

Role of e-fuels in climate change mitigation and Finnish pathway for e-fuels demonstration

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Smart Energy Day 9.6.2020

Outline

- 1 Role of electrofuels in climate change mitigation
- 2 Finnish demonstration pathway for electrofuel production
- 3 Summary

VTT key assets in Power-to-X



VTT competences

- Energy and hydrogen systems
- Electrolysis
- CO₂ capture from air and industry
- Biochemistry and biotechnology
- Catalysis and catalytic processes
- Process and system modelling
- TEA & LCA
- Scale up
- Fuel usage and engines

Green
hydrogen
technologies

Catalytic
conversion
processes

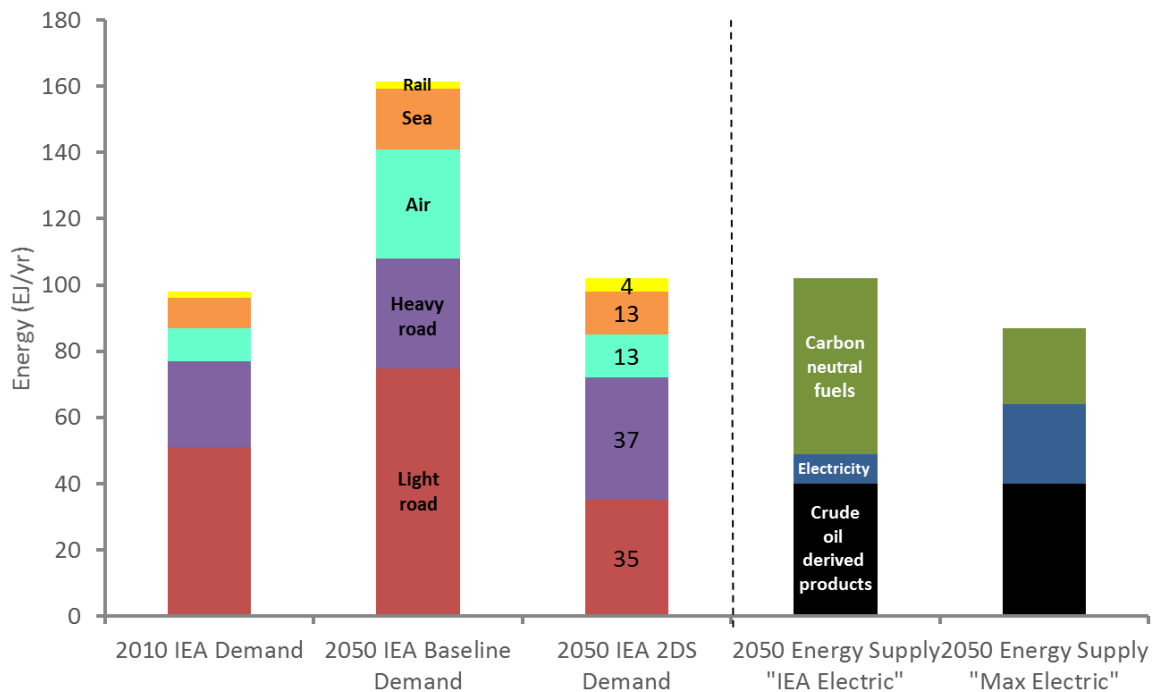
Microbial
conversion
processes



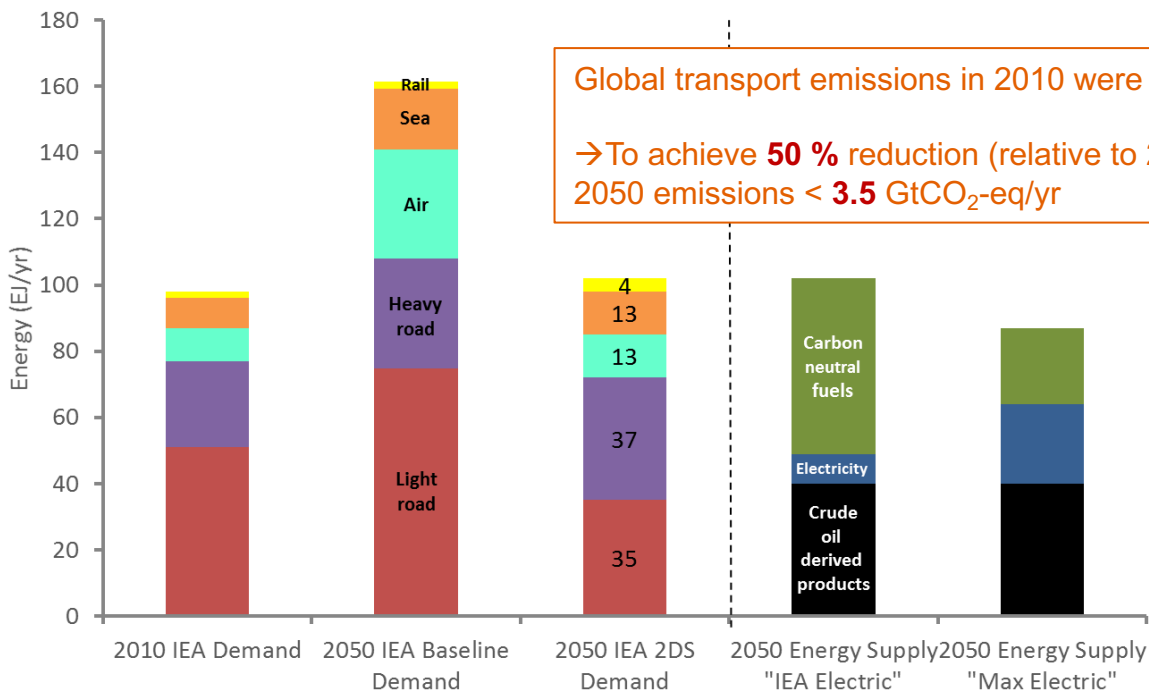
**Sustainable fuels,
chemicals and materials
without fossil resources**

Role of electrofuels in climate change mitigation

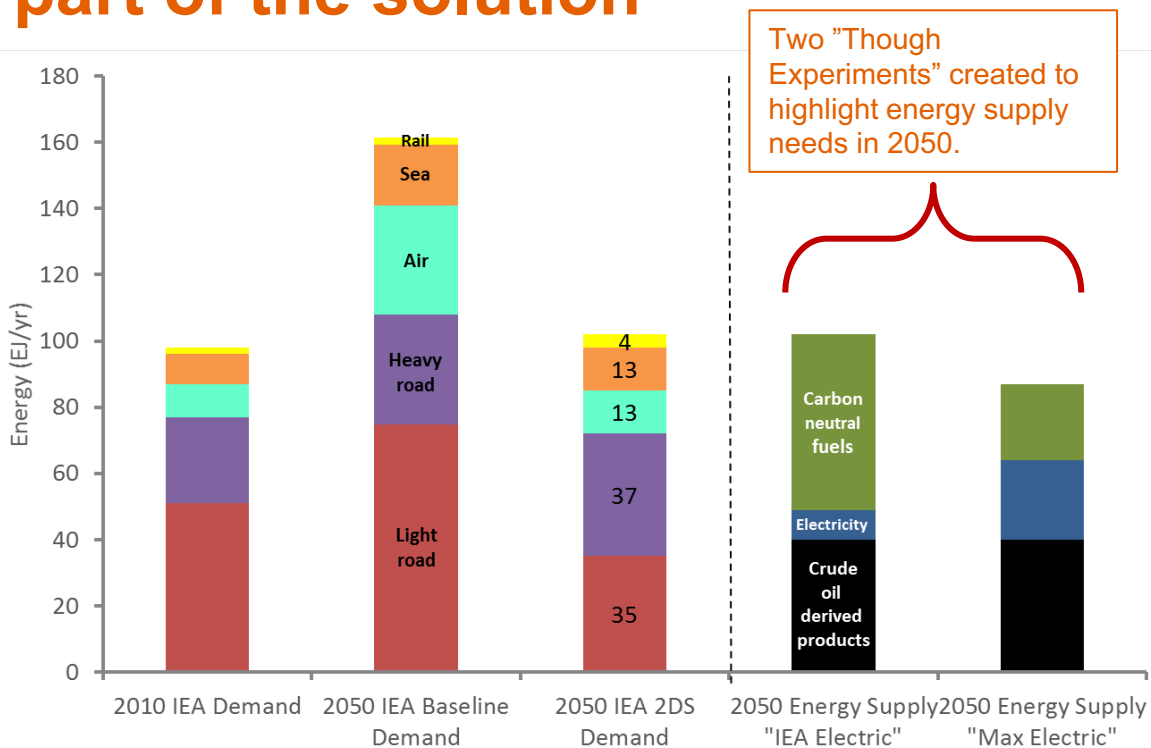
100 EJ problem – Direct electrification is only a part of the solution



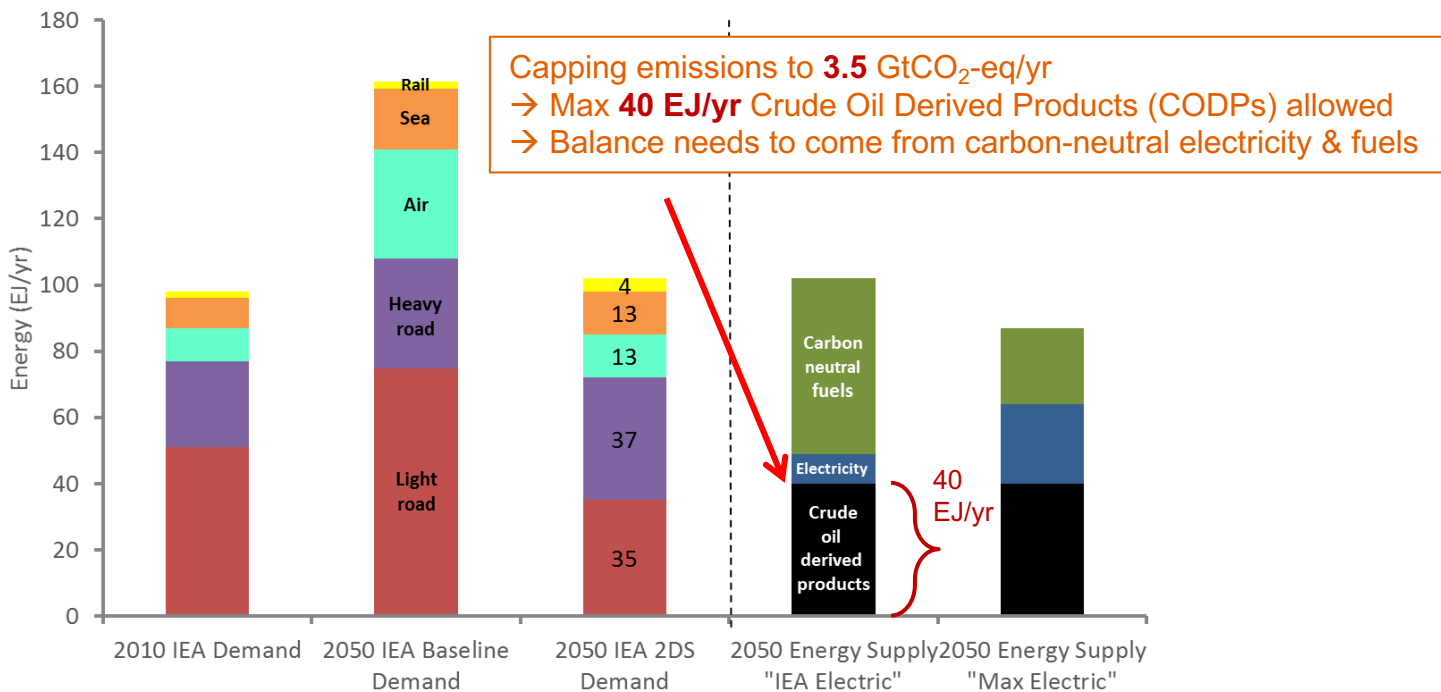
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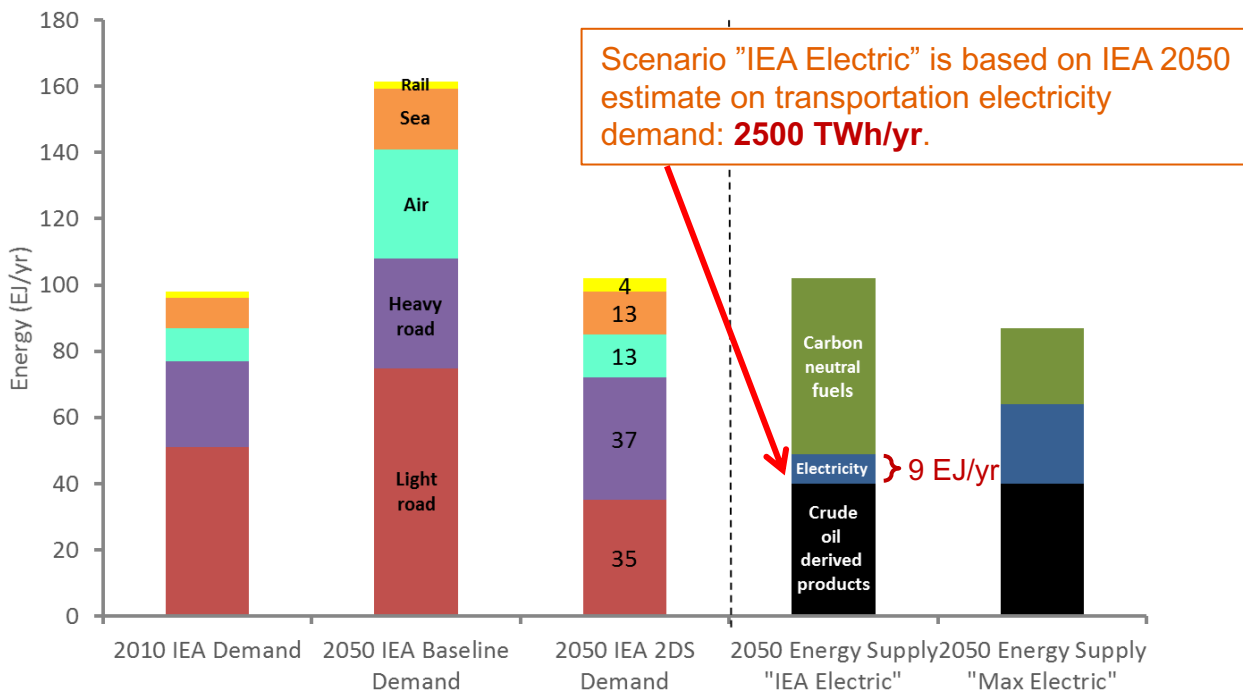
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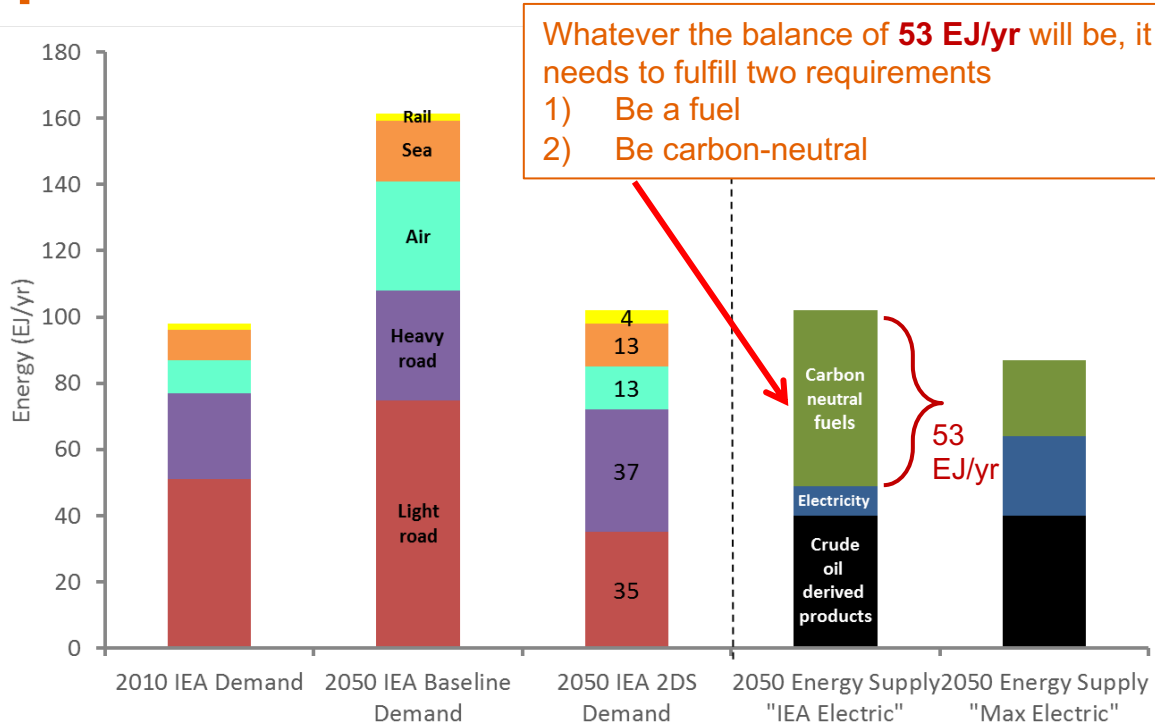
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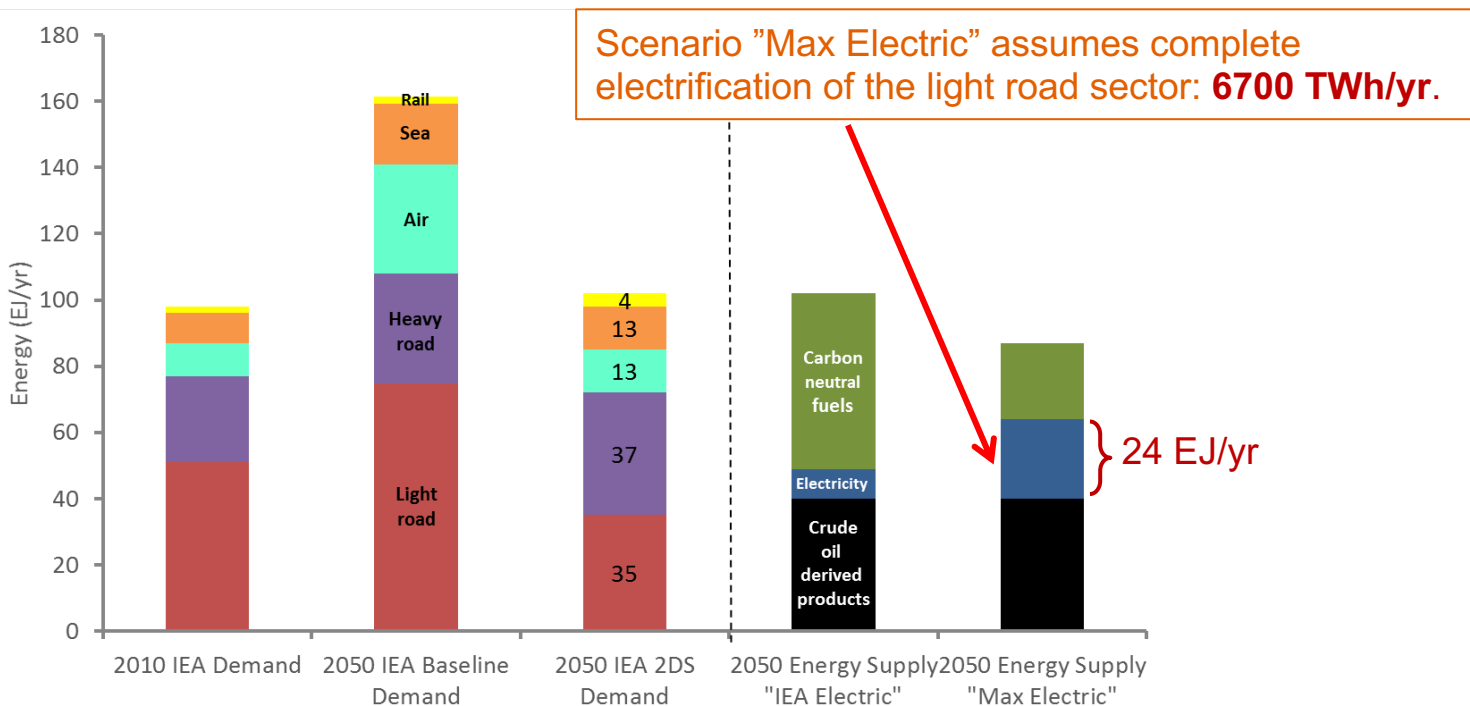
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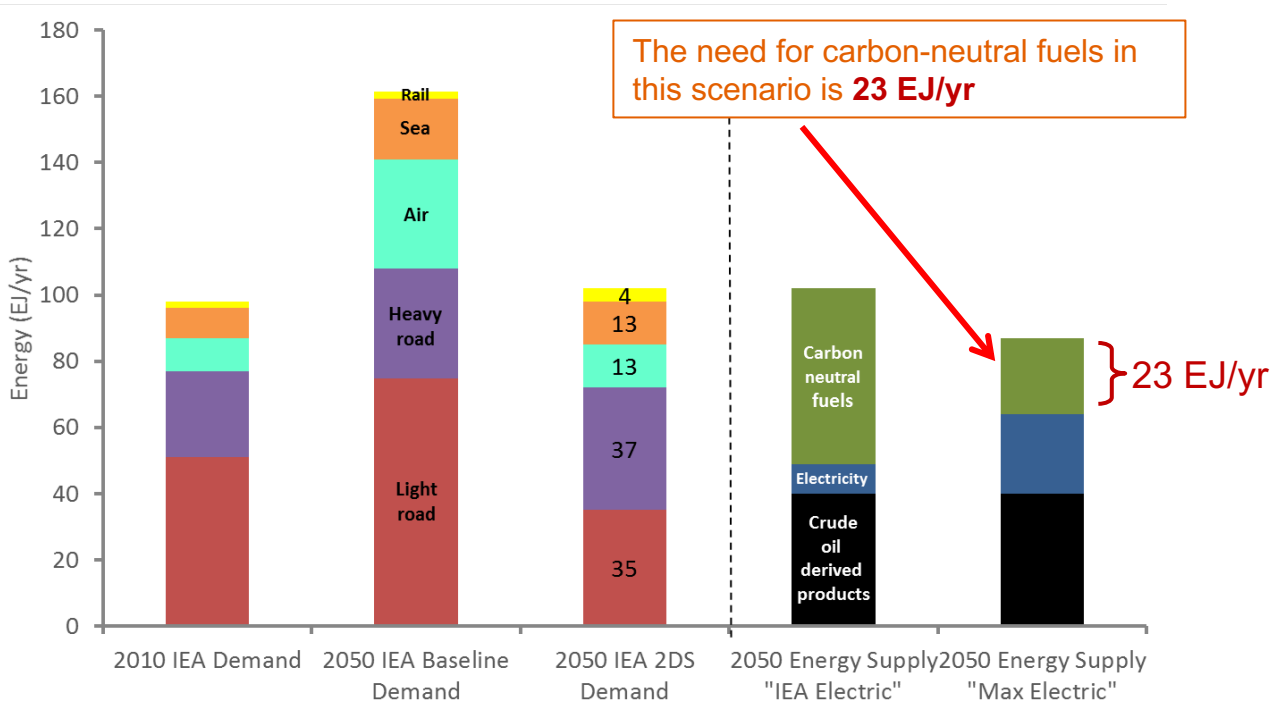
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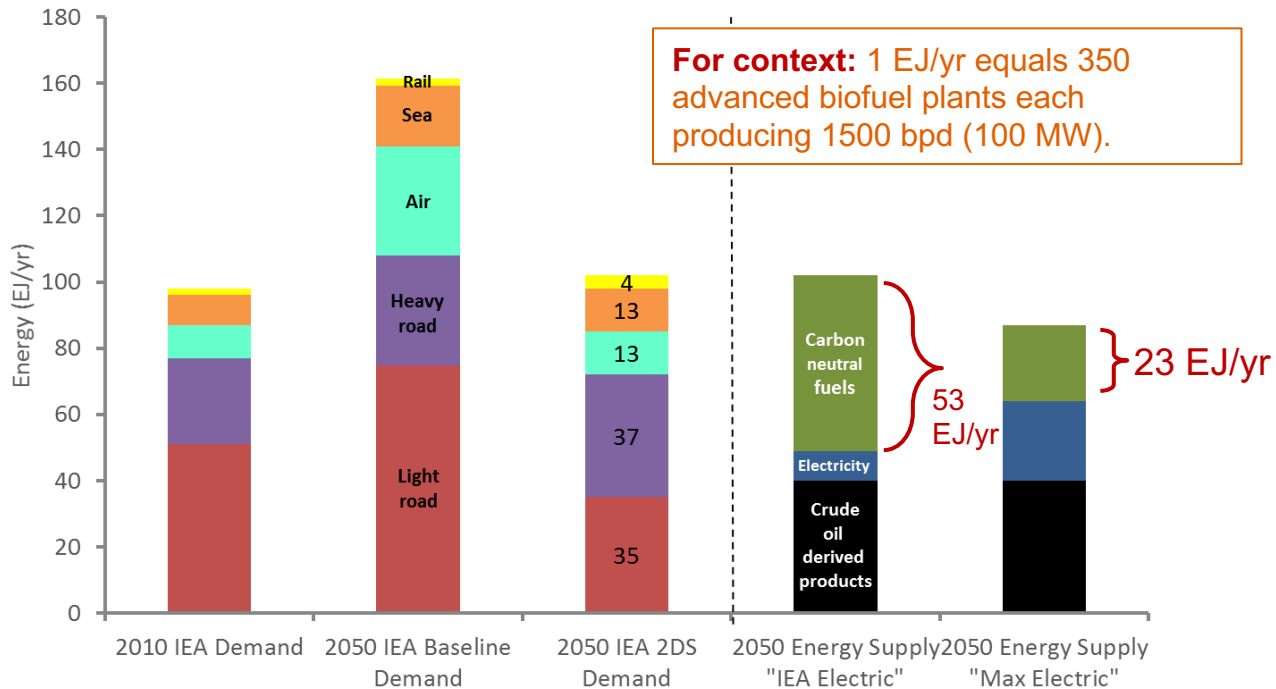
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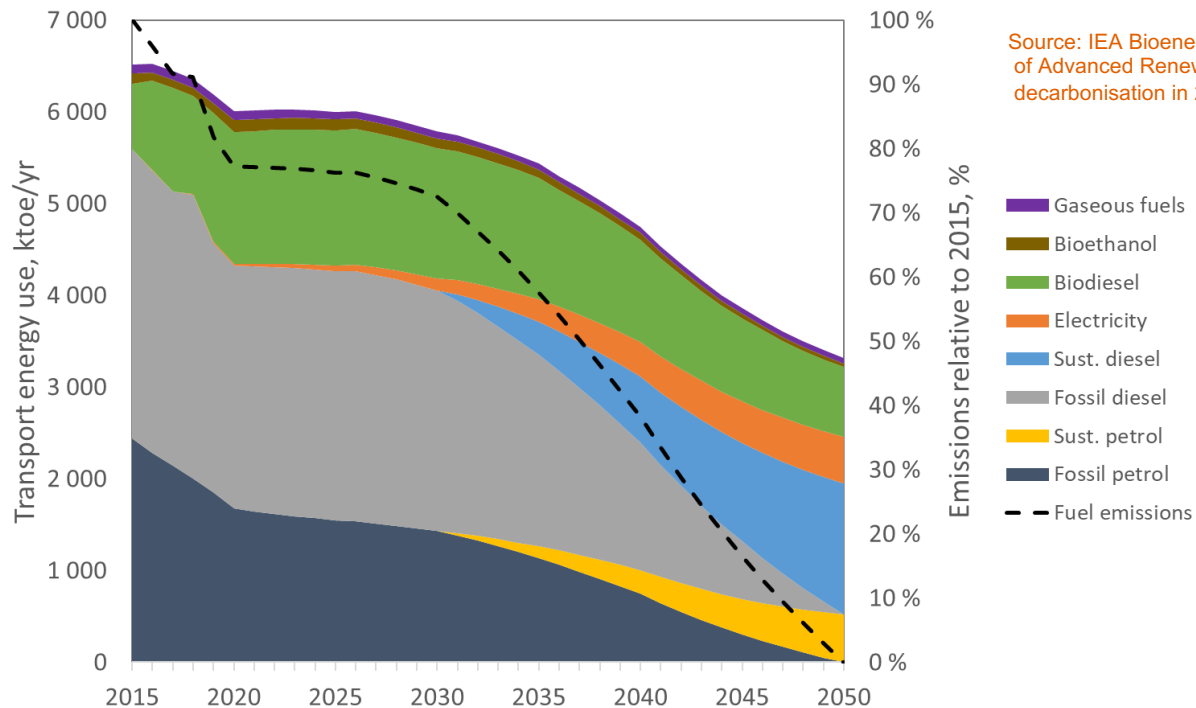
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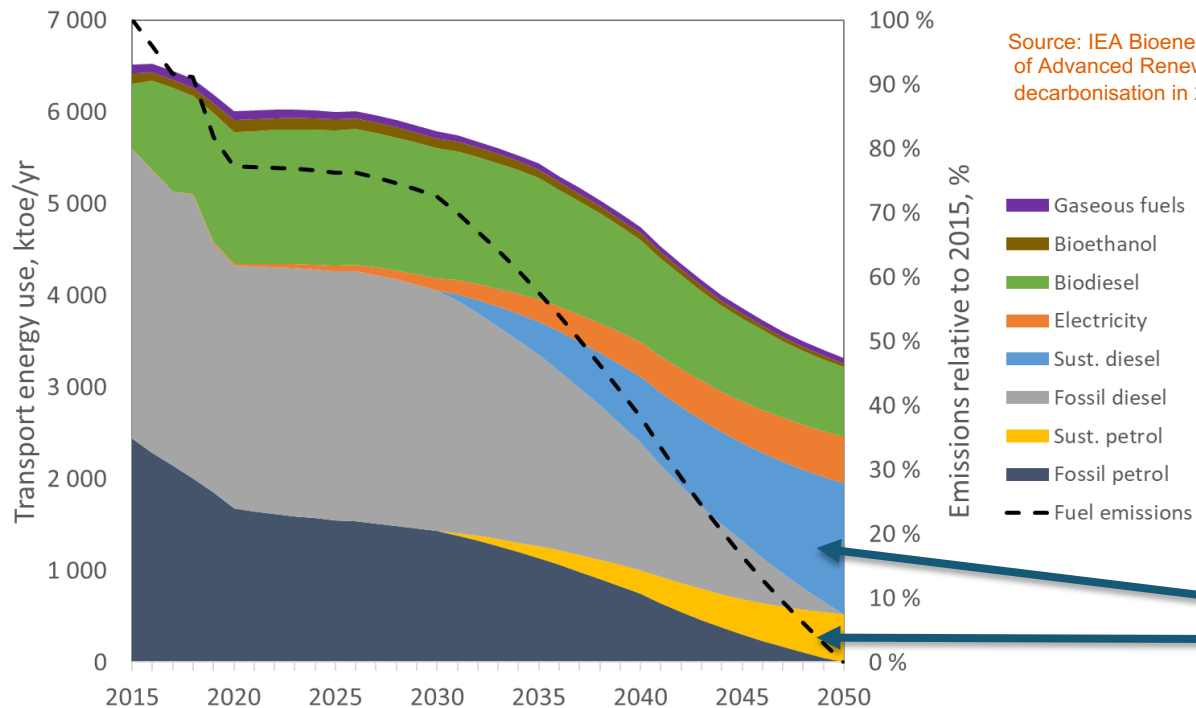


Case Sweden, carbon neutral transport scenario



Source: IEA Bioenergy Task 41 Special Project. The contribution of Advanced Renewable Transport Fuels to transport decarbonisation in 2030 and beyond.

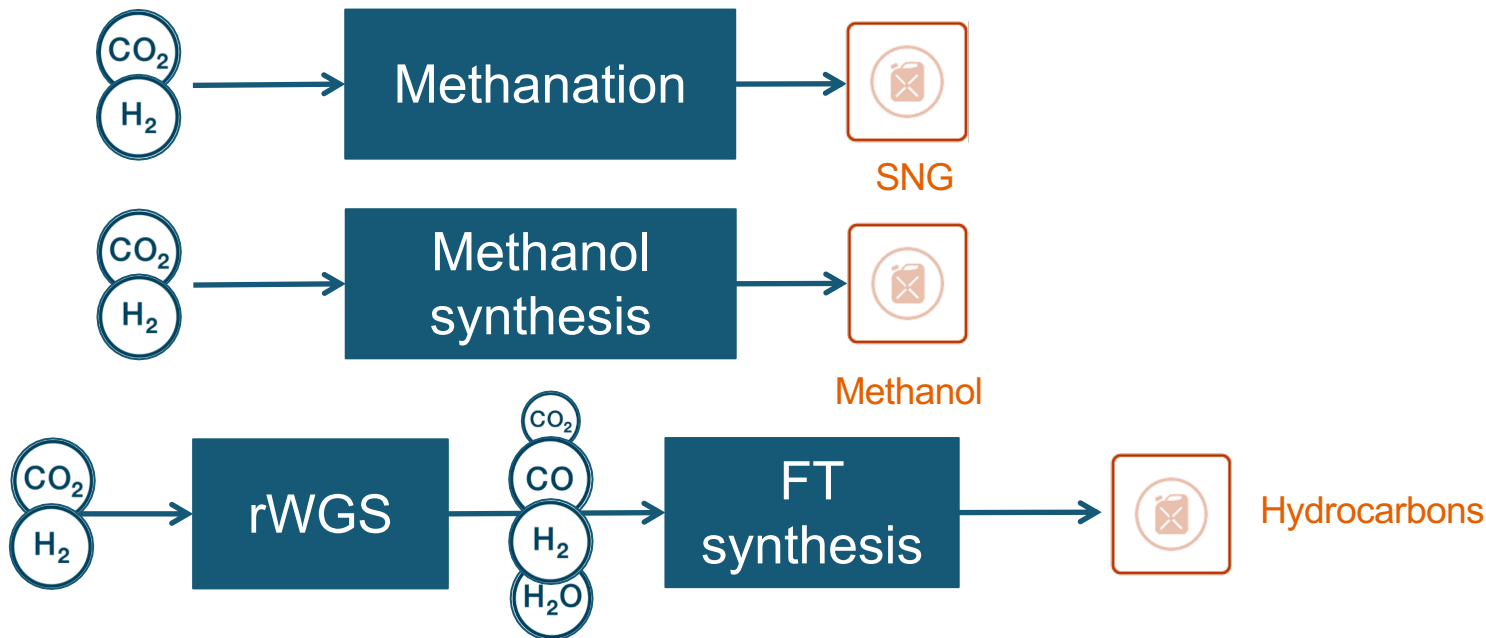
Case Sweden, carbon neutral transport scenario



Additional amount of sustainable "drop-in" fuels needed in addition to current policies to reach carbon neutral transport sector by 2050

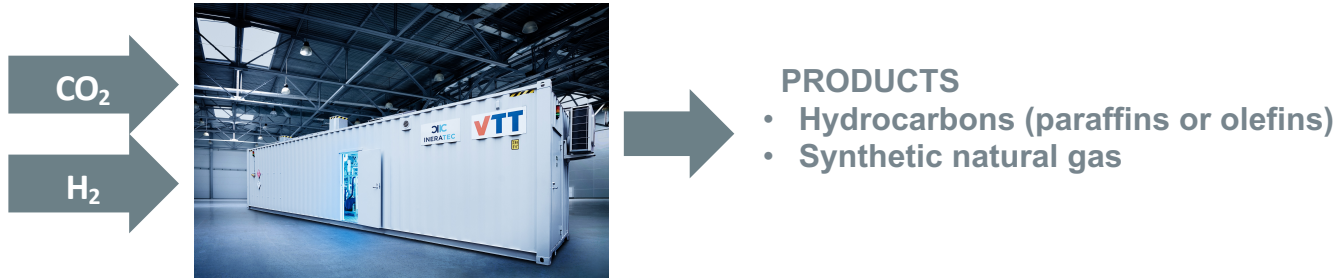
Finnish demonstration pathway to electrofuel production

Main pathways to electrofuels



VTT mobile synthesis unit (MOBSU)

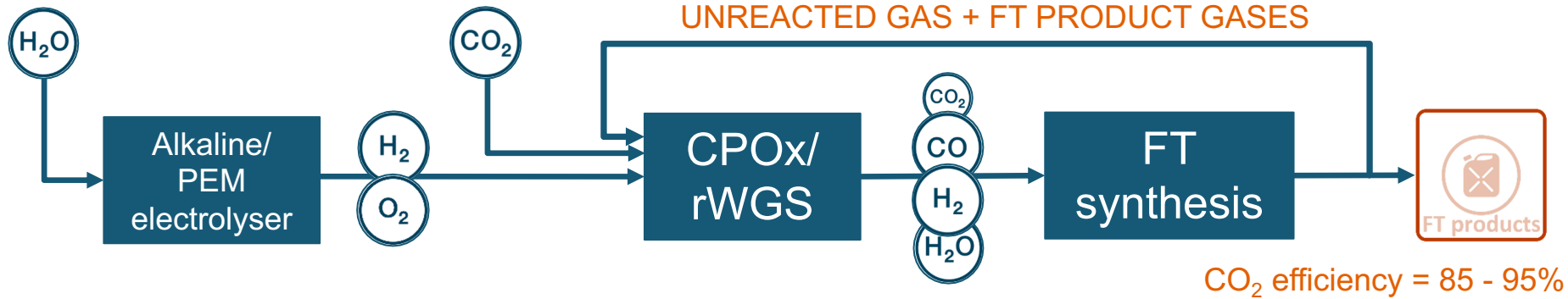
- MOBSU is a multipurpose synthesis unit for CO or CO₂ upgrading to energy carriers, fuels and chemicals
- Can be transported on-site where CO₂ emissions and energy are available



- Reverse water-gas shift (RWGS) reactor technology: **VTT**
- Intensified reactor technology for FT
- Proprietary RWGS and FT catalysts:

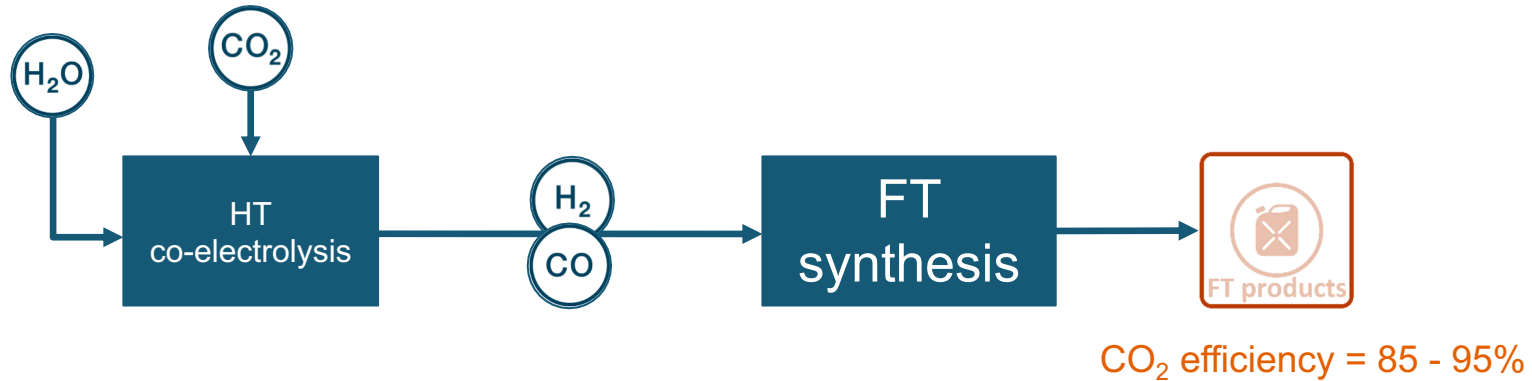
INERATEC
VTT

Approach 1 for hydrocarbons by P2X



- Studied at VTT in several projects and demonstrations

Approach 2 for hydrocarbons by P2X



- Studied currently at VTT in project P2MOVE

Some demonstrations

SOLETAIR PILOT SITE

SOLETAIR SITE WAS OPERATED IN
SHOWCASE MODE DURING
SUMMER 2017



SOLAR PV PLANT



DAC



ELECTROLYSIS



SYNTHESIS



SUPPLEMENTARY GAS



Demonstrations - ICO2CHEM

Infraserv Höchst

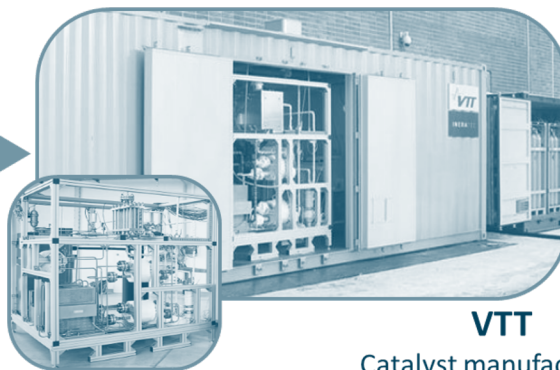
Industrial infrastructure integration
and waste gases supply



CO₂: from MEA-based
Biogas upgrading plant

H₂: from Chlor-alkali
electrolysis

CO₂ + H₂



Ineratec, VTT

Mobile synthesis unit RWGS+FT

VTT

Catalyst manufacturing

Ineratec, Polito, VTT

Catalyst testing, Process modelling
and Energy integration

FT product



Altana

Product testing

PHS, Polito, VTT

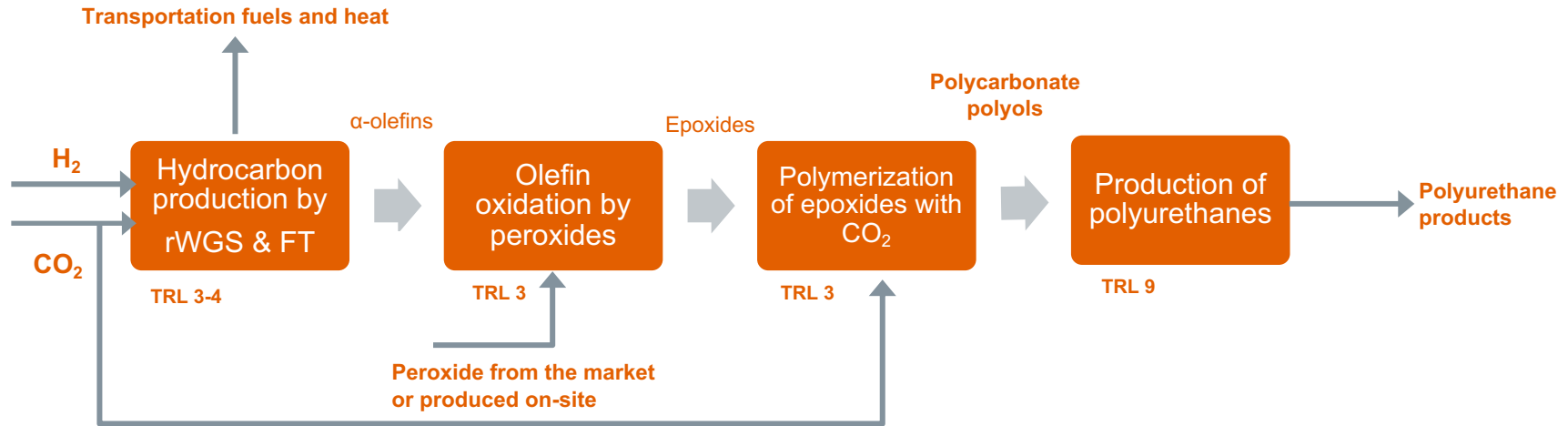
TEA and LCA analysis

Pathway to commercialization

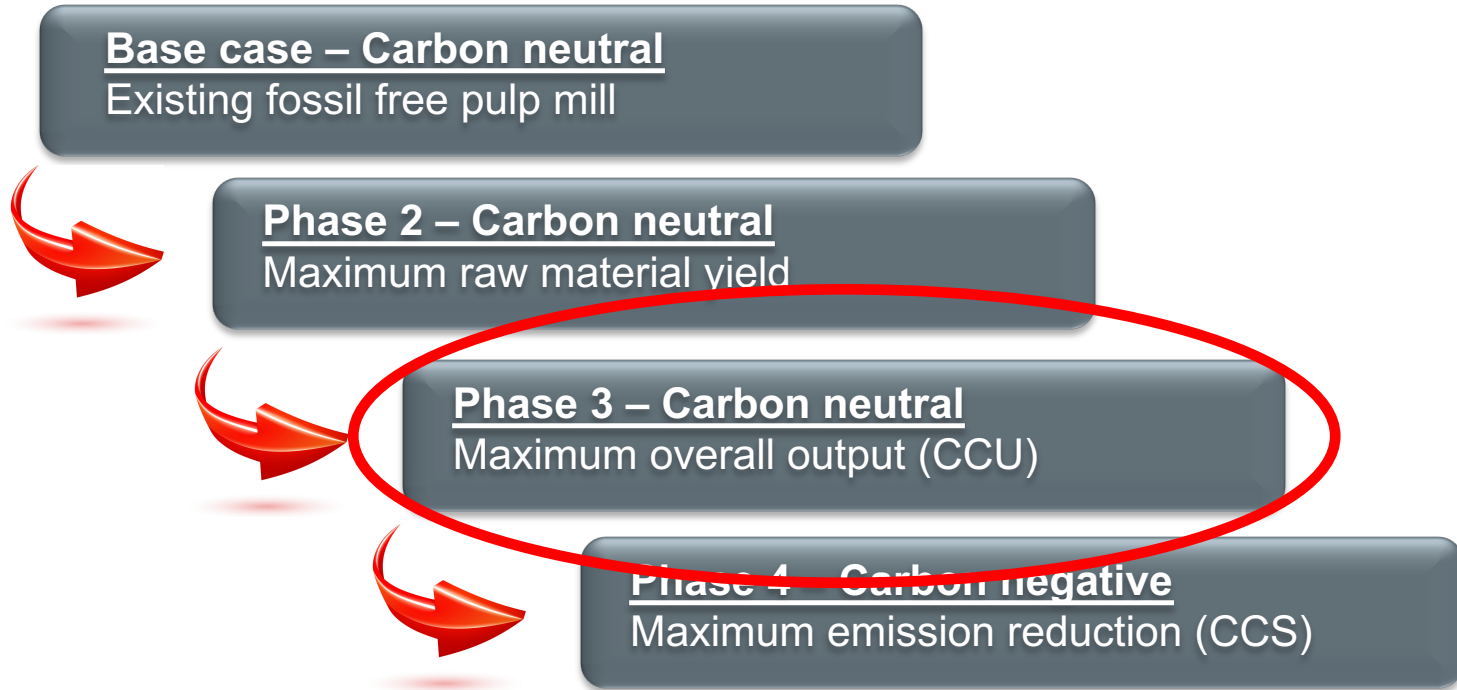
BECCU – Integrated production of fuels and chemicals from bioenergy CO₂

A process concept based on the CO₂ to hydrocarbons technology

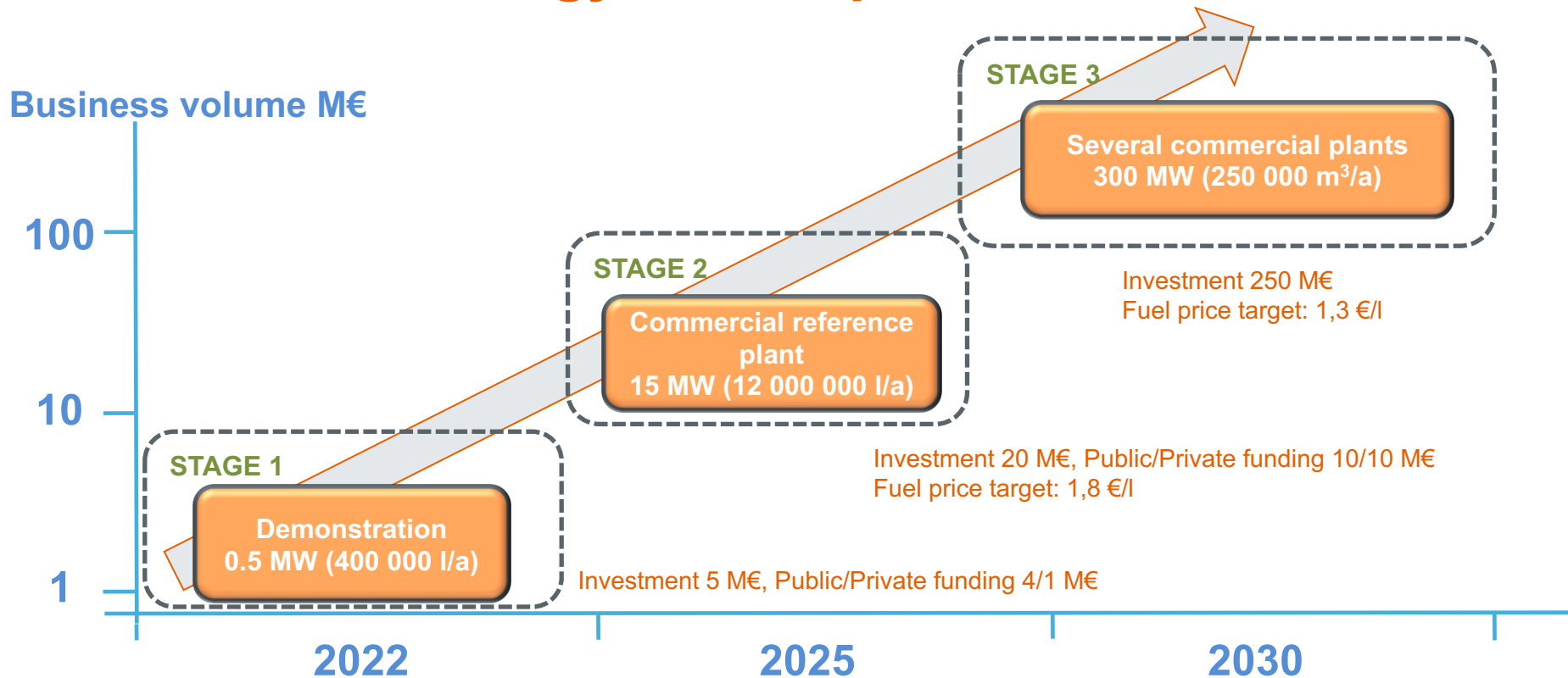
- The yield of C₂-C₄ olefins is maximised to be used in chemicals production
- Heavier hydrocarbons applied for transportation fuels (gasoline, diesel, jet fuel)



Stepwise emission reduction of a pulp mill – pulp mill as a source of biogenic CO₂



Finnish technology roadmap for electrofuels



Summary

Conclusions

VTT has **wide competence** in technologies for electrofuels

E-fuels are needed for climate change mitigation

VTT offers technologies and has determined pathway for **e-fuels commercialization** in Finland



Let's develop together the winning technologies for e-fuels!

bey⁰nd

the obvious

Thank you!

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