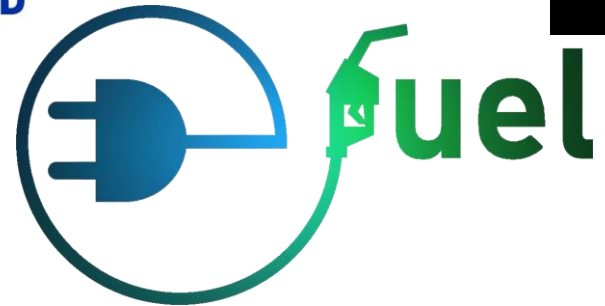


BUSINESS
FINLAND

VTT



E-fuel

Business Finland
co-innovation project

21/09/2022 VTT – beyond the obvious

Challenge

Efficient and profitable production of drop-in transportation fuels by Power-to-X

Our proposed solution

Combining of high temperature electrolysis and Fischer-Tropsch synthesis to obtain drop-in paraffinic fuels with high efficiency

Our vision

Year 2050, e-fuels will cover 20-30 % of final energy demand in transportation in Europe



The main objectives

- 1) To demonstrate production of drop-in paraffinic e-fuels in bench scale with high efficiency by combining and integrating high temperature electrolysis and Fischer-Tropsch synthesis
- 2) A readiness to scale up the concept after 2-year project to a production scale of 10 kton/a



Project partners and collaborators

INTERNATIONAL



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING



CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

NATIONAL

WP8: Management, Collaboration and Dissemination

WP1:
Novel high temperature
electrolysis

WP2:
CO₂ capture

WP4:
Process
integration &
demonstration

WP3:
Synthesis

WP7:
Business
case
evaluation

WP5:
E-fuel usability

WP6:
Energy systems and
climate impact analysis

Results
Support



Guidanc
e
Material
s

Parallel company projects



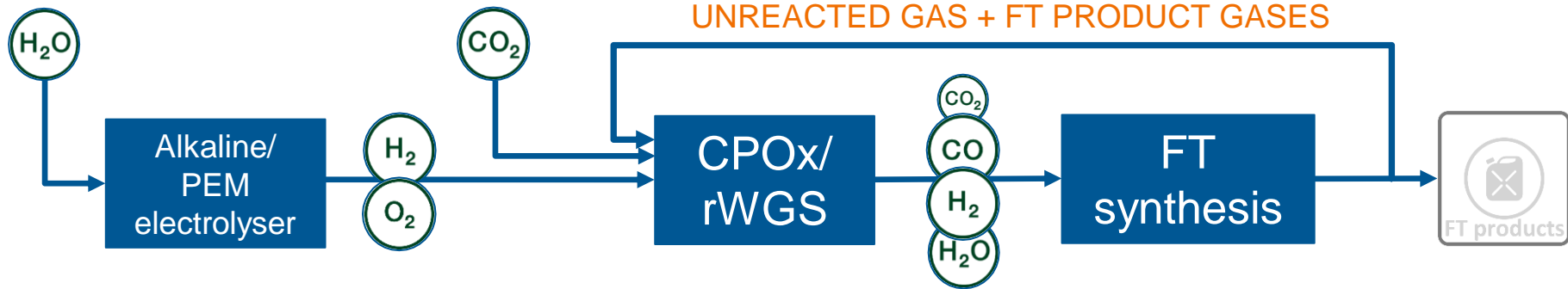
Companies supporting
the public project



ILMATIETEN LAITOS

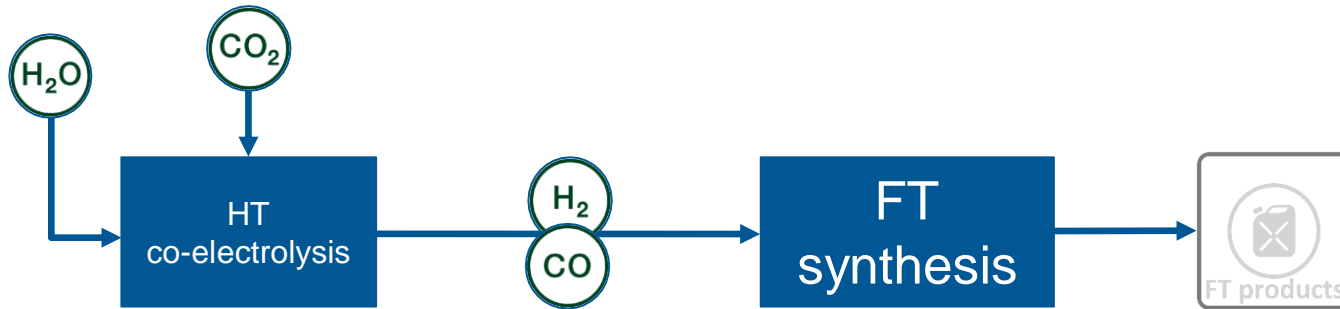


Approach 1 for hydrocarbons by P2X



- Proprietary VTT catalyst technology for reverse water-gas shift and Fischer-Tropsch steps (cobalt catalysts for paraffins and iron catalysts for olefins)
- Efficient intensified reactor technology for FT

Approach 2 for hydrocarbons by P2X



- Proprietary VTT catalysts for Fischer-Tropsch step (cobalt catalysts for paraffins and iron catalysts for olefins)
- Efficient intensified reactor technology for FT

VTT mobile synthesis unit (MOBSU)

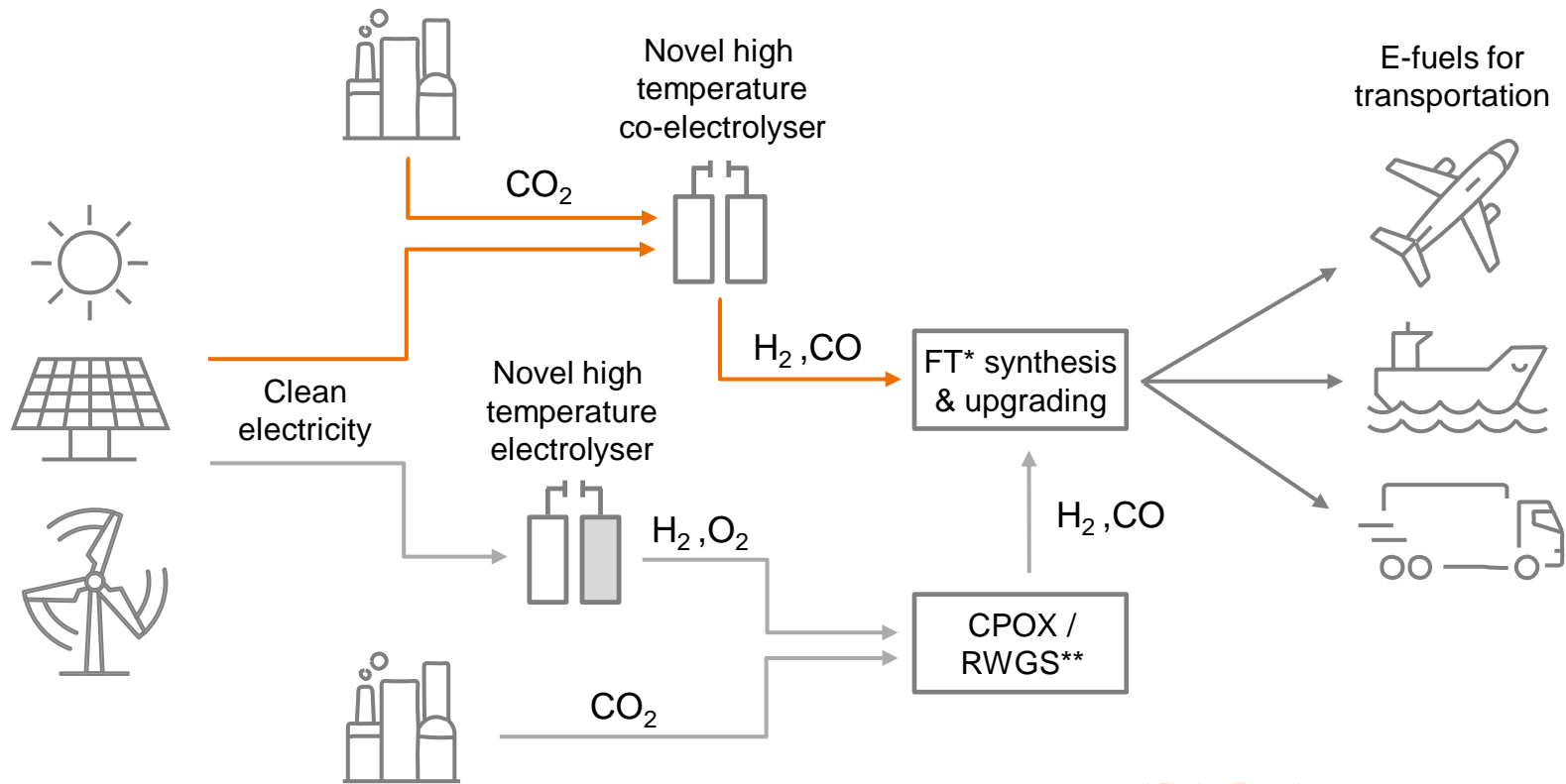
- MOBSU is a multipurpose synthesis unit for CO or CO₂ upgrading to energy carriers, fuels and chemicals
- Can be transported on-site where CO₂ emissions and energy are available



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



E-fuel concept



* Fischer-Tropsch

**Catalytic partial oxidation / Reverse water-gas shift

E-fuel demonstration – Integration of 3 units in industrial environment

Renewable
electricity



Convion 250 kW SOEC with Elcogen
stacks

Industrial
CO₂ emission



CarbonReUse or Kleener CO₂ capture



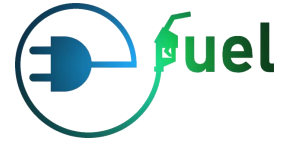
VTT Mobsu

E-fuels
for testing

E-fuel demonstration – schedule

		2022												2023									
Project/task		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	
SOEC pre-testing preparation						■	■	■	■	■	■	■											
SOEC pre-testing													■	■	■	■	■						
Full-demo preparation						■	■	■	■	■	■	■	■	■	■	■	■	■					
Full-demo campaign																		■	■	■			

End-use research within the E-fuel project



The main research questions and our activities are:

- **Will aliphatic e-diesel reduce engine-out exhaust emissions? The effect of blending aliphatic e-diesel with oxygenated diesel component oxymethylene ethers (OME)? Potential to form secondary aerosols in atmospheric reactions?** Measurement campaign with AGCO 44HD Stage V engine in collaboration by VTT Technical Research Centre of Finland, Tampere University and Finnish Meteorological Institute.
- **Will e-diesel improve durability and performance of diesel particulate filter (DPF)?** Durability, loading and performance of DPF is studied with conventional diesel and e-fuel.
- **How e-diesel performs in the field test with tractor?** E-fuel will be in the field test by AGCO and emissions will be measured by PEMS system.

**E-diesel blended
with $\text{CH}_3\text{O}(\text{CH}_2\text{O})_n\text{CH}_3$
oxymethylene ethers**





bey⁰nd

the obvious

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