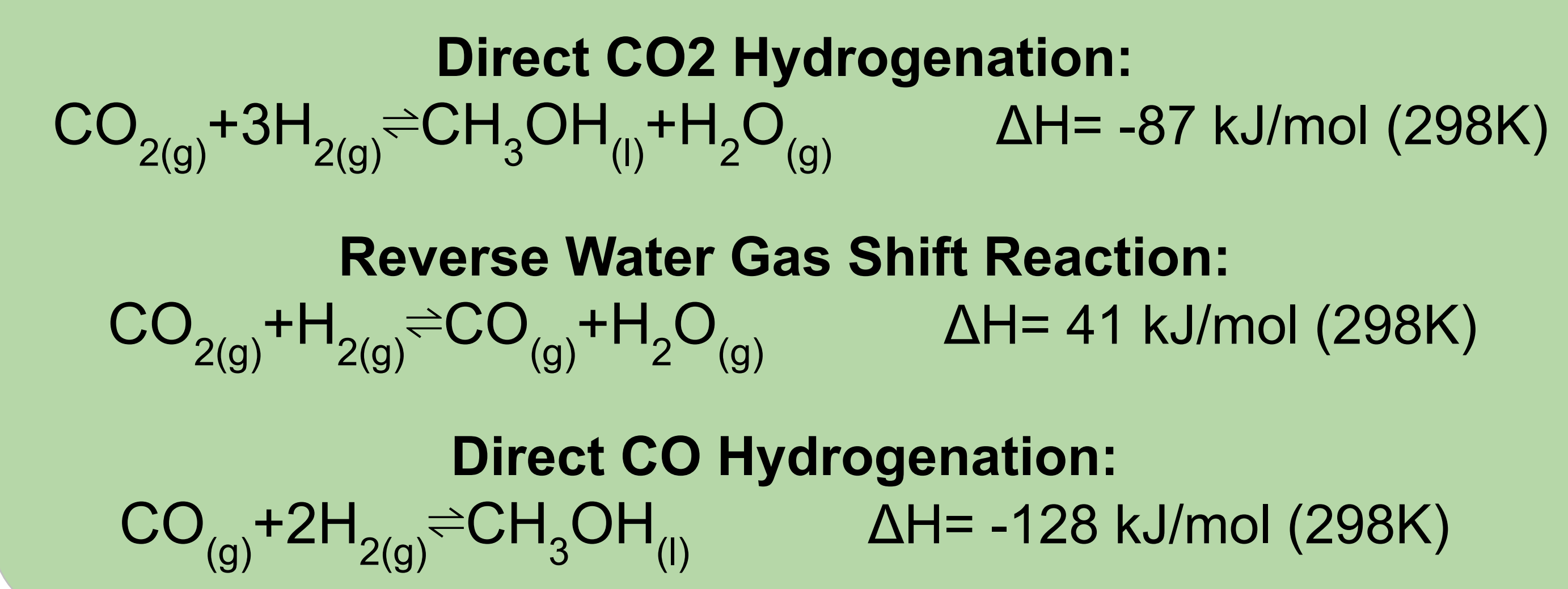


Methanol Synthesis Reactor
~30% conversion
Distillation Column
Produce Grade AA Methanol (99.85 wt%)

Acknowledgements

This project would not have been possible without the mentorship and guidance of **Dr. Hua Song** across the process selection and design phase.
Special thanks to the following individuals from Hatch for technical and commercial process advisory:
Ethan Ng | Lisa Zhong | Wessel Nel | Sanjiv Save | Kerry McKenna

Methanol Synthesis



Geography & Utilities

Location: Vanderhoof, British Columbia
Water Source: Nechako River
Electricity: Hydropower sourced from Kenney Dam; Kemano Generating Station