

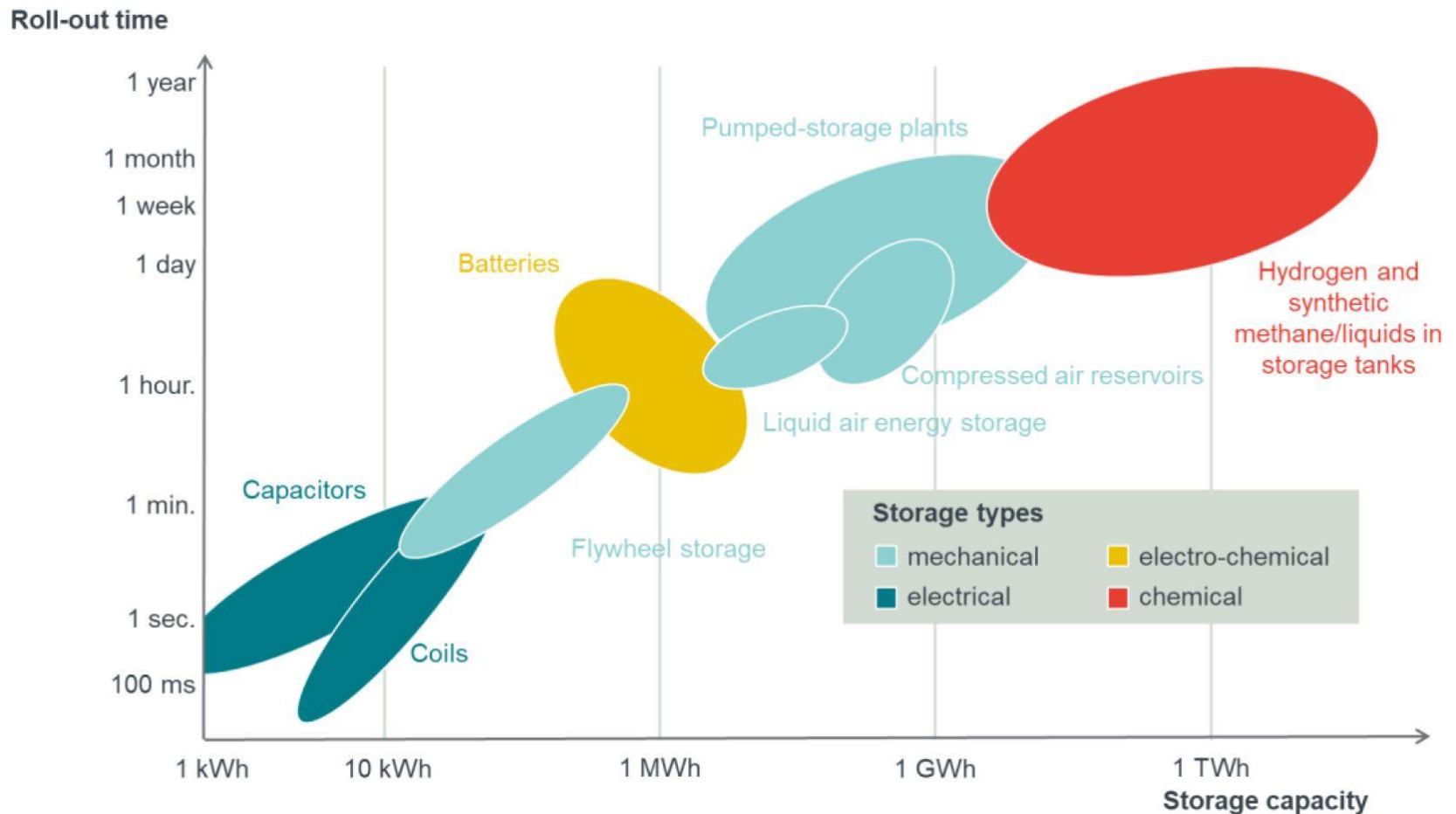


Aalto University
School of Engineering

More Flexibility with Energy Storage

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Department of Mechanical Engineering
Aalto University
25.2.2019*

Different options for energy storage





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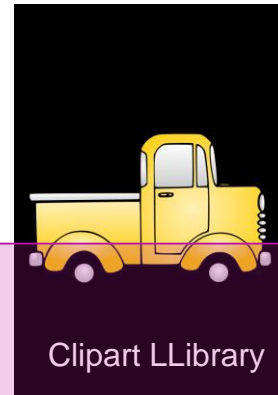
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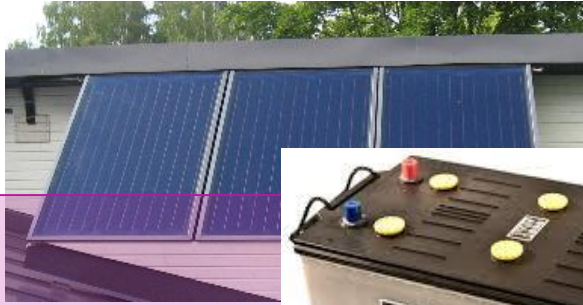
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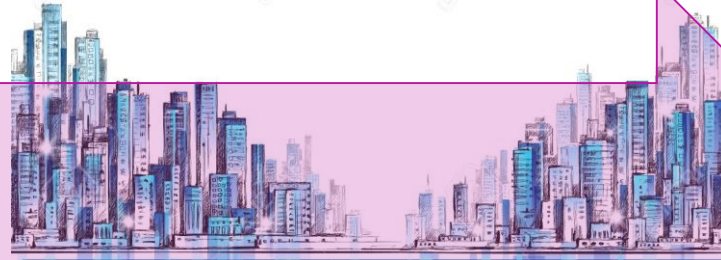
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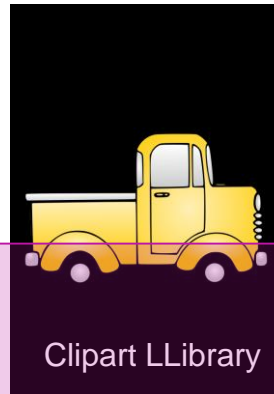
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Circular Energy Ecosystem

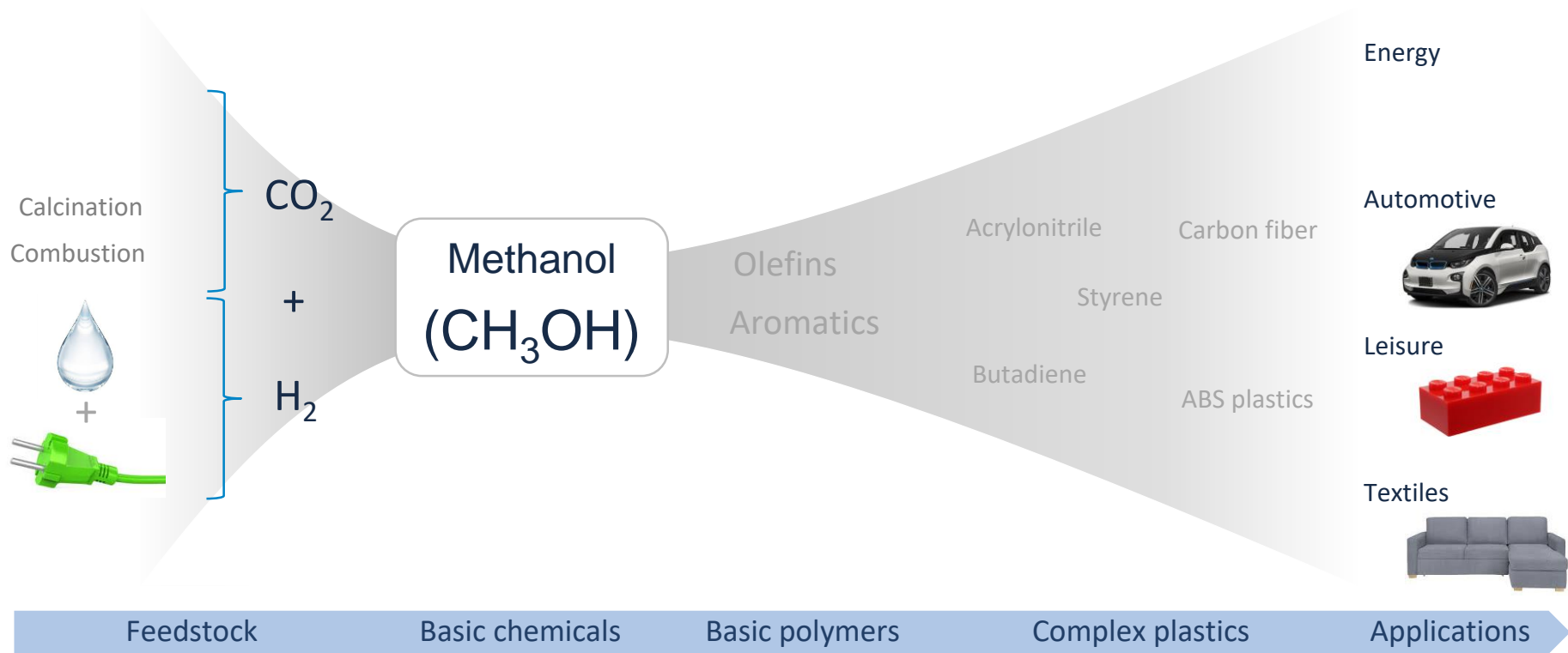


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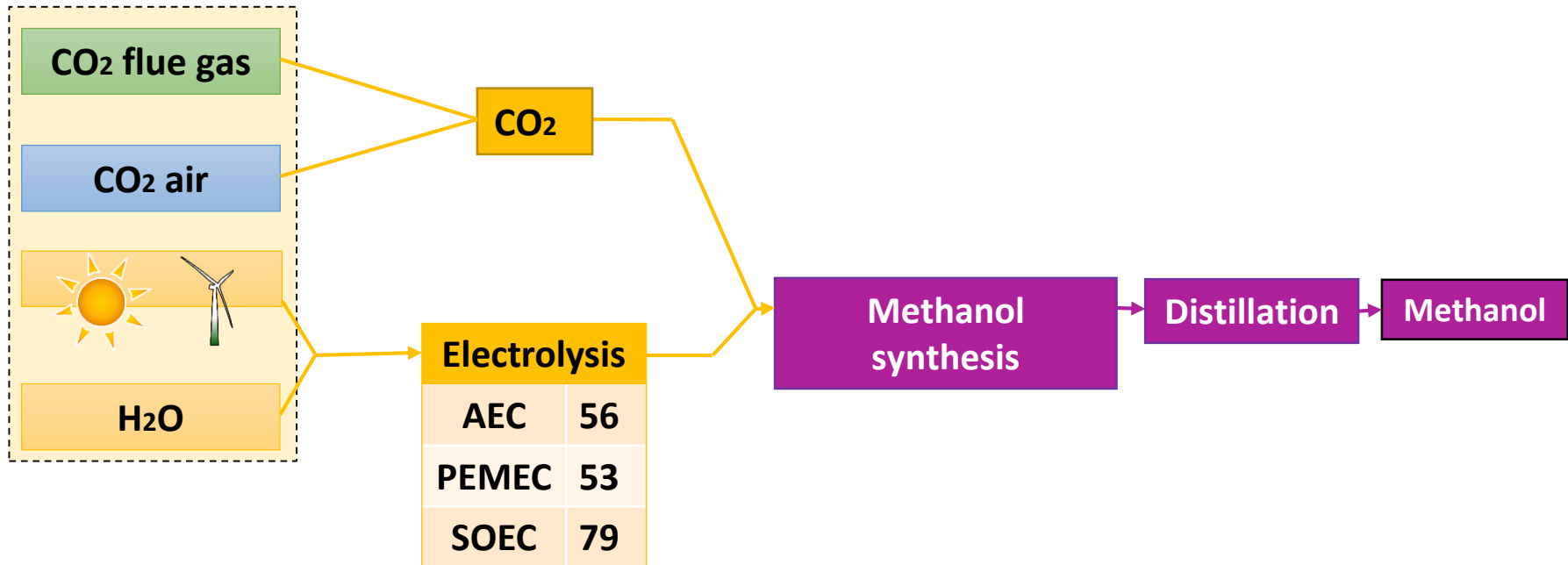
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Large-scale fossil free feedstock



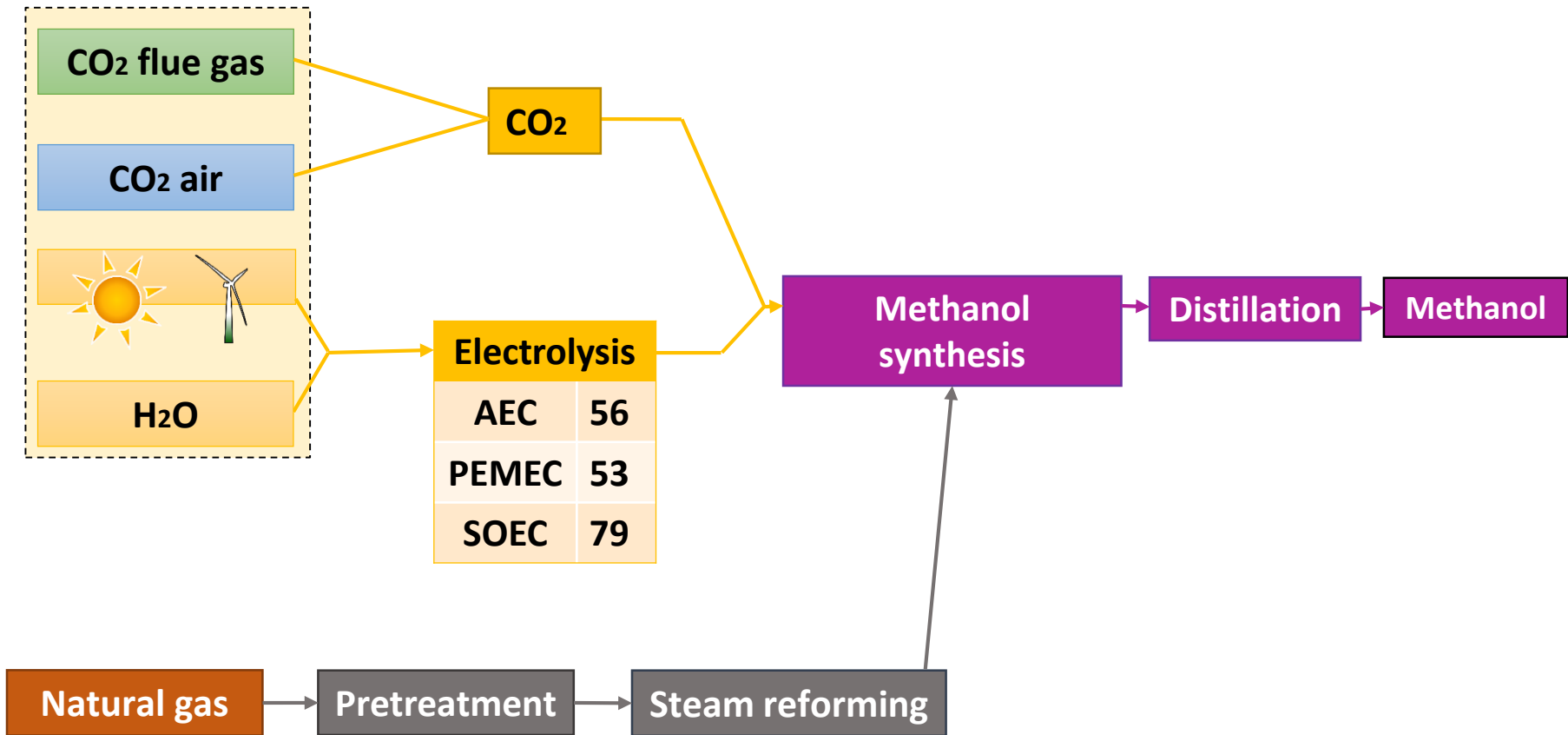
Power to methanol Efficiency

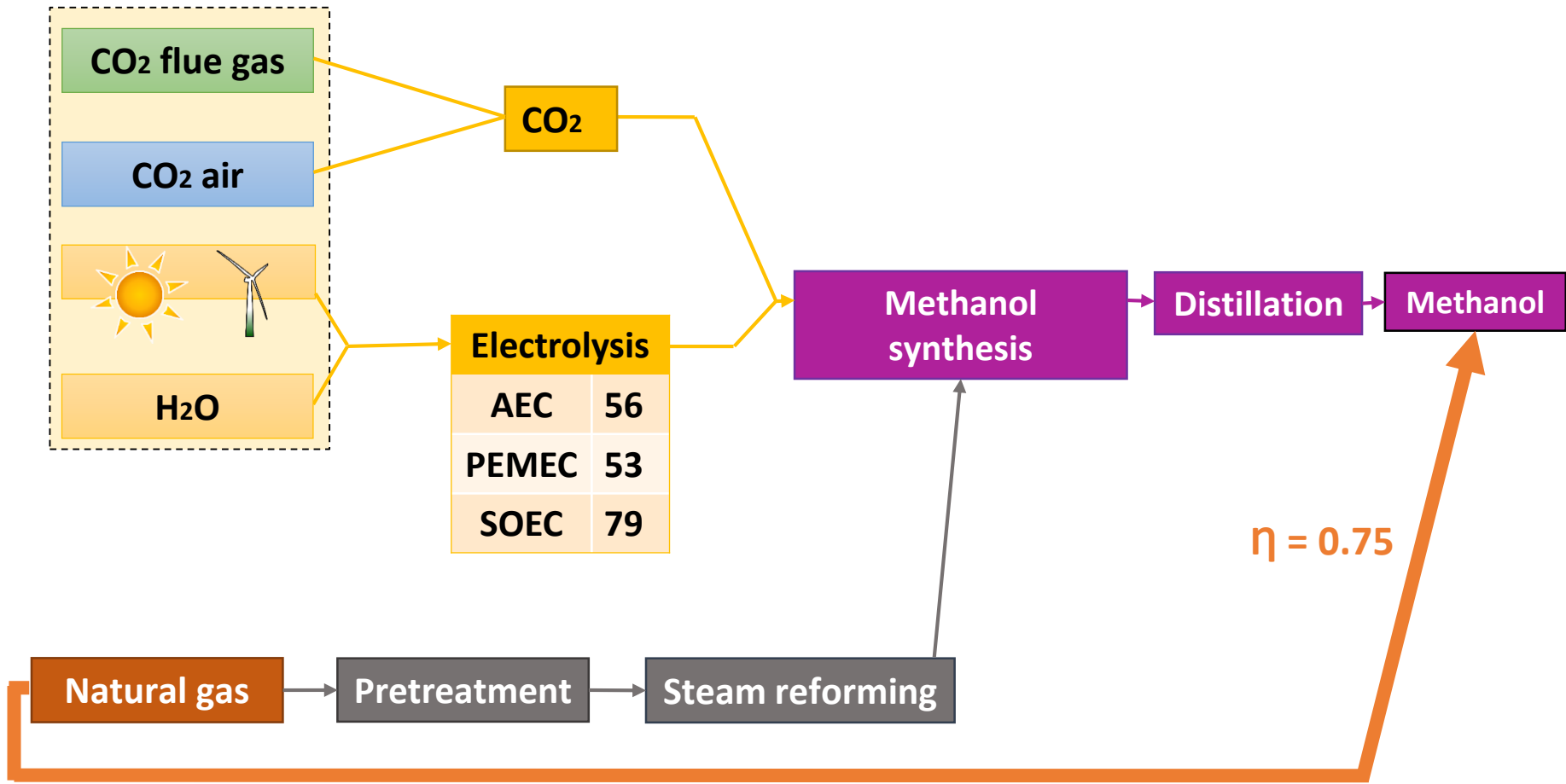
Power to Methanol

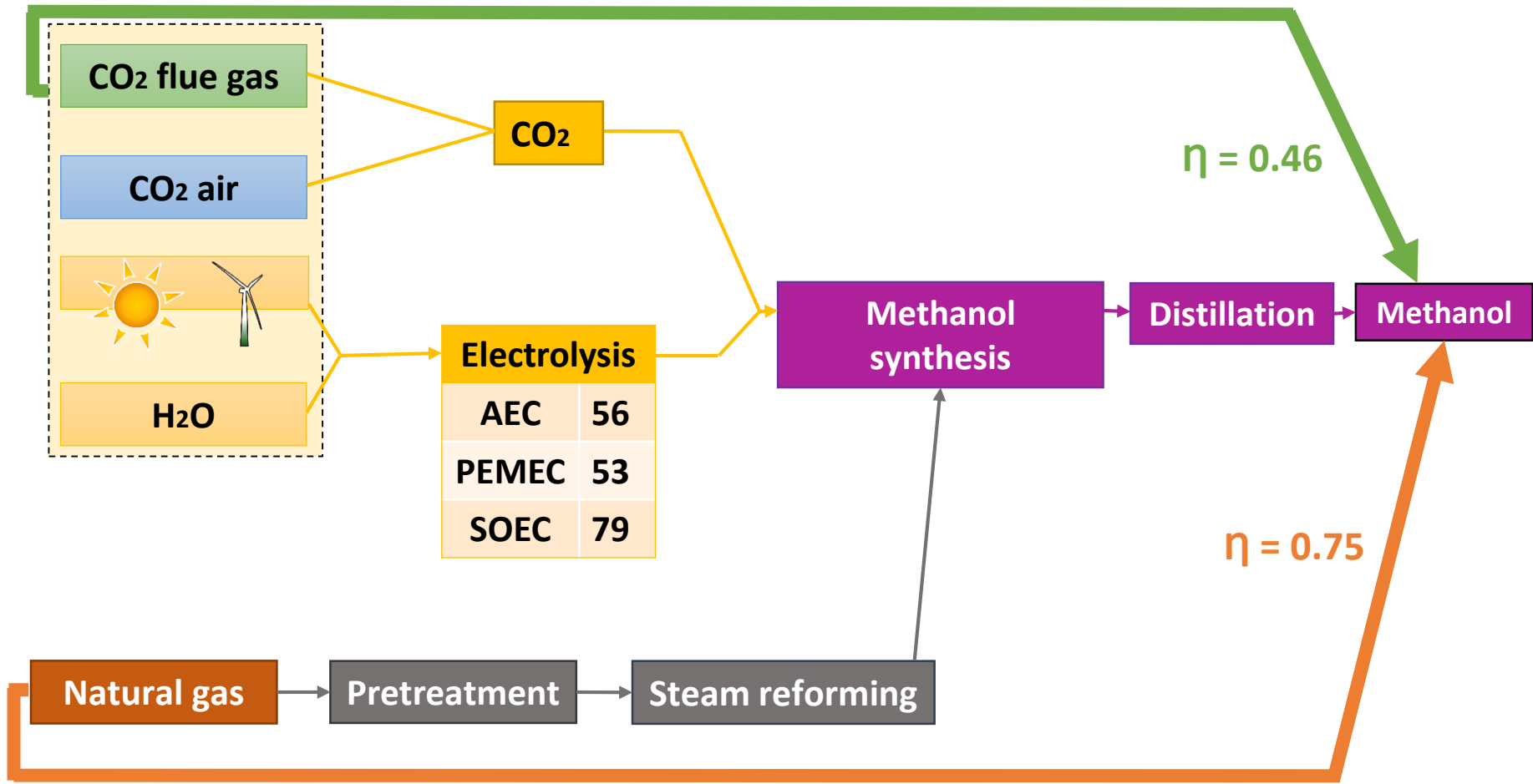


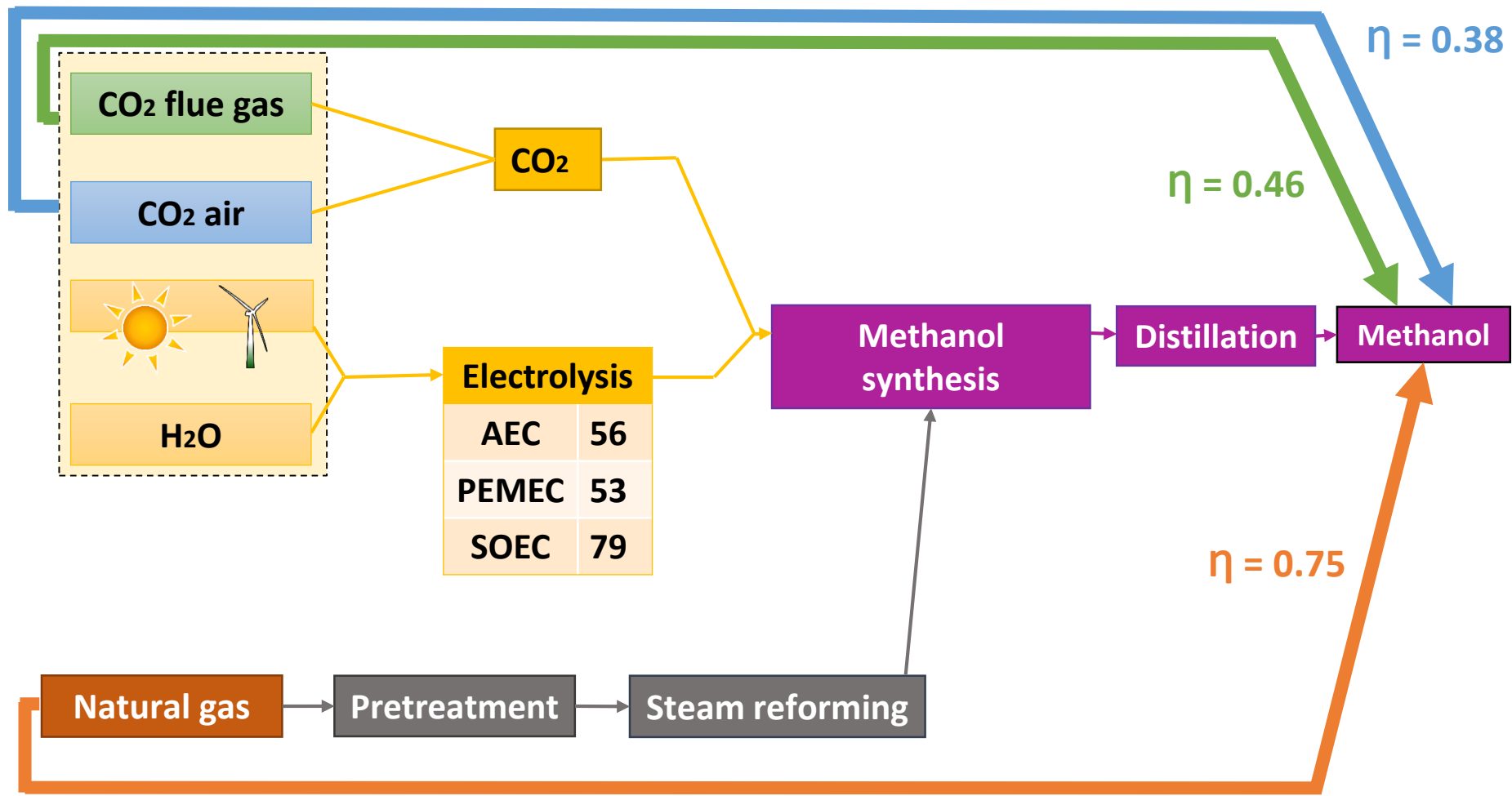
Electrolysis efficiency references:

Buttler, A. & Spliethoff, H.: Current status of water electrolysis for energy storage, grid balancing and sector coupling via power-to-gas and power-to-liquids: A review, Renewable and Sustainable Energy Reviews 82 (2018) 2440-2545.

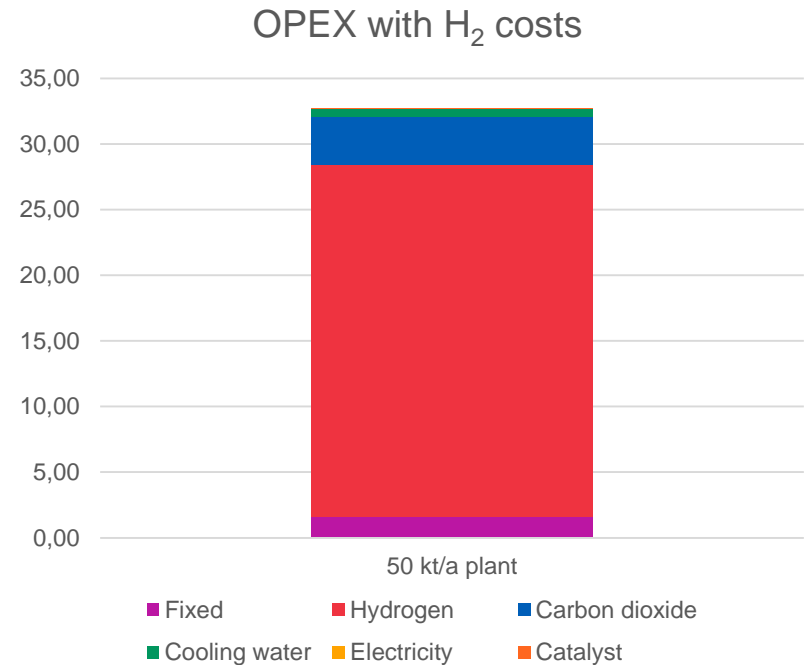
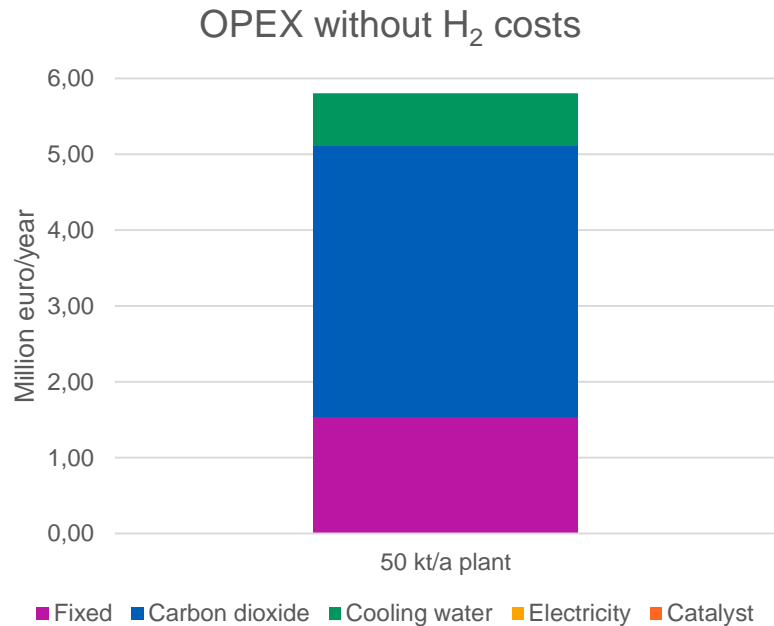






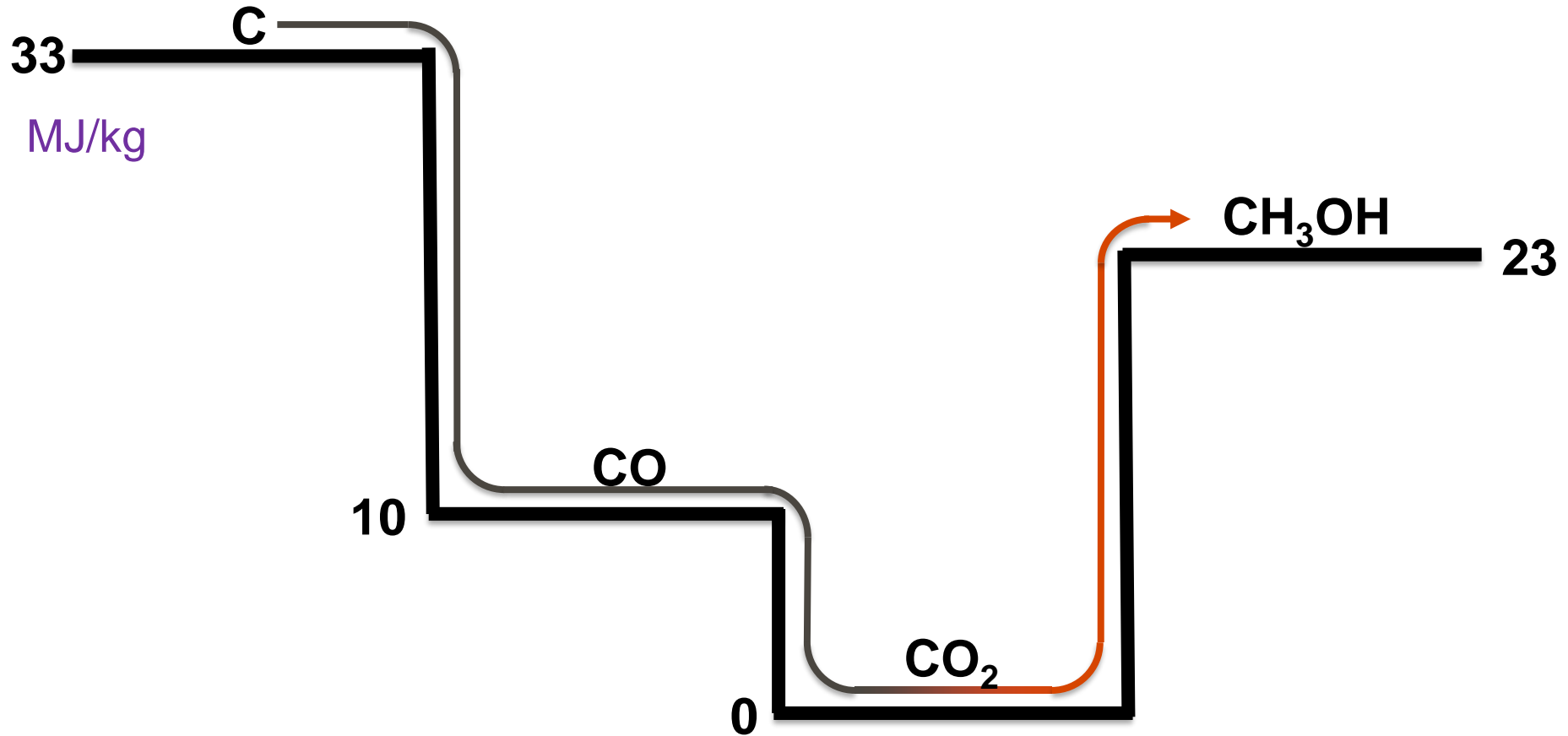


OPEX costs for Methanol plant



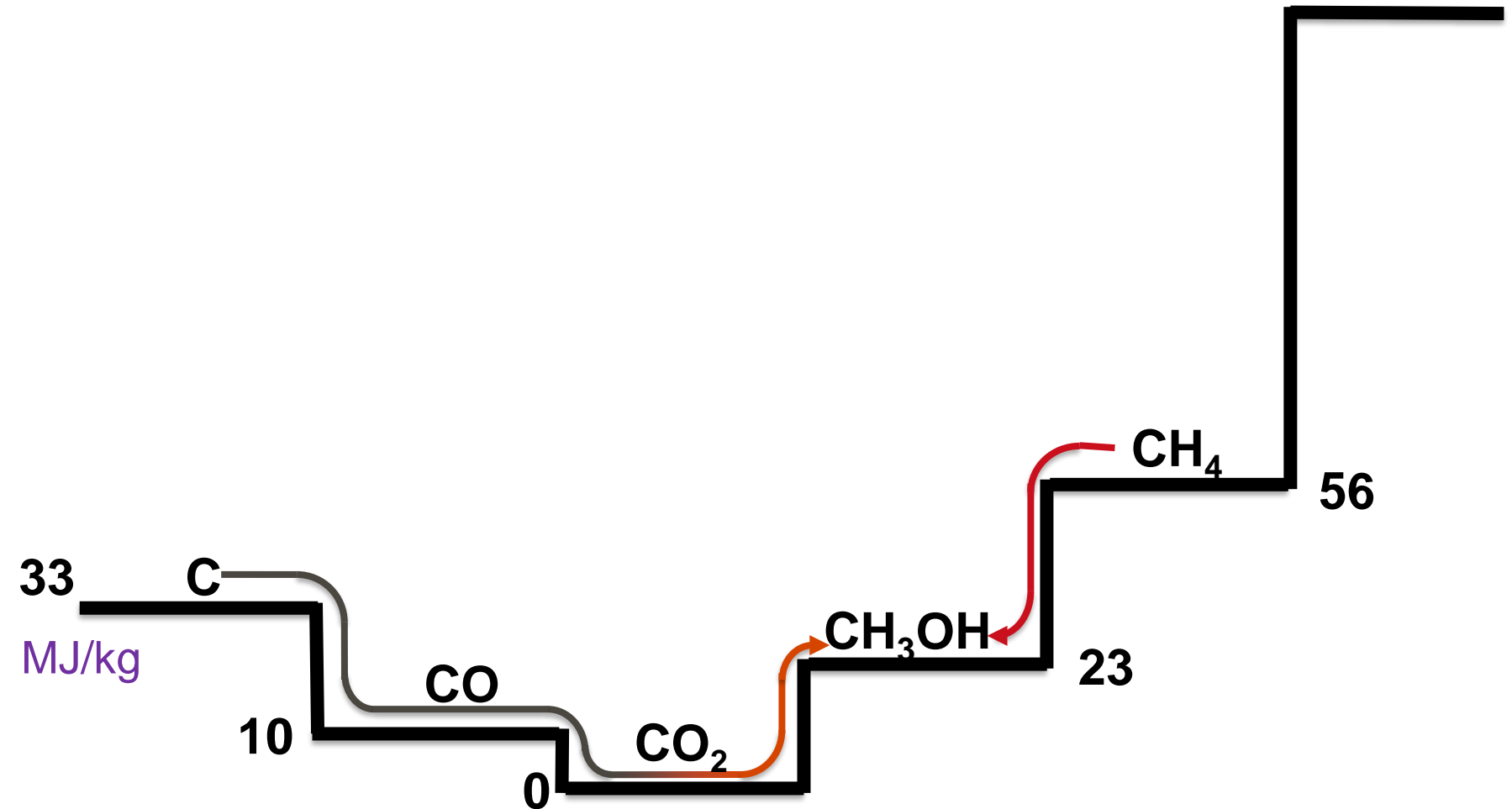
Why have we not done this before?

Thermodynamics – Heating value (HHV)



Higher heating value (HHV)

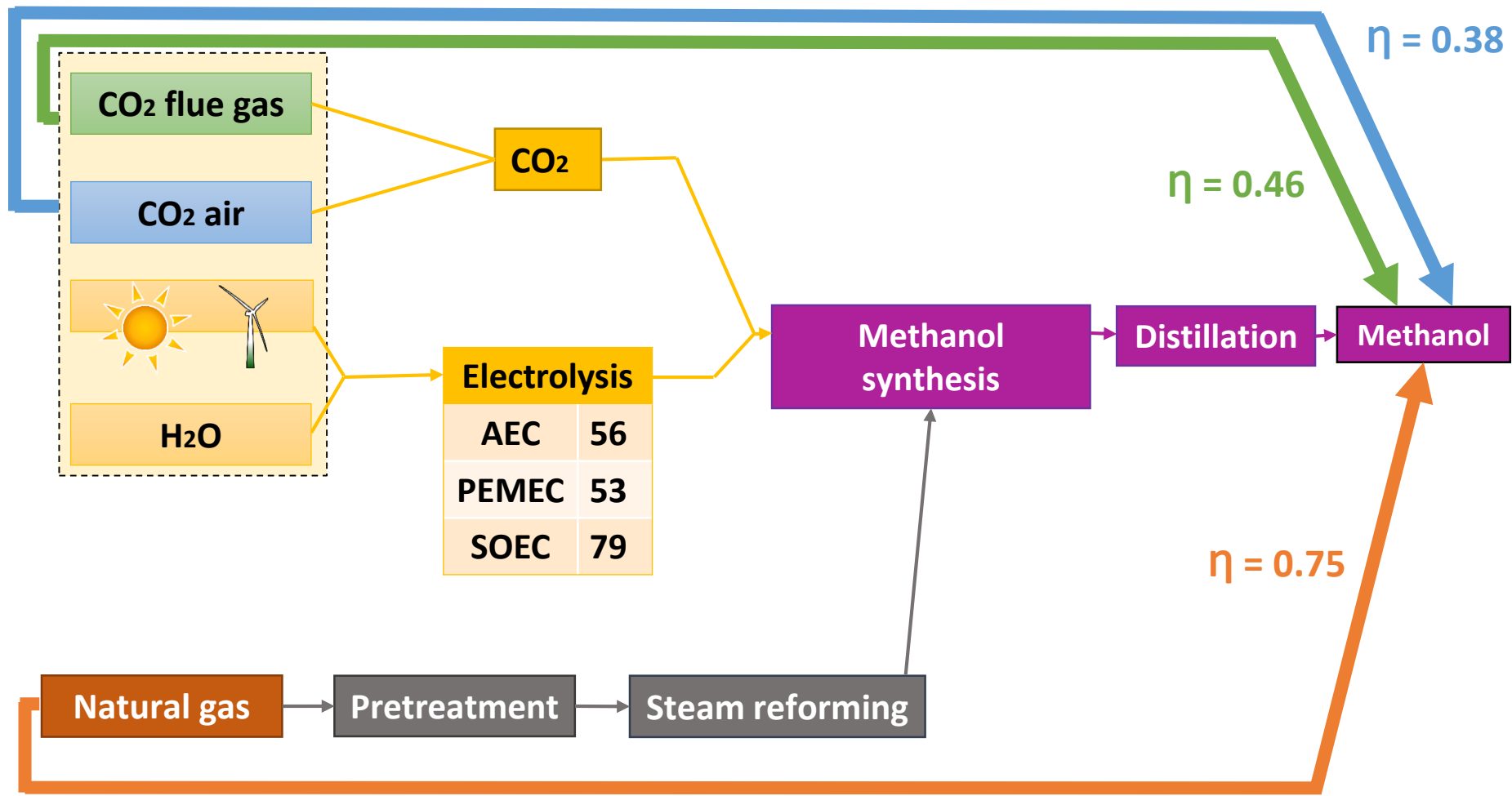
H₂ 142



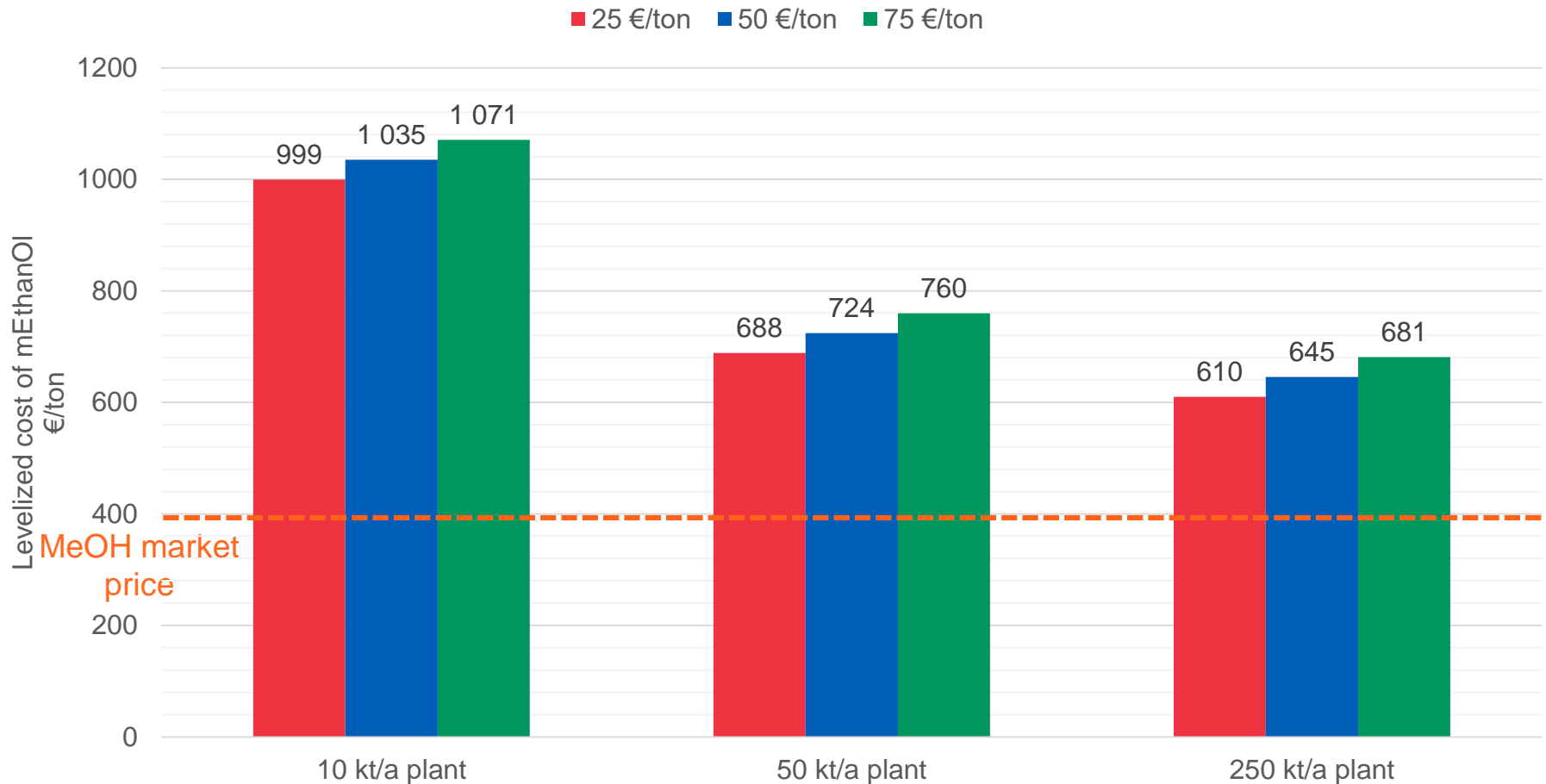
**Work against
thermodynamics**

-

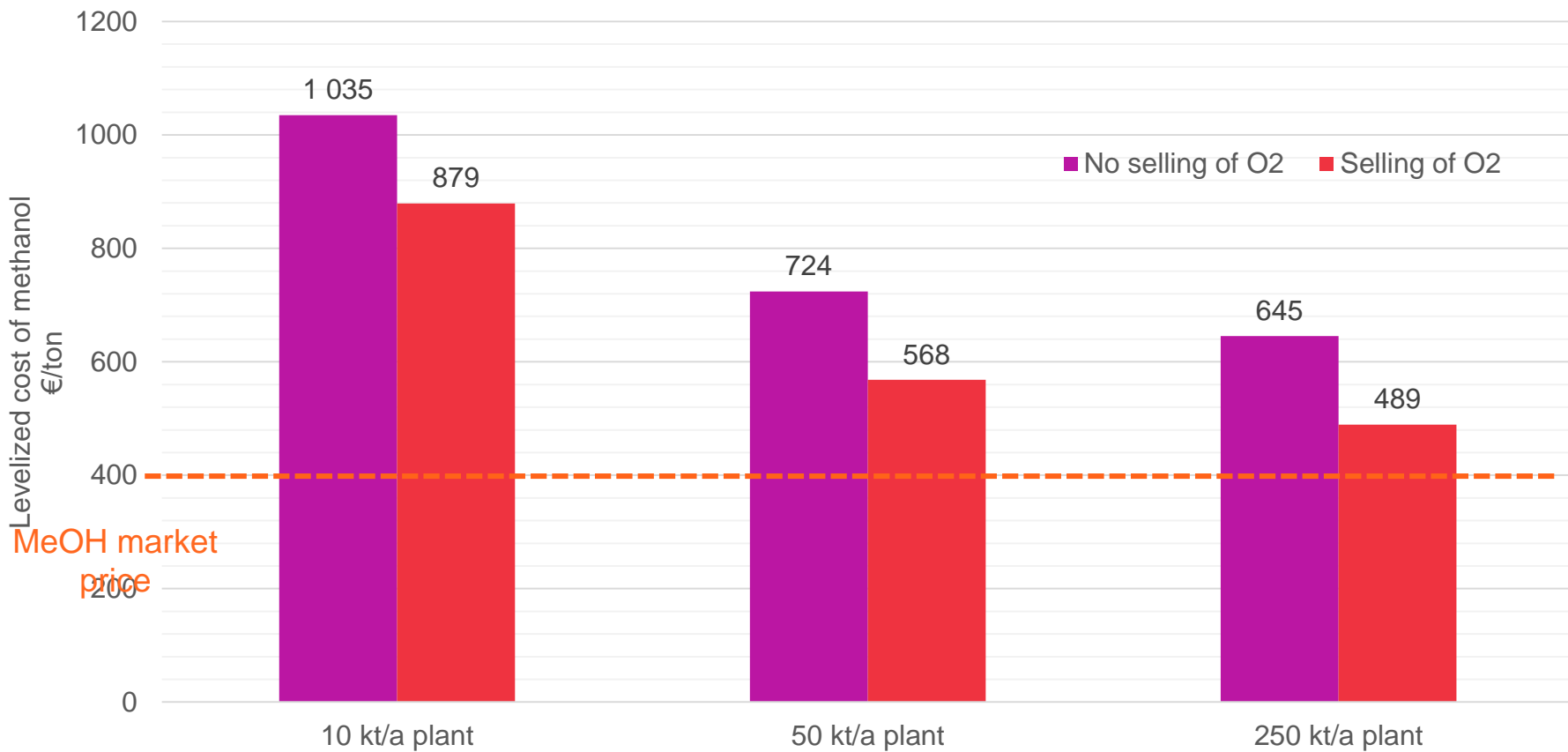
When reasonable?



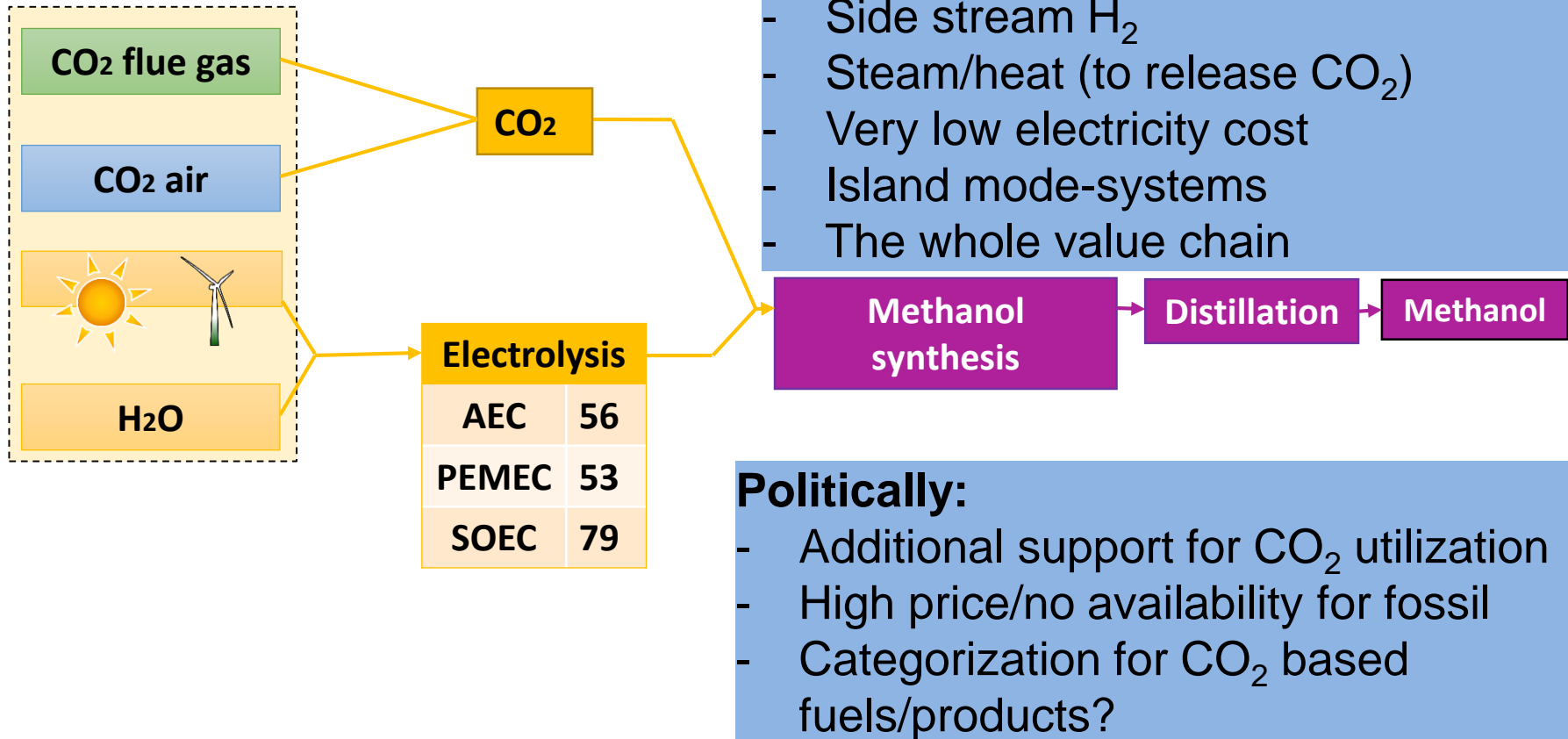
Effect of CO₂ price



Effect of selling O₂ as a by-product



Reasonable with synergies



Let's Create Together Circular Energy Ecosystem