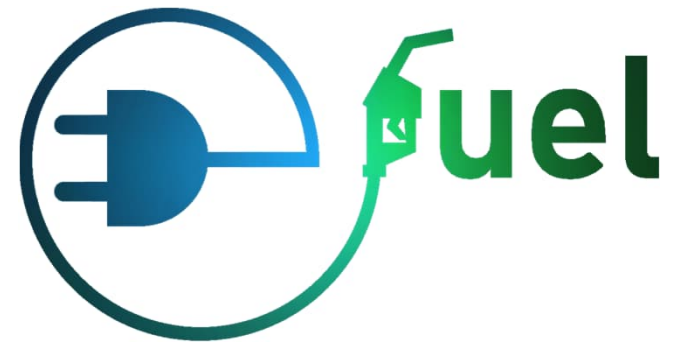


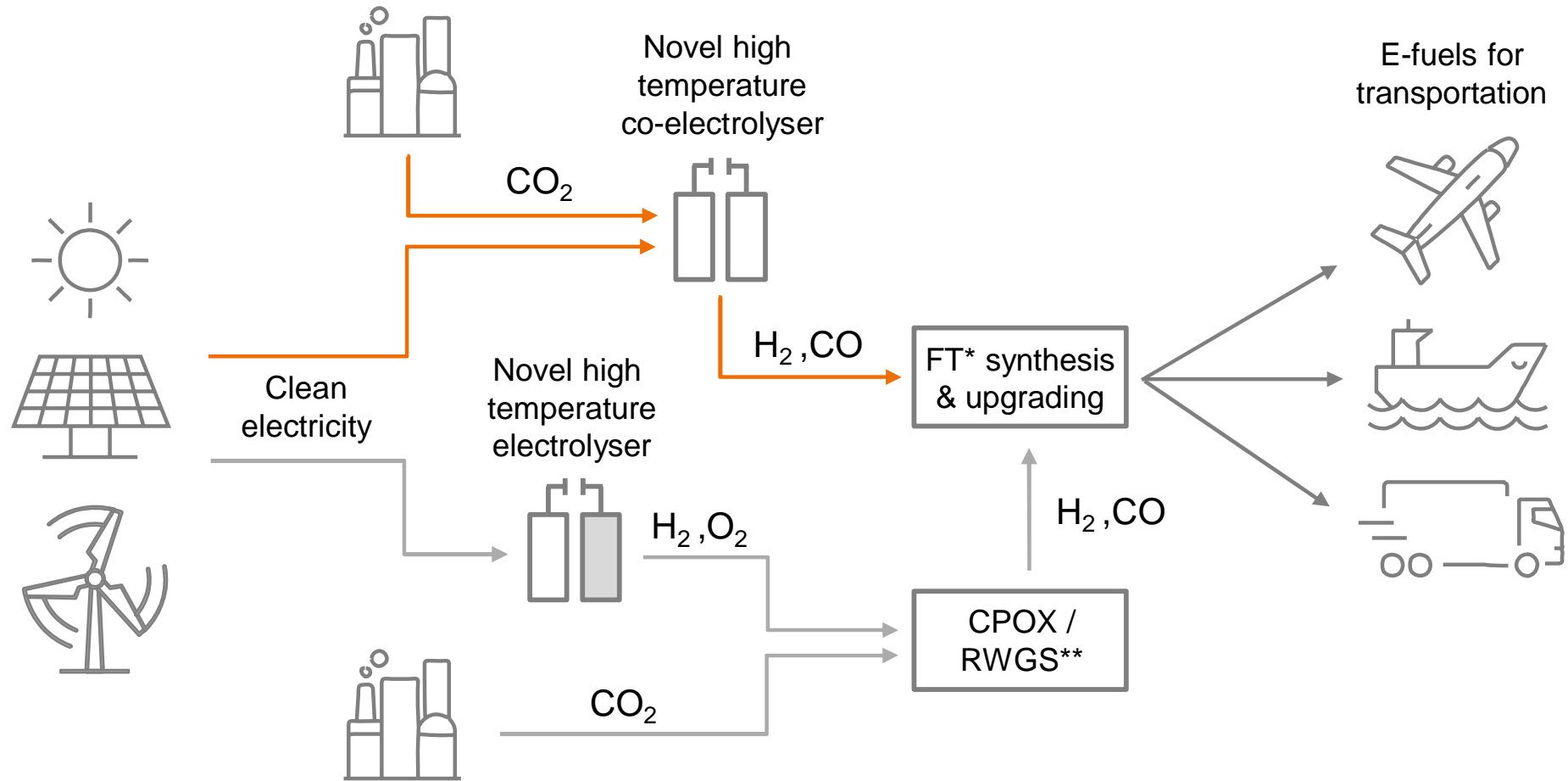
VTT



## WP4: Updates on demonstration

27/06/2022 VTT – beyond the obvious

# E-fuel concept



\* Fischer-Tropsch

\*\*Catalytic partial oxidation / Reverse water-gas shift

# E-fuel demonstration

- Initially, Kilpilahti (Neste) and Vuosaari (Helen) were the main nominees for the demonstration site with VTT Bioruukki as an alternative. Neste's and Helen's decisions on demonstration were negative.
- VTT assessed the E-fuel demonstration in Bioruukki to be possible with moderate changes to the infrastructure, and the external funding (outside E-fuel project) required to make these changes and preparations has been secured. At Steering Group meeting 4 the E-fuel demonstration site was chosen to be Bioruukki.
- VTT will make preparations for both a SOEC pre-testing (Q4/2022) and full E-fuel demo (Q2/2023) in Bioruukki.

# Bioruukki EFUEL demo preparation project

Project started 10.5.2022

## TASKS

- New demo site construction to accommodate all units (Convion SOEC, both Kleener and CRUF CO2 separation containers, CO2 compressor container, MOBSU, H2 compressor container, auxiliary gas container(s))
  - Located at the north side of the building
- Bioruukki steam generator upgrades
  - Automation upgrade to enable long-term continuous operation
  - Used also as a flue gas source (LPG fired) for CO2 separation → New infrastructure to make this possible
  - Steam analysis (performed 04-05/22) showed that steam quality must be improved for SOEC suitability. Feed water/steam purification system required.
- Other infra and preparatory work
  - Mechanical: Pipe bridge to demo site, other auxiliaries (N2, H2, water etc.), drains, gas venting infrastructure
  - Electrical: Electrical supply to all containers
  - Automation: Full-plant safety automation
  - Site-wide risk analysis with demo partners

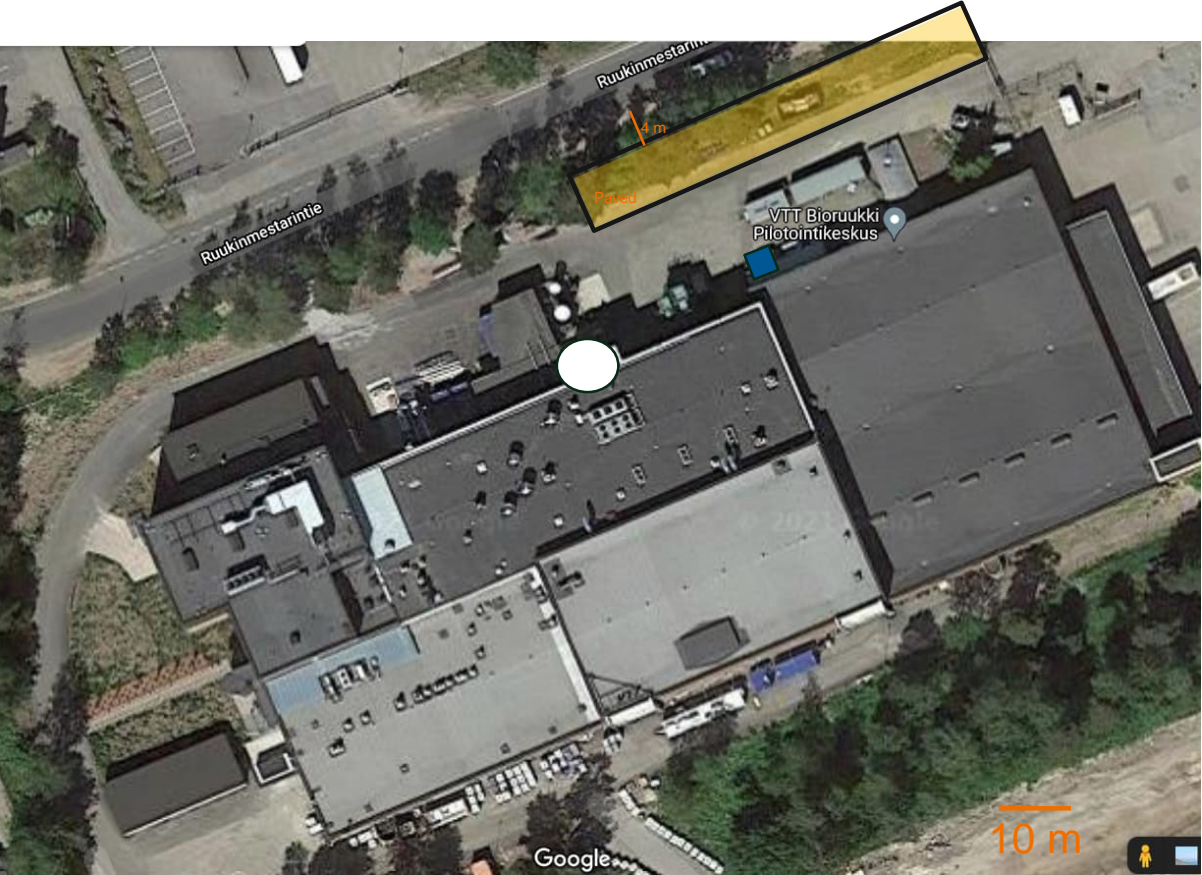
# E-fuel demonstration – Bioruukki schedule

Project/task	Partners	2022												2023								
		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	VTT/(CONVION)					■	■	■	R1	●	■											
SOEC pre-testing	CONVION											■	■	■	■	■	■					
Full-demo preparation	VTT/(ALL)					■	■	■	■	■	■		R2	■	■	●	■	■				
Full-demo campaign	ALL																■	■	■			

● SOEC unit to test site  
 ● All units to test site  
 R1 Site-specific risk analysis 1  
 R2 Site-specific risk analysis 2

# Initial layout – Bioruukki

Phase 1 – SOEC pre-test



New process area (yellow) to be constructed during 2022 and early 2023

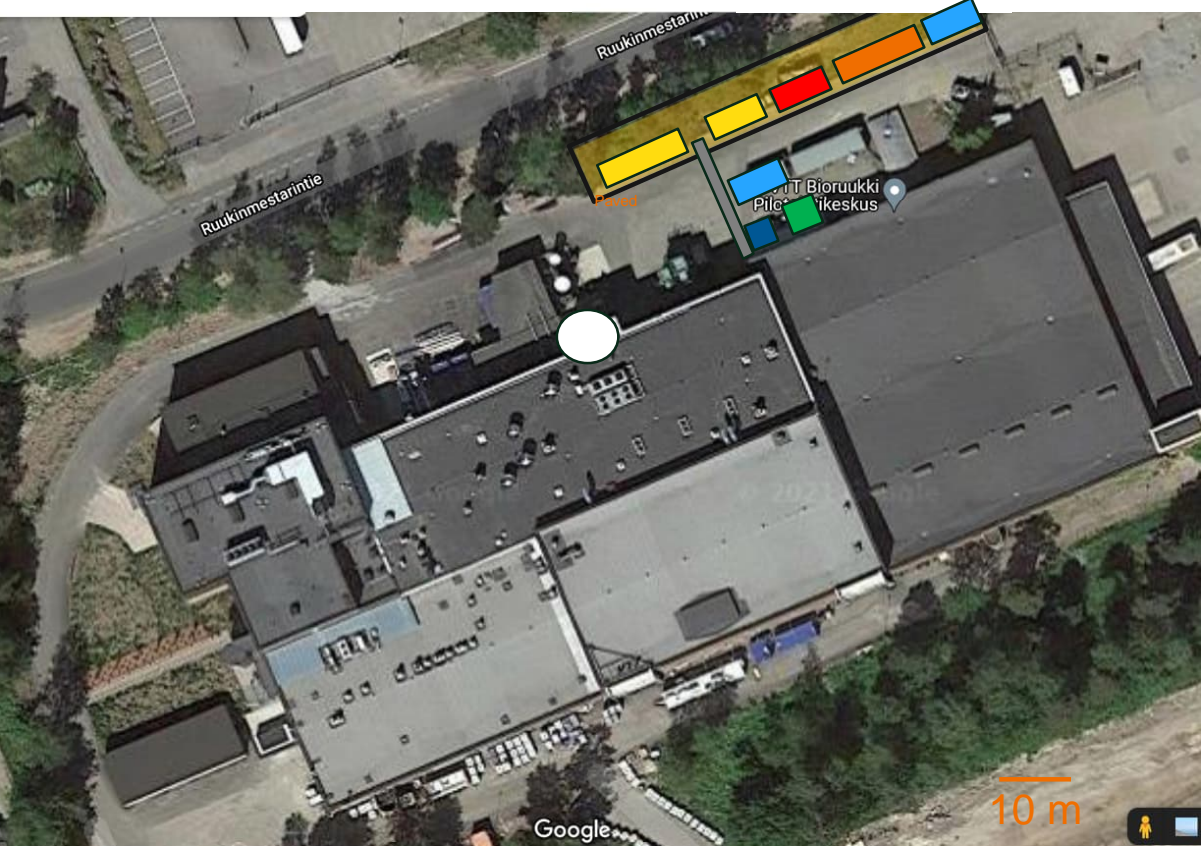
 ELECTROLYSIS

 STEAM/FLUE GAS










# Initial layout – Bioruukki

Phase 2 - Full demo spring 2023



In total 8 containers:

-  MOBSU
-  ELECTROLYSIS
-  H2 COMPR.
-  GAS CONTAINER
-  CO2 SEPARATION
-  CO2 COMPR.
-  STEAM/FLUE GAS

# Bioruukki auxiliaries

## Bioruukki steam generator steam analysis

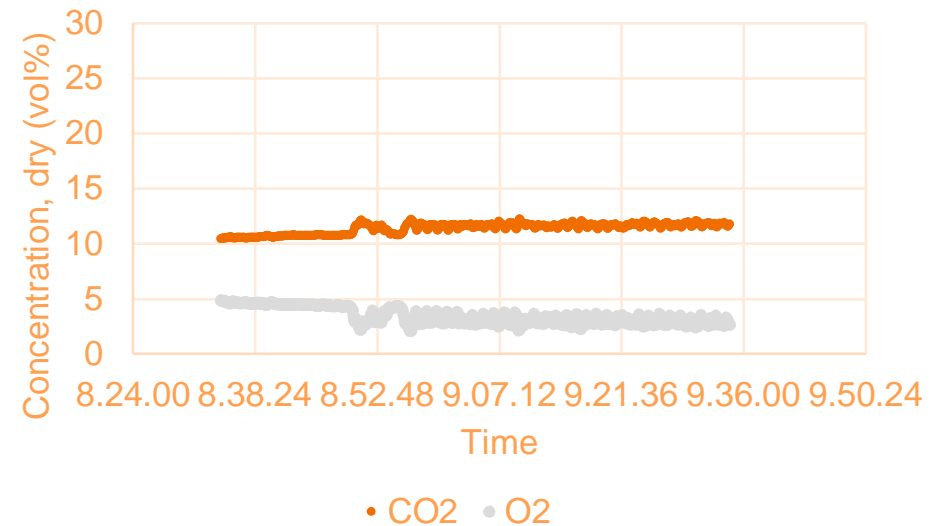
Höyrykehitin	30/03-22				*04/05-22				
	IoVe	SyVe	Höyry 1	Höyry 2	IoVe	SyVe	Höyry 1	Höyry 2	RO
pH-arvo	8,1	11,1	8,1	7,3	8,2	10,5	8,4	5,1	6,3
p-luku [mmol/l]	0,00	1,63	0,00	0,00	0,00	0,45	0,01	0,00	0,00
Sähkönjohtavuus [mS/m]	16,8	57,2	1,5	1,6	16,2	10,6	1,1	0,57	0,18
Kovuus [°dH]	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Rauta [mg/l]	-	1,3	0,03	0,03	-	-	0,010	0,004	0,004
Silikaatti [mg/l]	-	2,3	0,02	0,07	-	-	0,006	0,037	0,046
Kiintoaine	Ei	Erittäin lievä	Ei	Ei	Ei	Ei	Ei	Ei	Ei
Vatex E 60									

Näytteet: IoVe = Pehmennetty vesi, SyVe = Syöttövesi.

- Steam quality at present not suitable for SOEC application
- Water filtration unit to be installed in June/22 to improve feed water quality

27/06/2022 VTT – beyond the obvious

## Steam generator flue gas composition 25.5.22



- Steam generator is LPG fired and operated with excess air
- CO2 concentration 10-12 vol%



# bey<sup>0</sup>nd

## the obvious