

Renewable methanol from CO₂: A technology solution ready at scale

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CARBON
RECYCLING
INTERNATIONAL

CRI in a nutshell



Launched in 2006 in Iceland



Private equity financed by investors from Iceland, US, Canada and China



Built, owns & operates first industrial scale CO₂-to-Methanol plant



Marketing branded renewable methanol from electrolysis (Vulcanol™) since 2012

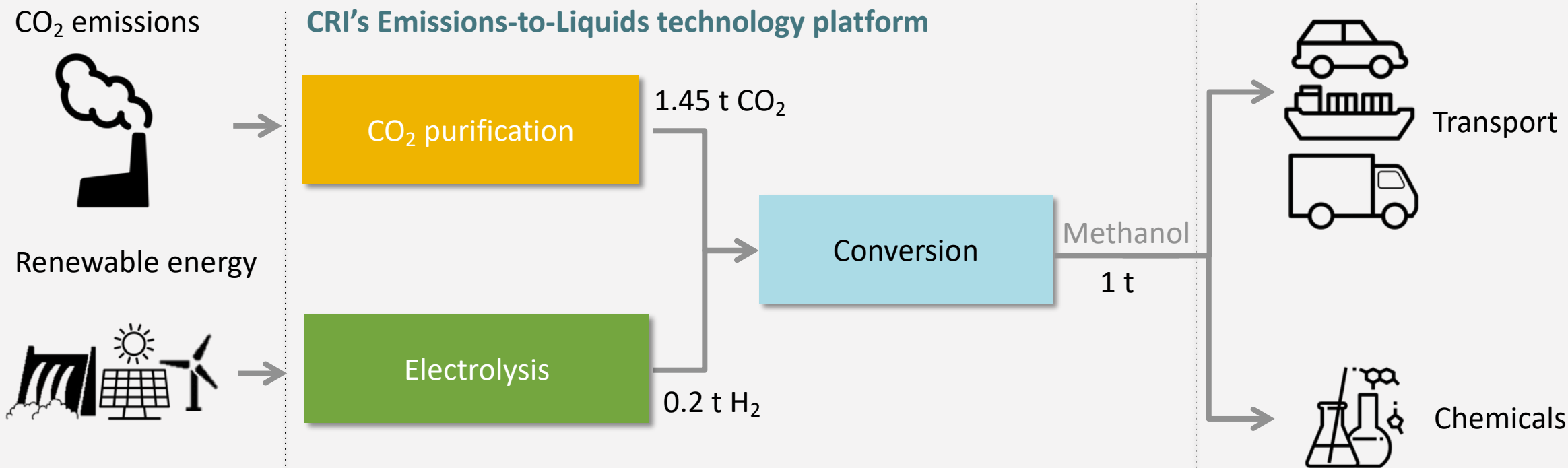


Develops and implements commercial CO₂-to-Methanol systems on turn-key basis

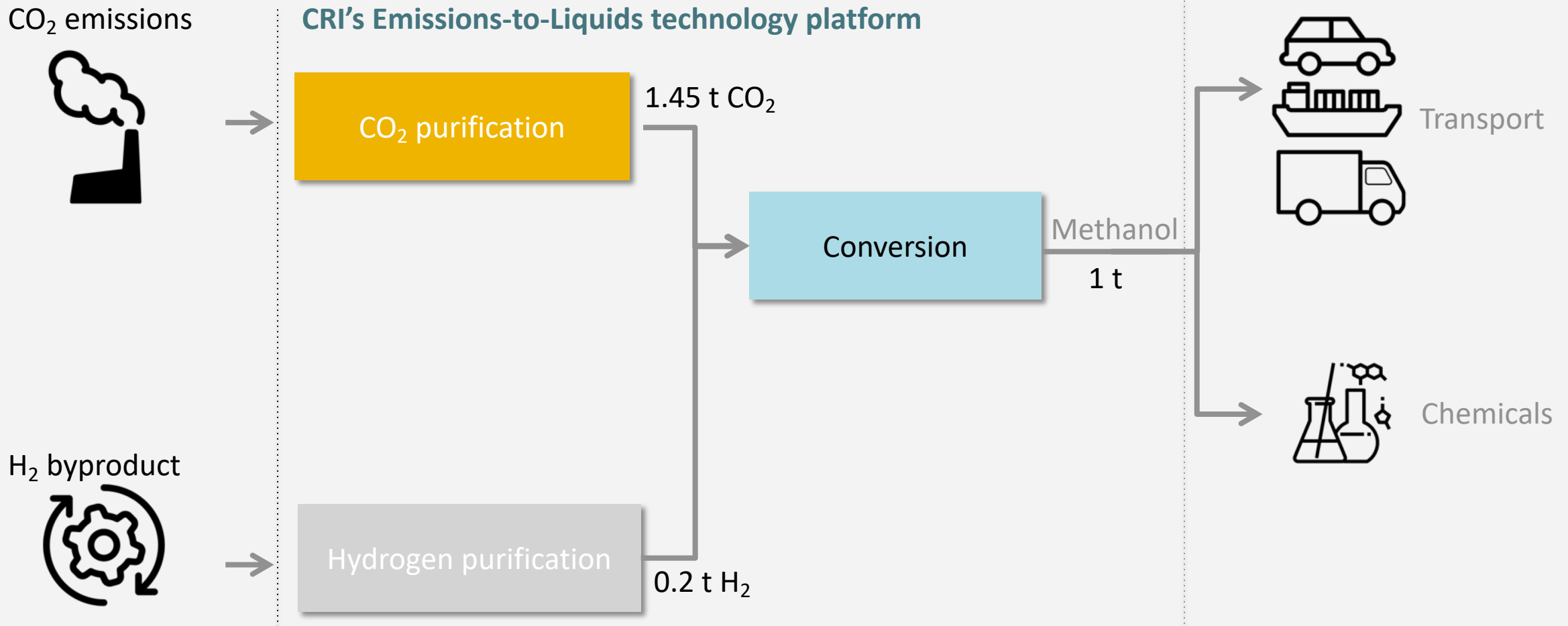


Experienced team covering full value chain from R&D, sales, advocacy to EPCM

CRI's advantage: One step from CO₂ to methanol with no byproducts



Same technology also applies with surplus H₂ (EU: *recycled carbon fuels*)



CRI's *George Olah* CO₂-to-methanol plant, Svartsengi, Iceland



First commissioning: 2012

Upgrade: : 2015

Nameplate capacity: 4000 t/yr methanol

CO₂ conversion: 5600 t/yr CO₂

Electrolysis: 6 MWe base-load

Building on more than 12 years of full value-chain experience

2007



Pilot plant and lab
0.001 t/d

2012



Industrial scale
4 t/d

2015



Industrial scale-up
12 t/d

2019



Wind power + CO₂
1 t/d

2020

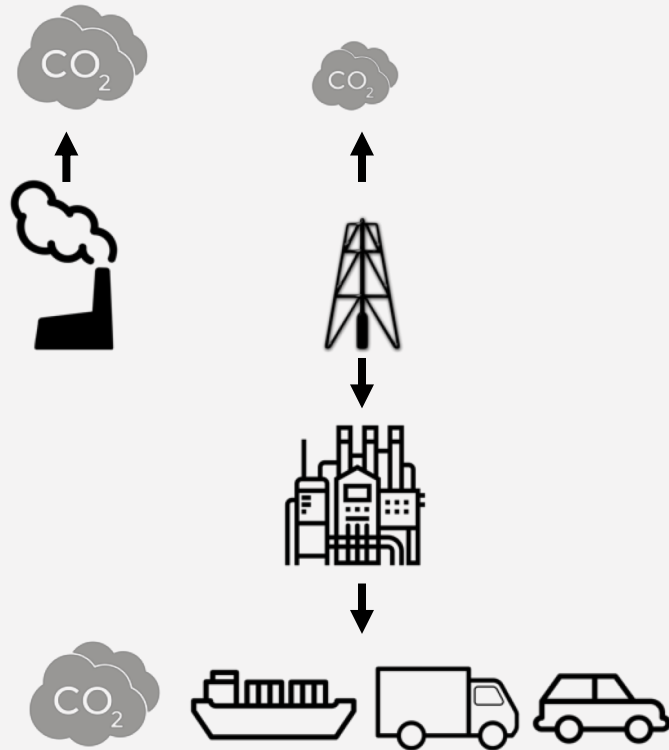


BOF gas + CO₂
1 t/d

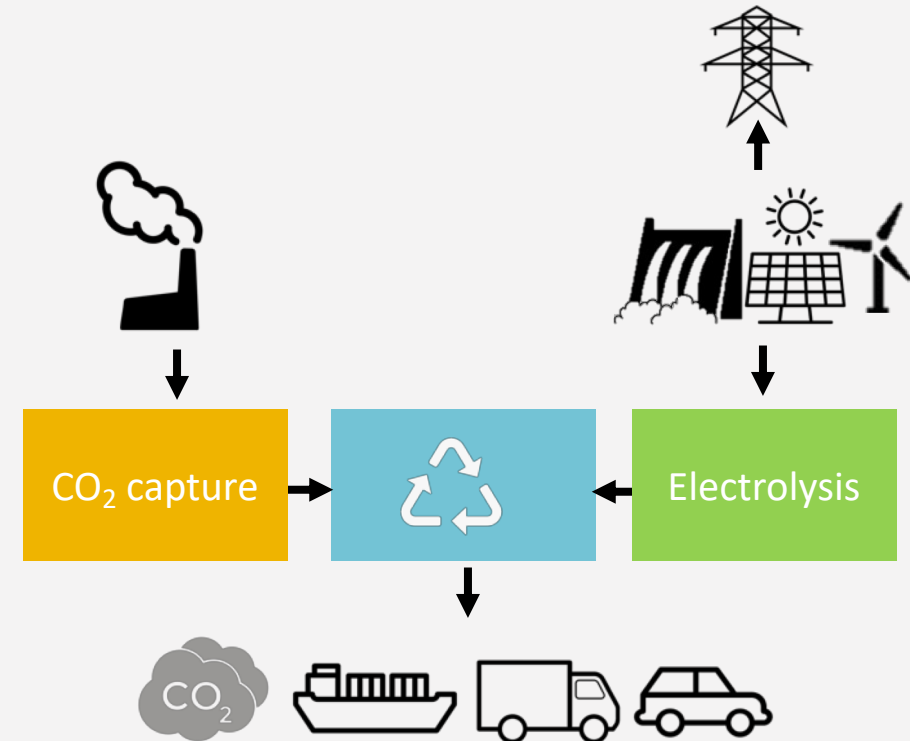


How renewable methanol reduces CO₂ footprint

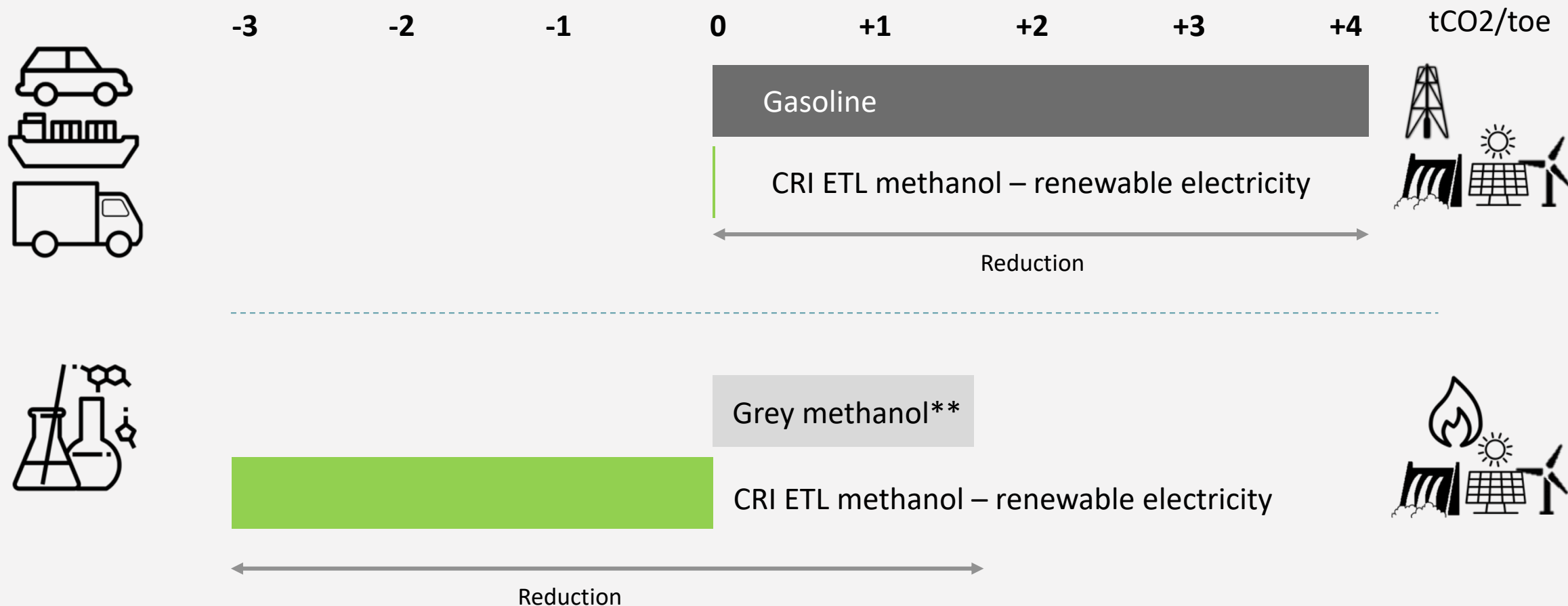
„Business as usual“



CRI's Emissions-to-Liquids



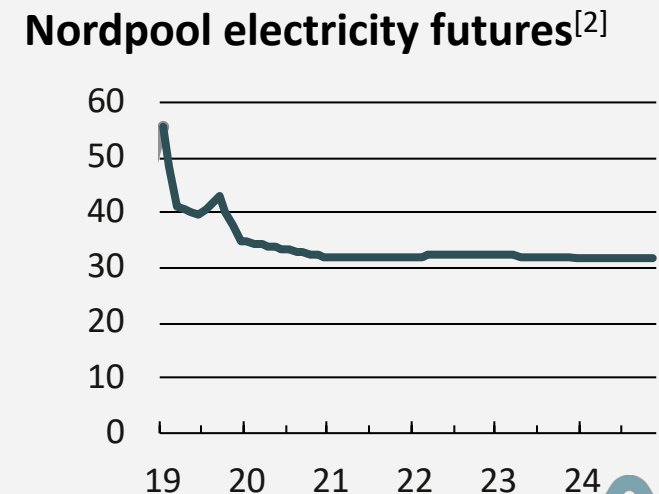
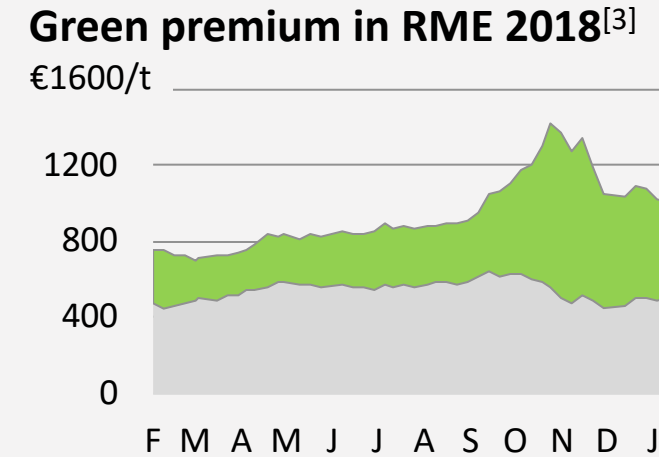
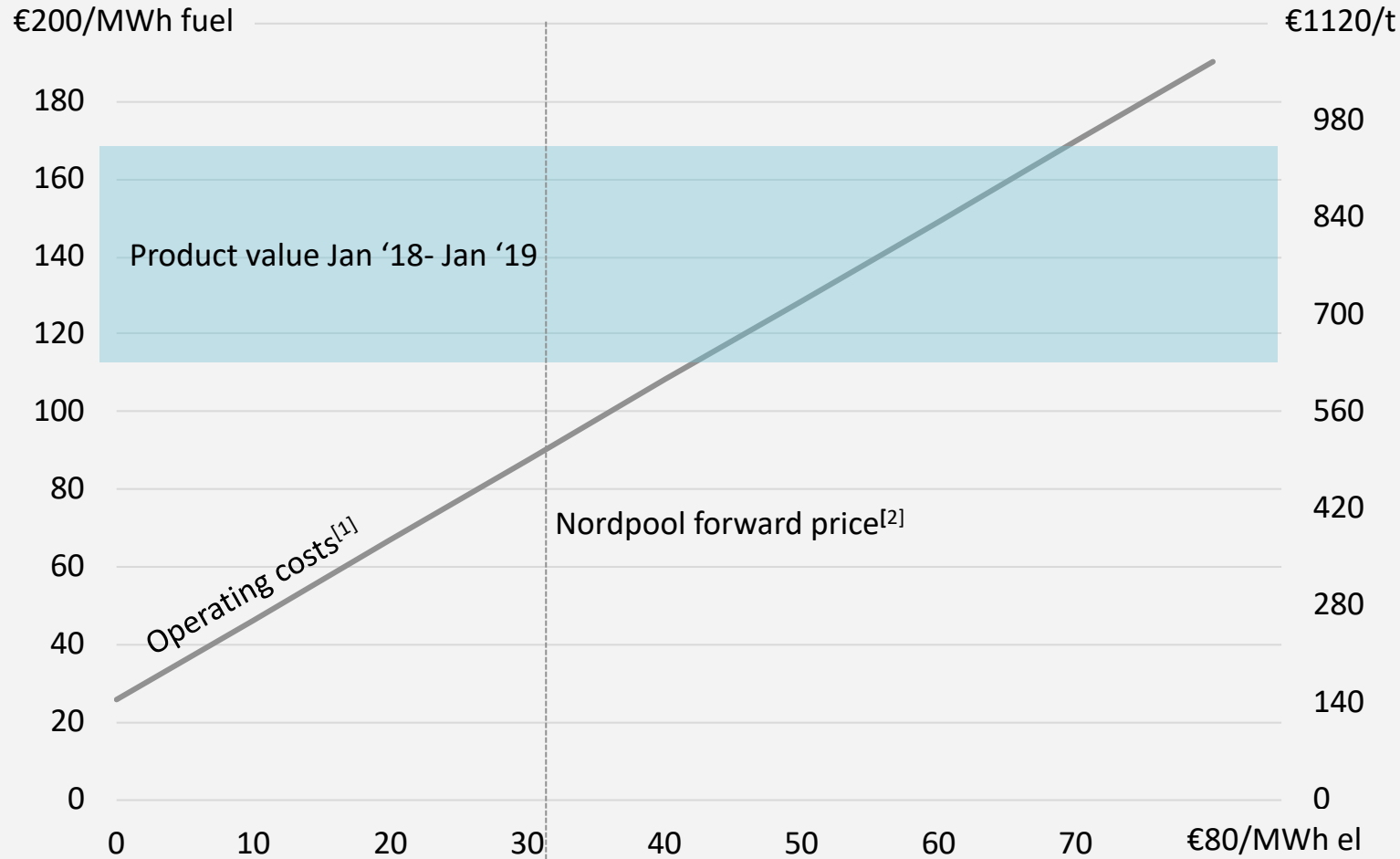
CO₂-to-methanol reduction of net life-cycle CO₂ emissions



*RED II directive 94 gCO₂e/MJ gasoline or diesel; **State-of-the art SME methanol Johnson Matthey Technol. Rev., 2017, 61, (4), 297–307



Basic economics of ETL power-to-methanol production

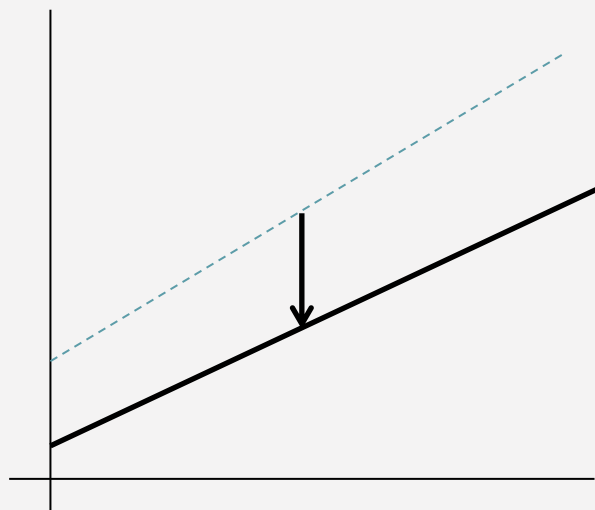


Product value: UK double counting Sources: [1] 140 t/d capacity [2] NasdaqOMX, no grid fee [3] RME & gasoil CIF ARA



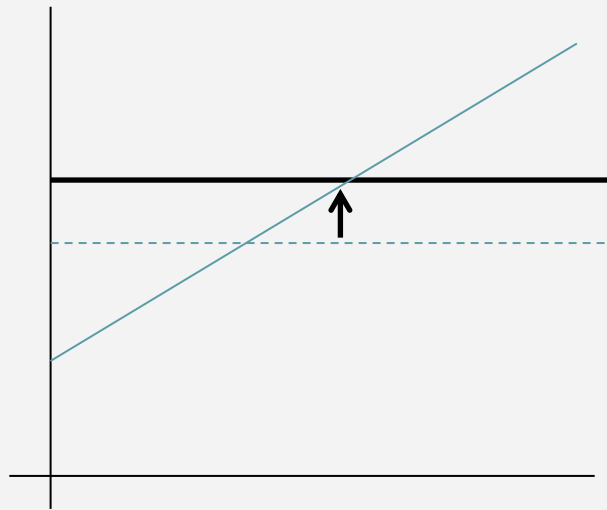
Trends supporting profitability of renewable methanol production

OPEX improving



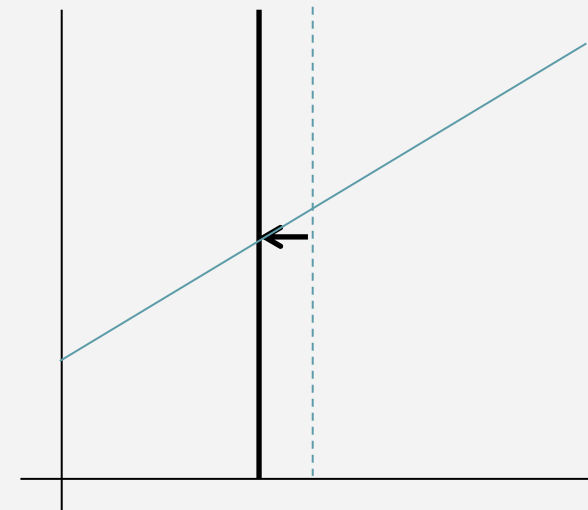
Learning curve effects
Scale economies
Efficiency improvements

Growing demand



Increasing targets for low CO₂ fuels
EU cap on crop-based biofuels
BEV limited to light duty low range

Lower cost RES electricity



Wind and PV LCOE falling
Intermittency = stranded capacity
Grid congestion



- Liquid low CO₂ intensity or neutral product
- Compatible with existing transport and chemicals infrastructure
- CRI solution demonstrated and ready for large scale
- Competitive with other advanced fuel pathways



Thank you for listening

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