



# Making **Optimal** **Performance** Possible

Introducing electrochemistry at Haldor Topsoe





A close-up portrait of Haldor Topsøe, an elderly man with glasses, wearing a dark suit and tie. He is looking slightly to the right of the camera with a thoughtful expression. The background is a soft, out-of-focus teal color.

“The corporate world in itself means nothing unless it improves the lives of people and the conditions in poor countries.”

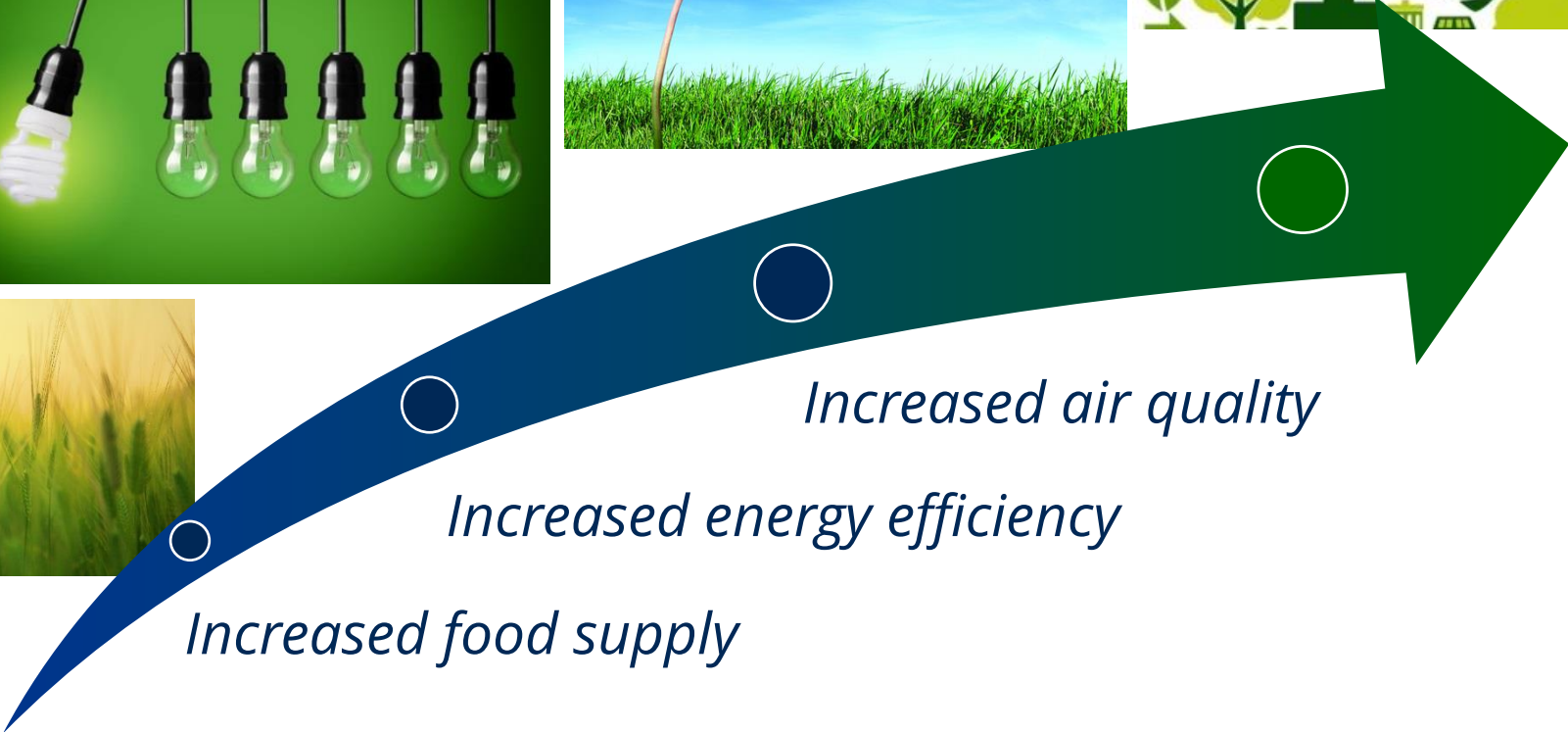
Haldor Topsøe

A handwritten signature in white ink, which appears to be 'H. Topsøe', written in a cursive style.



# Continuously enabling a sustainable future

The Topsoe way



*Increased food supply*

*Increased energy efficiency*

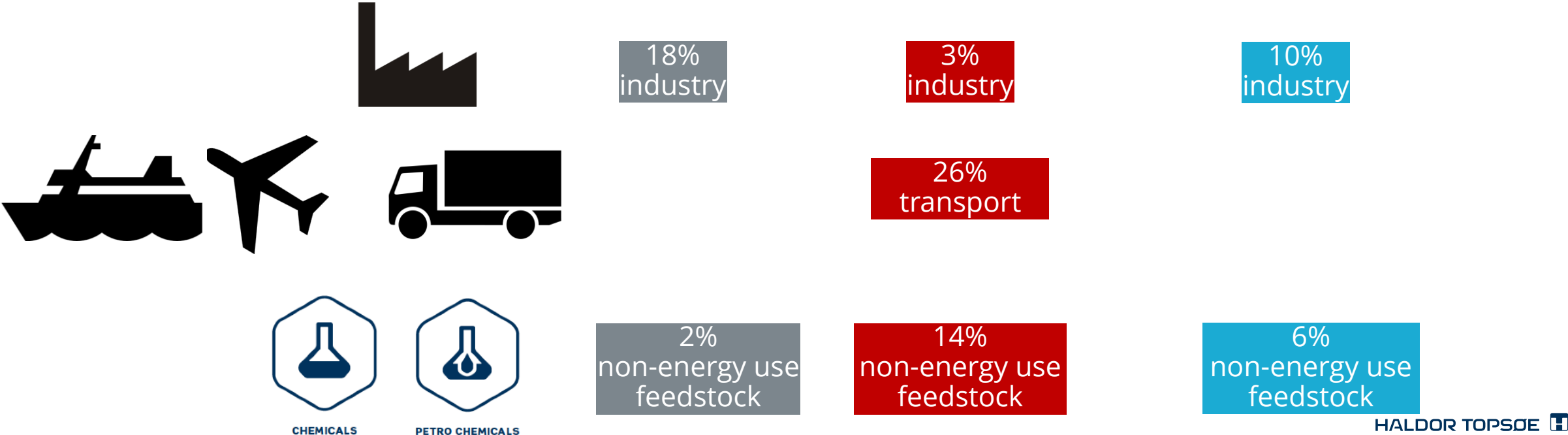
*Increased air quality*

***Increased sustainability***

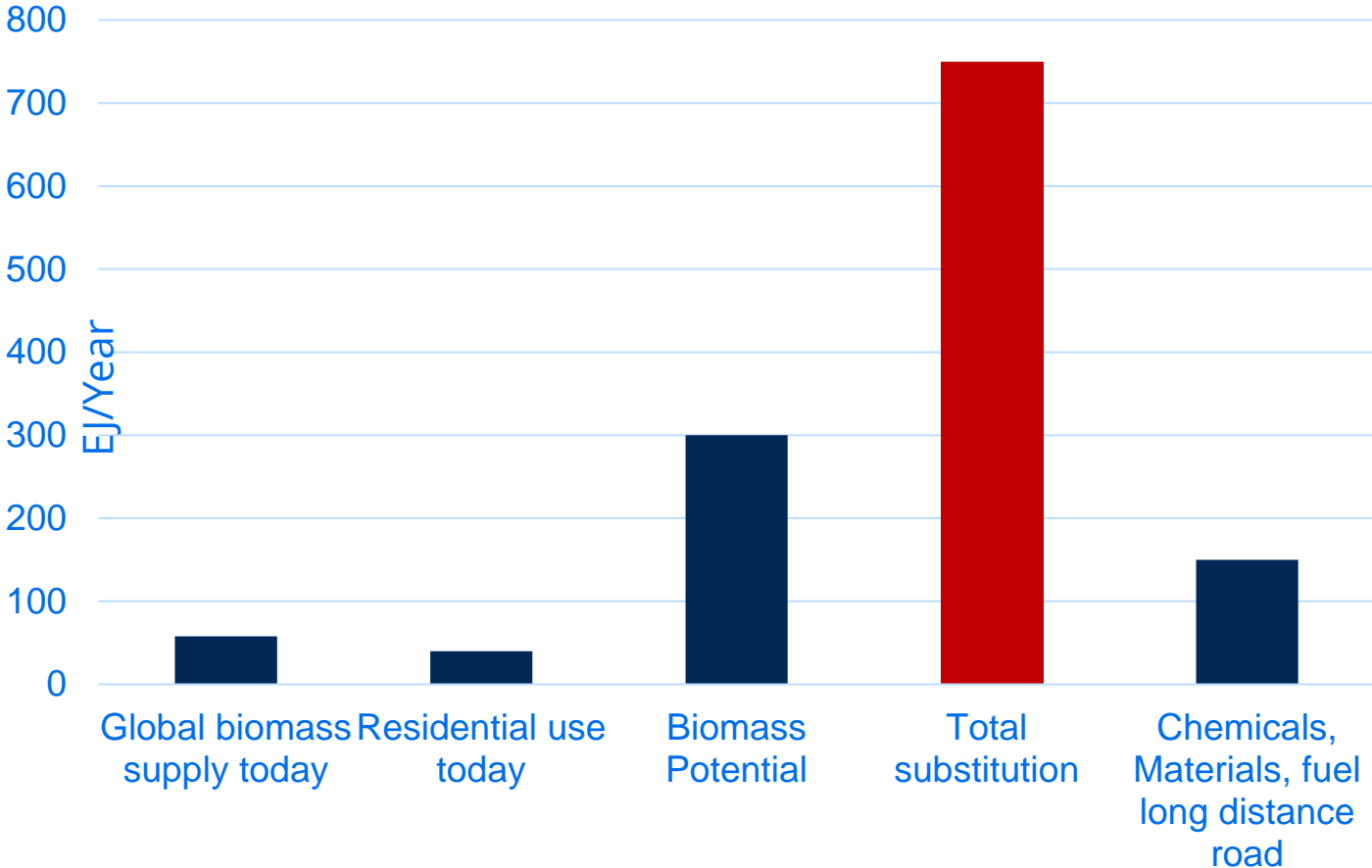
# Substituting fossil with renewable resources

77% of the fossil energy can in principle be replaced with renewable energy

Energy source	Coal	Oil	Natural gas
% not easily replaced with current technologies	<b>20 % of total coal use</b> (6 % of total energy use)	<b>43 % of total oil use</b> (14 % of total energy use)	<b>16 % of total NG use</b> (3 % of total energy use)
Energy EJ (Mtoe)	33 (777)	78 (1863)	19 (454)



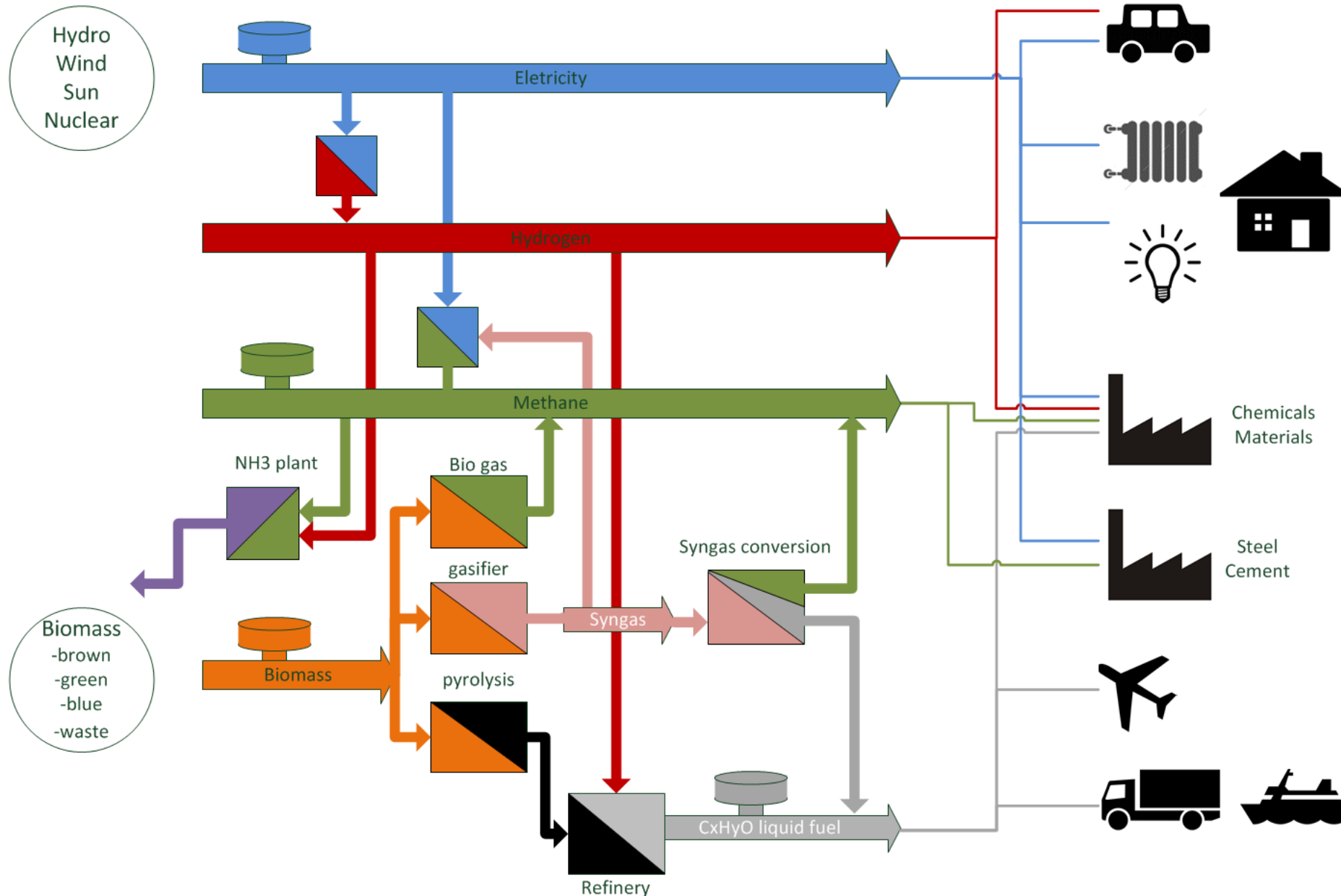
# Recycling carbon containing waste takes the pressure of the need for biomass utilization



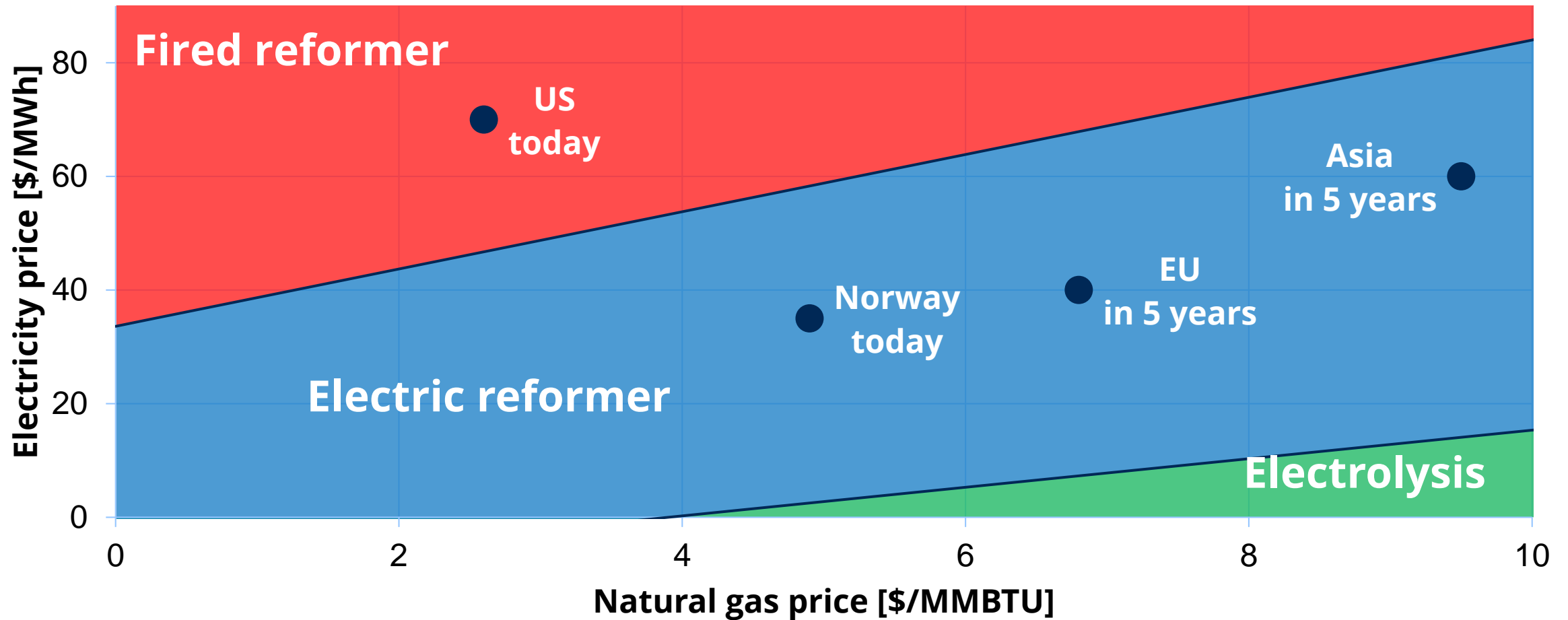
Data from; Slade, R., Bauen, A. & Gross, R., 2014. Global bioenergy resources. Nature Climate Change, 4(2),pp.99-105. HALDOR TOPSØE 

Breaking the biomass bottleneck of the fossil free society, Henrik Wenzel 2010 Concito

# The primary producers depends on electricity, CO<sub>2</sub>, waste and biomass.



# Need for lower renewable H<sub>2</sub> cost



Total production cost, including current EU CO<sub>2</sub> tax, depreciation, etc.



# There is a need for processes for recycling complex biomass feedstocks

Used cooking oils  
Animal fats



Fatty acid triglycerides



Kraft pulping process



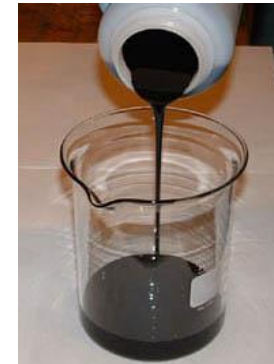
K-Lignin and tall oil



Wood/grass/algae/waste pyrolysis  
Hydrothermal liquefaction

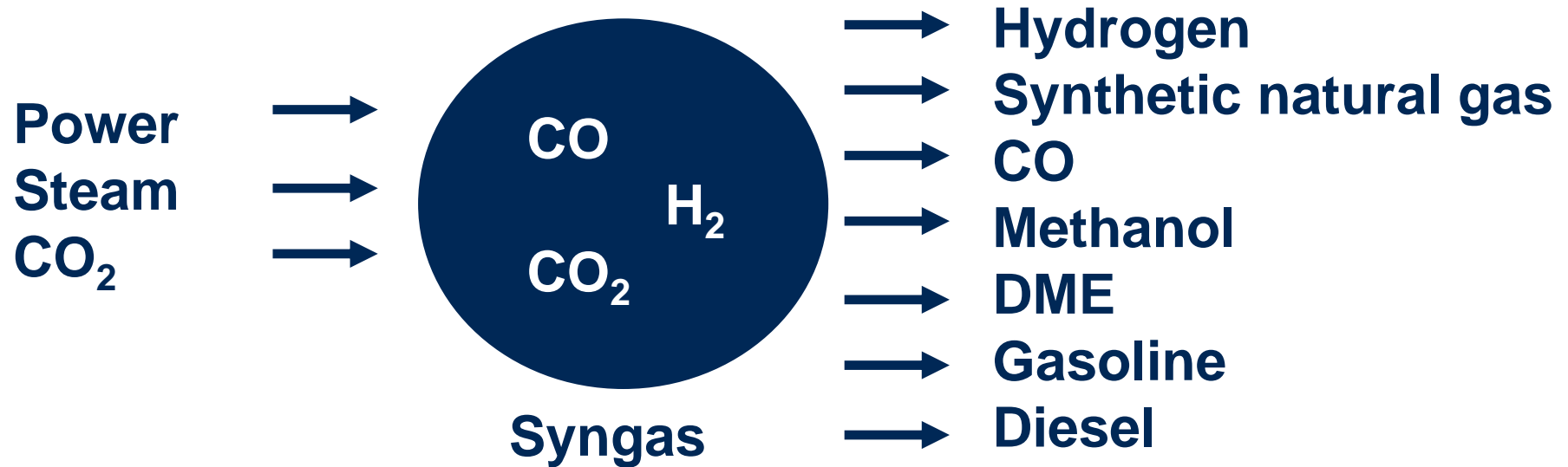


Pyrolysis/  
hydrothermal oils



# Technical proven processes exist for a large variety of CO<sub>2</sub> conversions

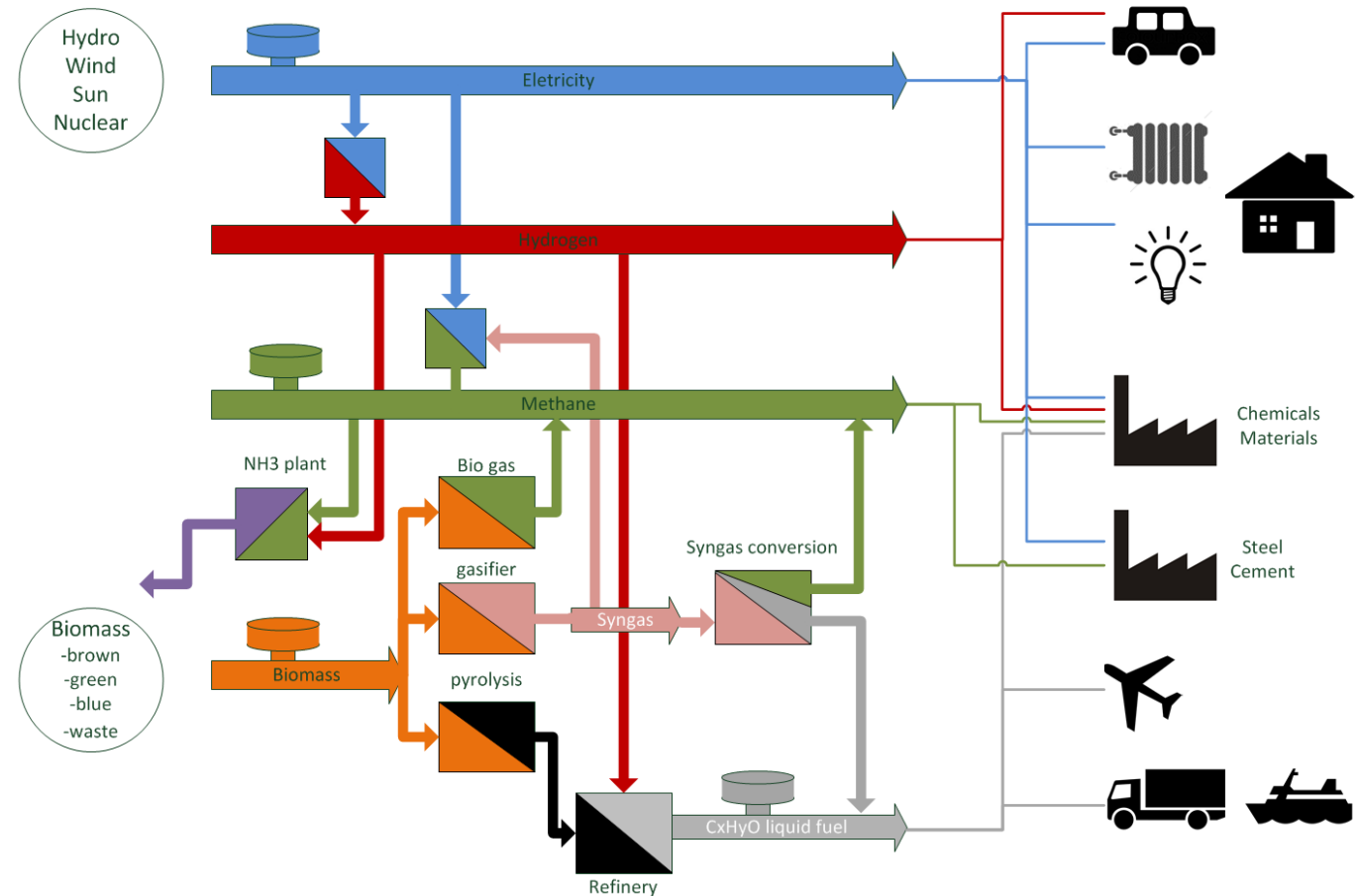
Need for continued improvements to give the optimal solution for a circular economy



# How can Europe achieve a circular economy by 2030?

Establishing the foundation for the circular economy

- Couple the power sector to the chemical industry
- Reduce the cost of renewable hydrogen
- Biomass and waste utilization for fuels and chemicals
- Optimize CO<sub>2</sub> utilization for a circular economy



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