

The value of biomass in the transition to net-zero carbon emission economies

Dr. Fangwei Cheng

Postdoctoral Research Associate | Princeton University

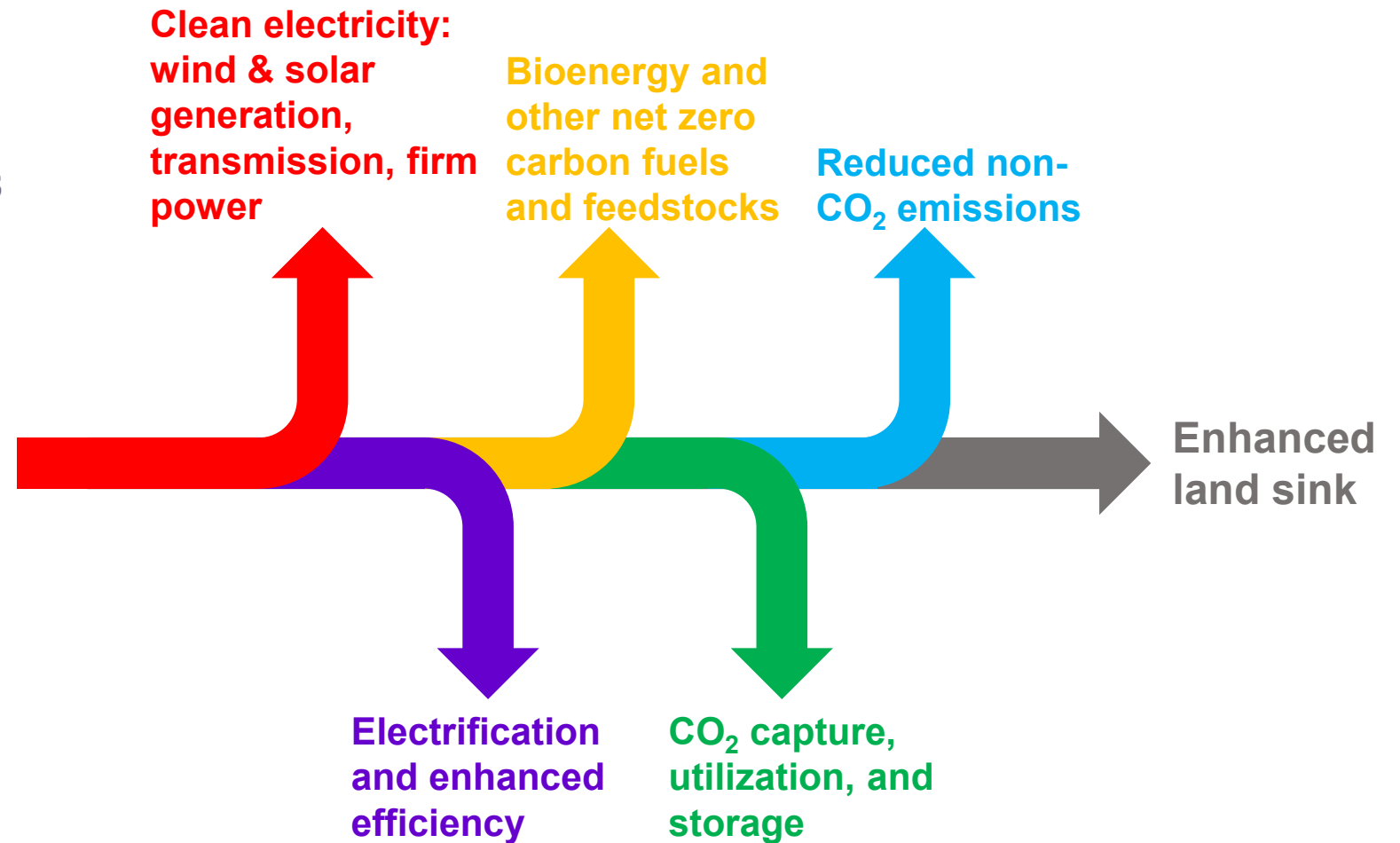
Andlinger Center for Energy and the Environment

tcbiomass: Achieving Net Zero Carbon Goals – the Role for Biomass

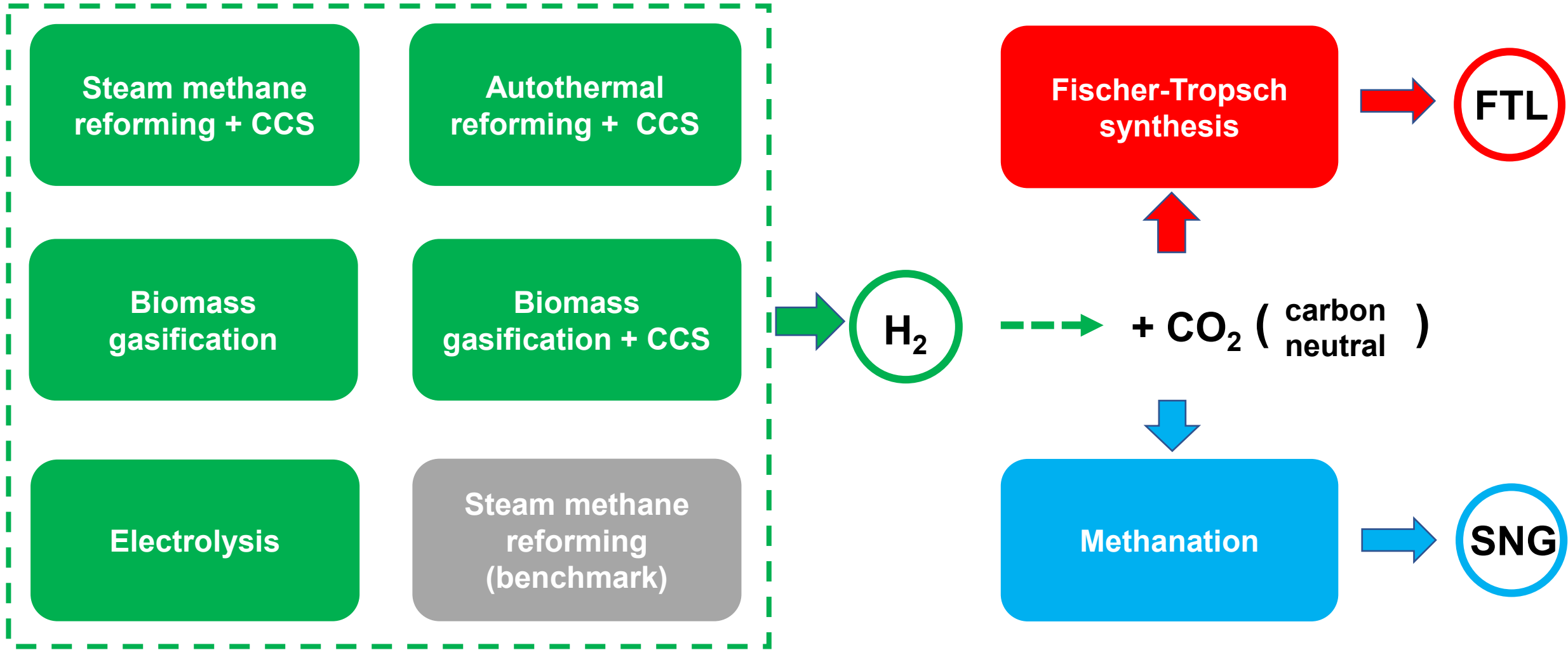
19-21 April 2022, Denver, Colorado

Net zero strategies

NET-ZERO AMERICA: Potential Pathways, Infrastructure, and Impacts



15 Clean Pathways for H₂, FTL, and SNG Productions



Levelized Cost of Carbon Mitigation (LCCM)

$$\text{Levelized cost of fuel (LCOF)} = \frac{\text{Sum of cost over the life time (\$)}}{\text{Sum of energy produced over lifetime (GJ)}}$$

&

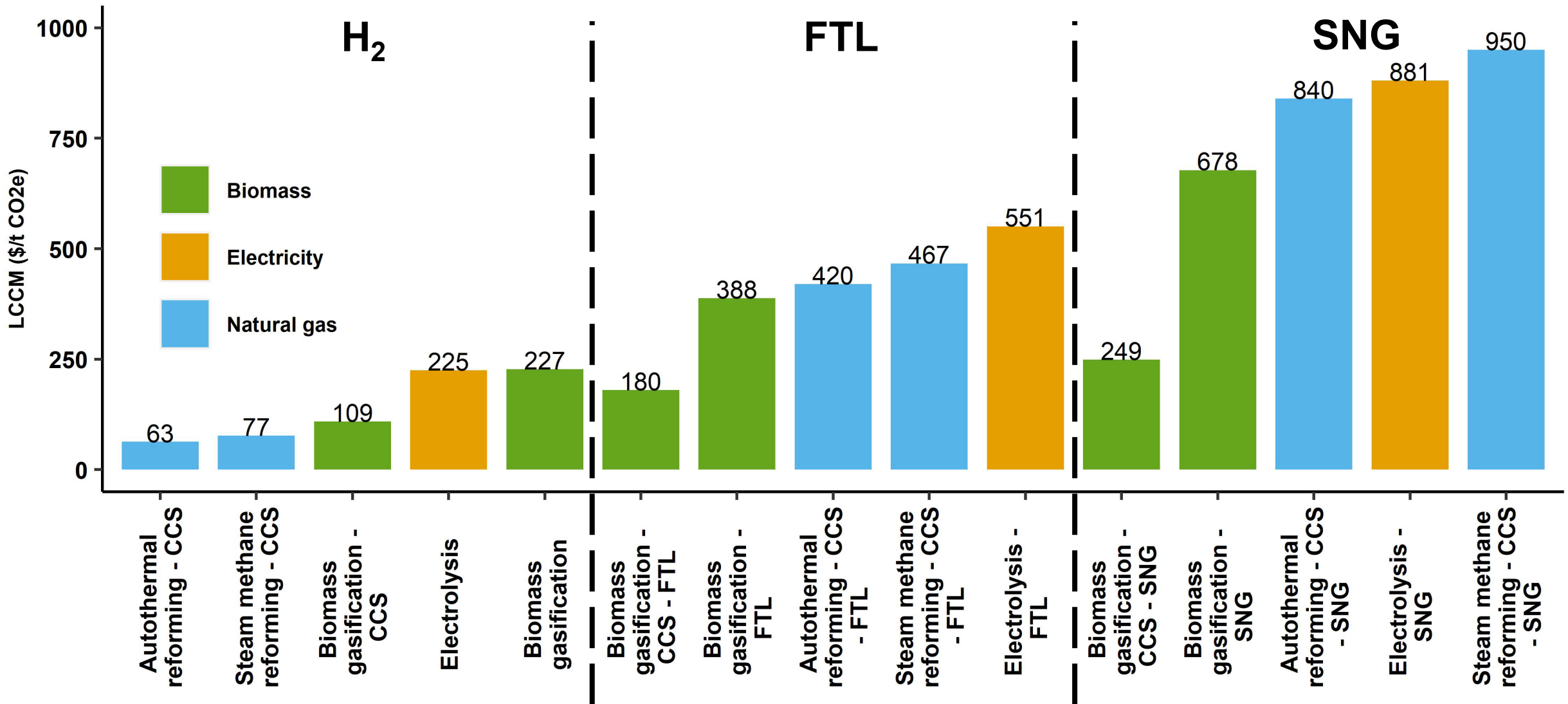
$$\text{Life cycle GHGs} = \frac{\text{Sum of life cycle GHGs over the life time (t CO}_2\text{e)}}{\text{Sum of energy produced over lifetime (GJ)}}$$



Levelized cost of carbon mitigation(LCCM)=

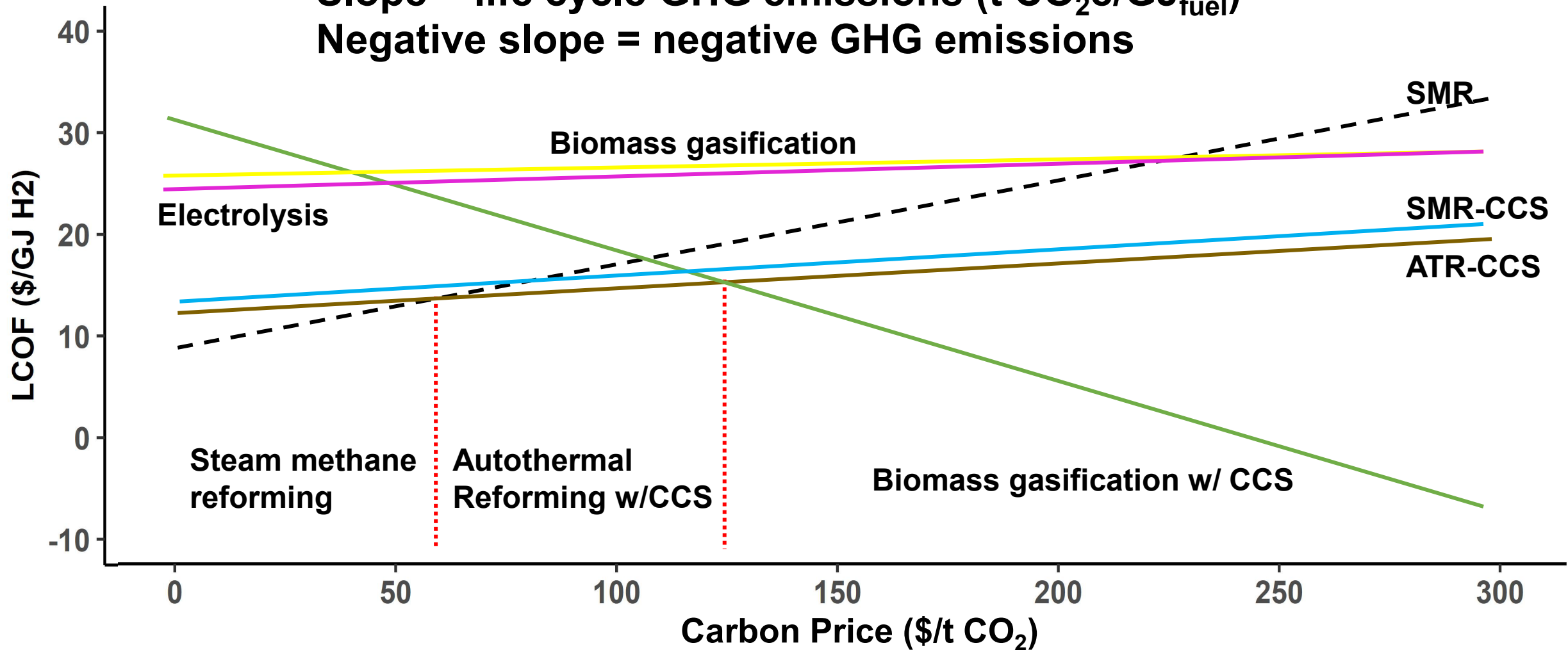
$$\frac{\text{Financial cost}}{\text{GHG reduction}} = \frac{(\text{LCOF}_{\text{evaluated technology}} - \text{LCOF}_{\text{benchmark}})[\$ \text{ per GJ energy}]}{(\text{GHG}_{\text{benchmark}} - \text{GHG}_{\text{evaluated technology}})[\text{t CO}_2\text{e per GJ energy}]}$$

LCCM Facilitates Cross Fuel Comparison



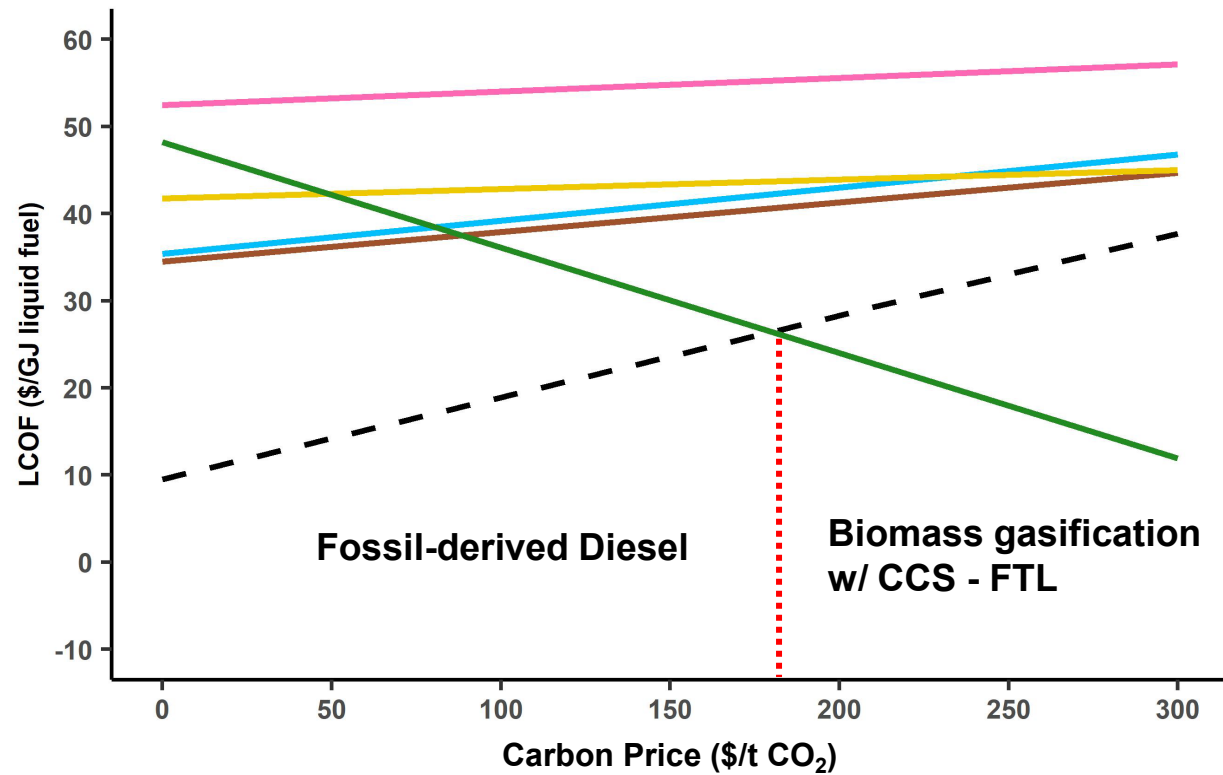
Levelized Cost of H₂ as function of CO₂ price

Slope = life cycle GHG emissions (t CO₂e/GJ_{fuel})
Negative slope = negative GHG emissions

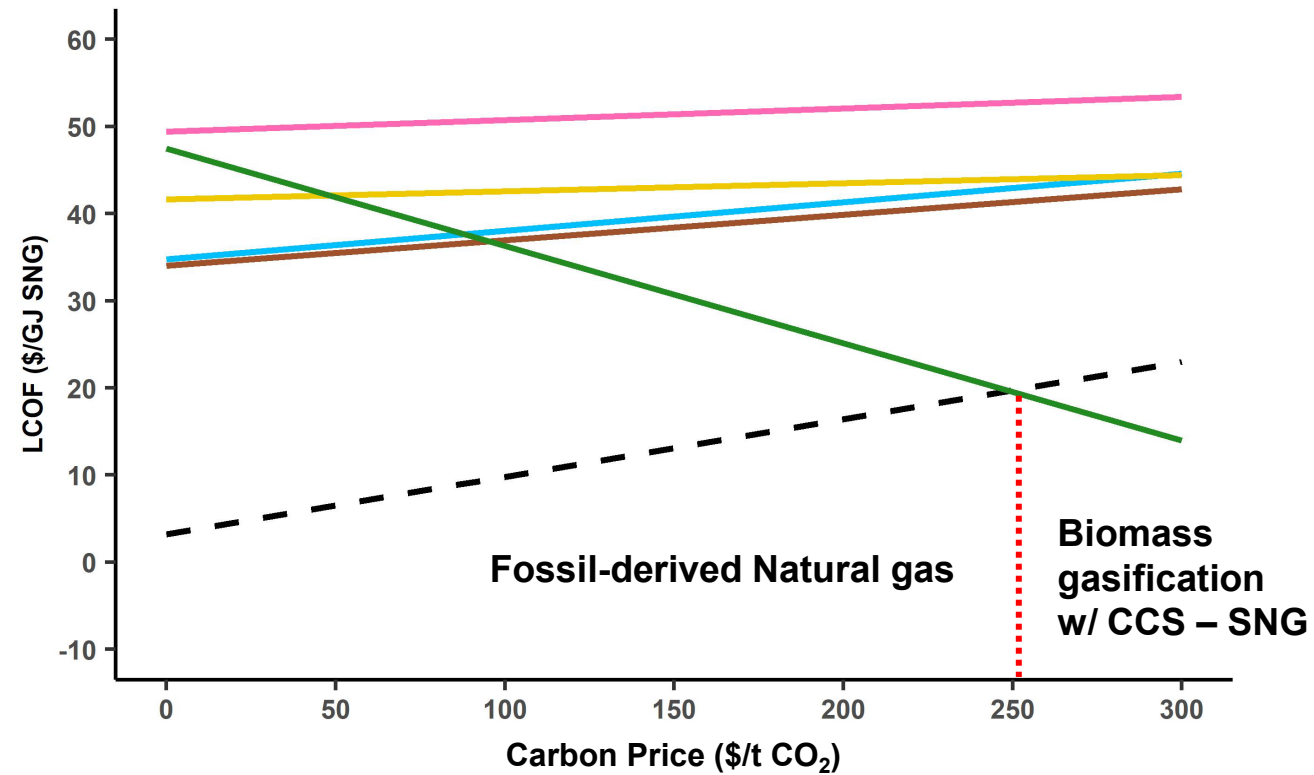


Levelized Cost of FTL and SNG as function of CO₂ price

Levelized cost of FTL



Levelized cost of SNG



- Fossil diesel
- P7 SMR-FTL
- P8 ATR-FTL
- P9 Elec-FTL
- P10 BGH2-FTL
- P11 BGCCS-FTL

- Fossil NG
- P12 SMR-SNG
- P13 ATR-SNG
- P14 Elec-SNG
- P15 BG-SNG
- P16 BGCCS-SNG

Key takeaways

- 1. Levelized cost of carbon mitigation (LCCM) facilitates cross fuel comparisons.***
- 2. Hydrogen is less expensive to decarbonize than liquid fuel and natural gas.***
- 3. Biomass with CCS plays a potentially important role in reaching net-zero emission goals.***

Acknowledgement

