

# Low Carbon Pathways

*A bridging programme in Concawe*



**1** Early-stage  
High efficiency operation

**2** Evolution  
Progressive introduction of low-emission components and low-carbon feedstocks

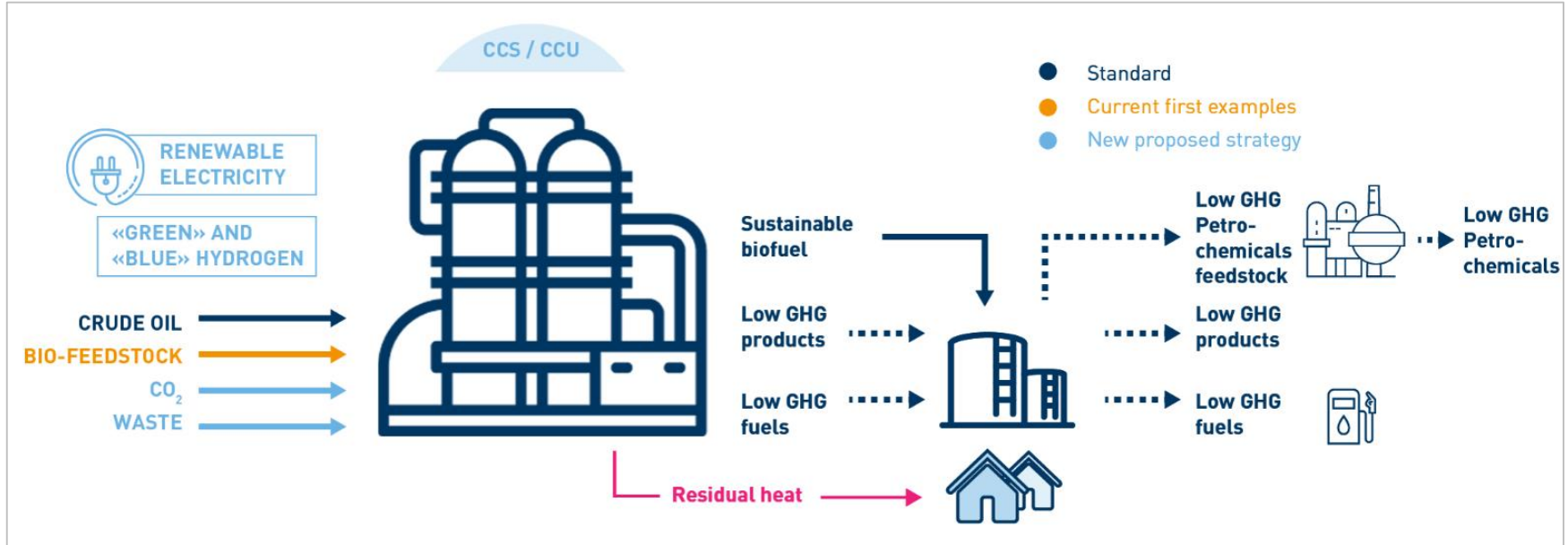


Refinery 2050: Conceptual Assessment.

Exploring opportunities and challenges for the EU refining industry to transition towards a low-CO<sub>2</sub> intensive economy



## Refinery 2050: The concept

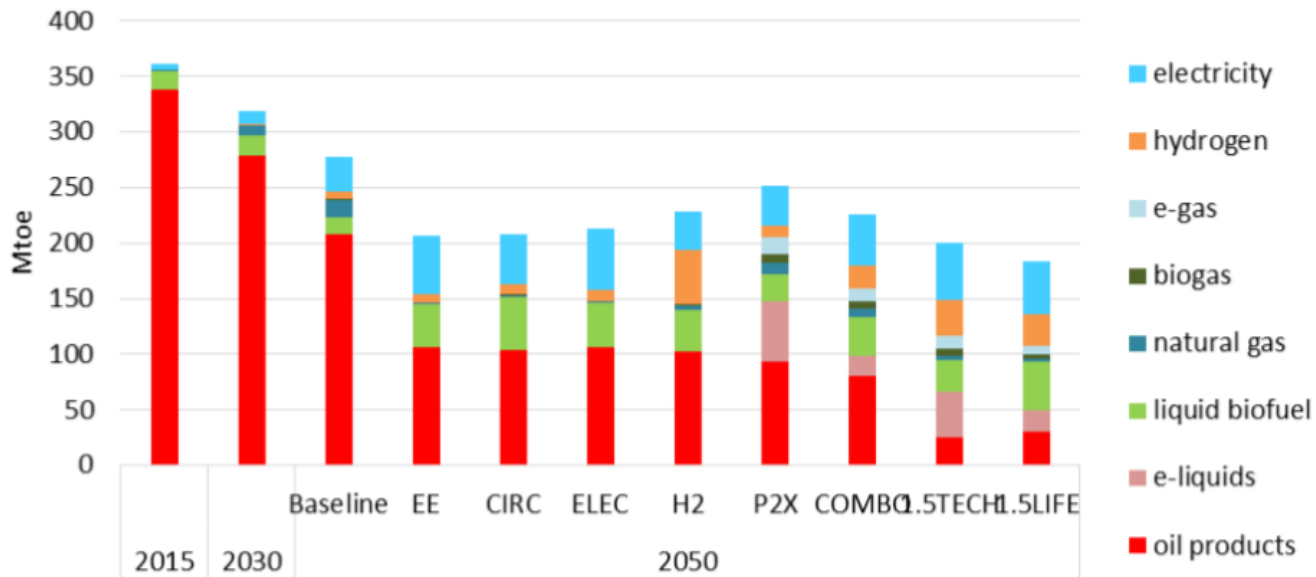


Reducing emissions within the site + the final use of our products

# Evolution of demand

## Inspiration from A Clean Fuels For all - Alternative 1.5C scenarios

Figure 57: Fuels consumed in the transport sector in 2050



Source: PRIMES.

# Multiple technologies

Examples!

From food-crop based  
(Cap)



To biomass residues



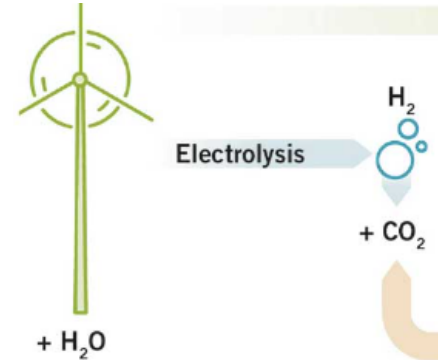
Waste materials



Low-carbon fuels



e-fuels



>70% GHG savings!

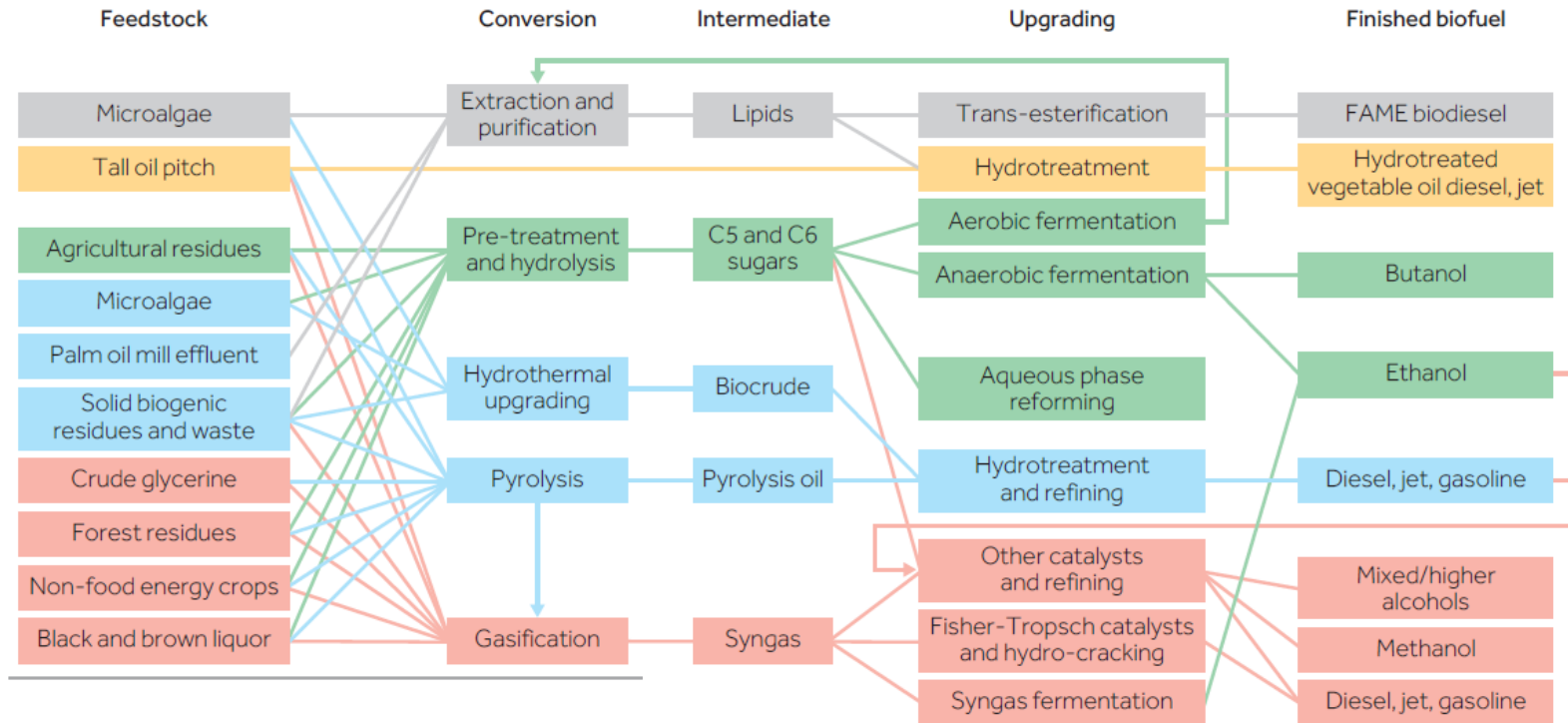


*"Good idea, but we might need to process them a little all the same!"*

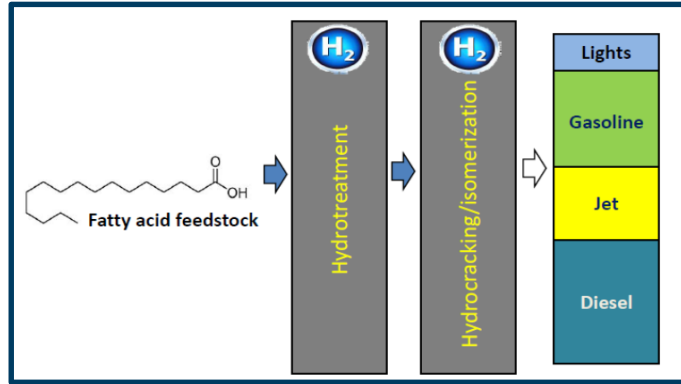
Source: IPFEN

# Multiple technologies

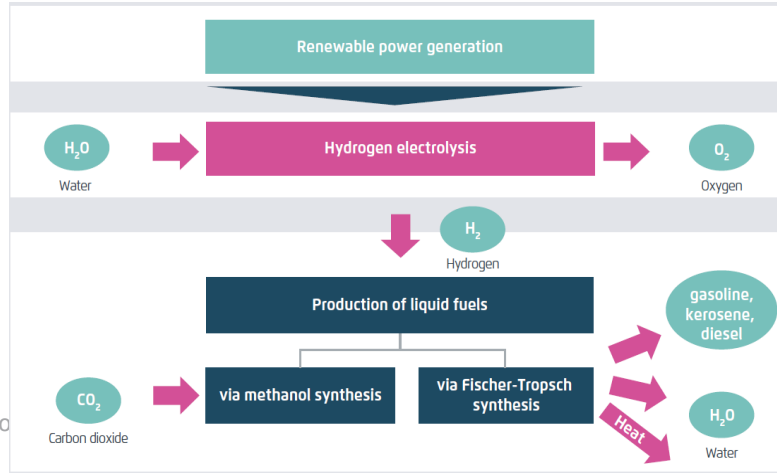
Example of advance biofuels pathways (Source [IRENA 2016])



# HVO



# efuels



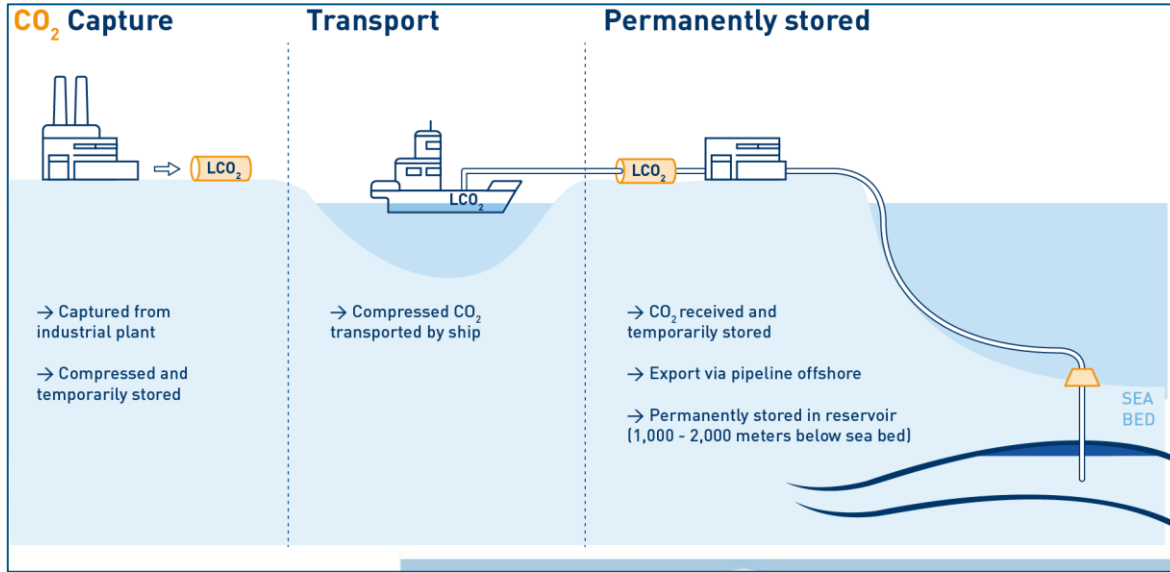
# Biomass to Liquid (E.g. Gasification + FT)



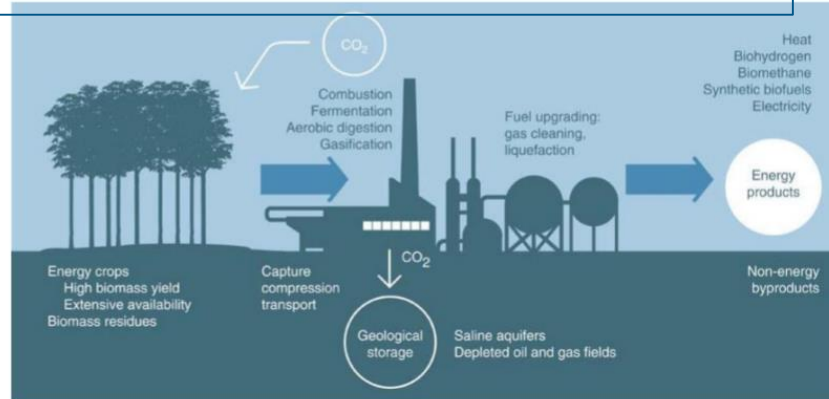
Source: <https://www.total.com/en/energy-expertise/projects/bioenergies/biofuel-converting-plant-wastes-into-fuel>

# CO<sub>2</sub> capture and Storage (CCS)

Clean H<sub>2</sub>



Bio-CCS  
Potential  
negative  
emissions





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