VTT Fuels and Chemicals from CO2
Bio4Fuels Days 2024, Helsinki Finland

Tom Granström
+358 50 512 42 32
tom.granstrom@vtt.fi

VTT Technical Research Centre of Finland Ltd.

VTT – *beyond the obvious*

VTT is a visionary research, development and innovation partner and one of the leading research organisations in Europe.

Our role is to promote the utilisation and commercialisation of research and technology in business and society. Through science and technology, we turn global challenges into sustainable solutions for business and society in a responsible way.

284 M€
turnover and other operating income

2,355 (40/60)
employees

45%
of the net turnover from abroad

32%
a doctorate or a licentiate's degree

Established in
1942

Steered by Ministry of Economic Affairs and Employment

Sustainable Products and Materials (SUSA)

Sustainable production: processes, technologies, materials and products from lab-to-pilot scale

BA52 Industrial Chemistry

Valuable chemicals, polymers, fuels, and from recycled streams and raw material feeds e.g. biomass, CO2, plastic, waste and sustainable energy metals

BA53 Industrial Biotechnology and Food

Biotechnical production of high value chemicals and proteins. Biosynthetic materials and material components. Innovative food solutions

BA54 Biomaterial Processing & Products

Novel bio-based materials and structures from biomaterial feeds e.g. biocomposites, biomass, fibre and cellulose

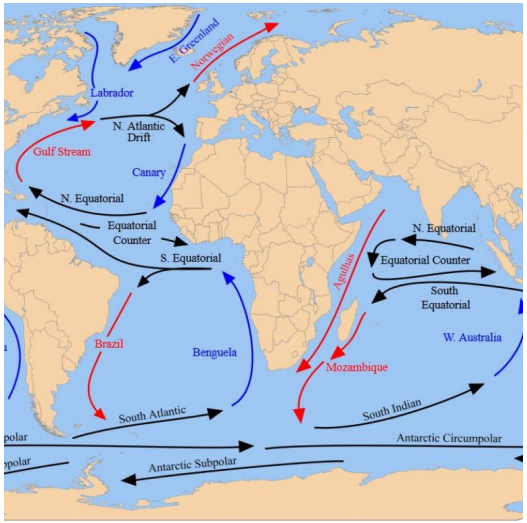
BA55 Knowledge Driven Design

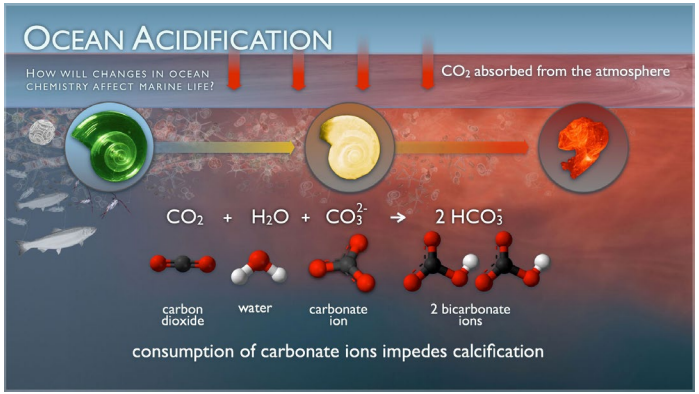
Design and production of new materials and components. Maximize lifetime value of assets.

BA56 Cognitive Production Industry

Advanced manufacturing technologies. Data driven industries. Optimization of supply chains and maintenance. Robotics.

Climate change

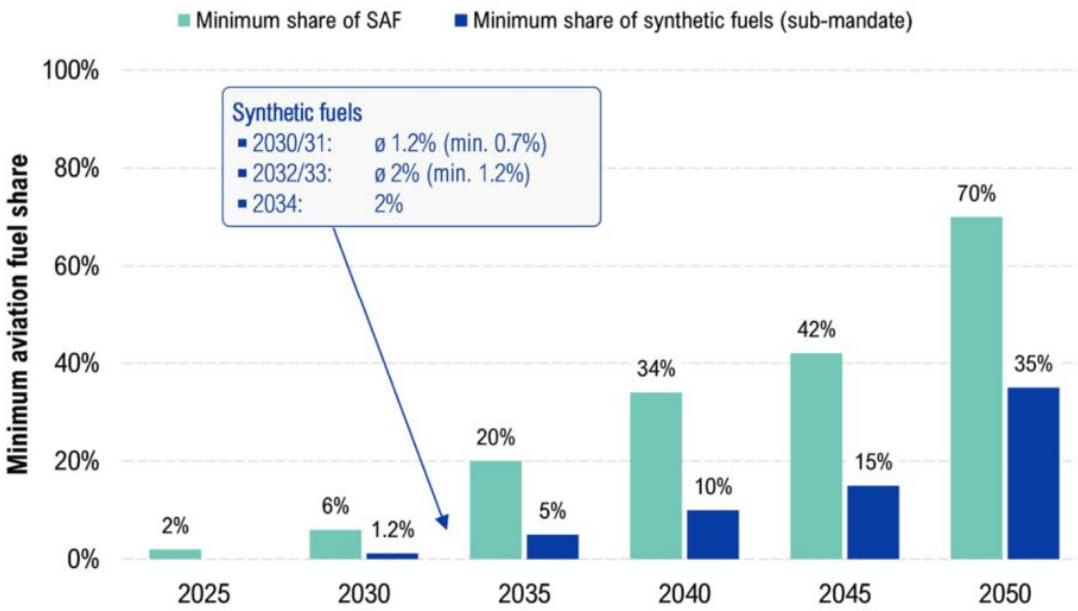


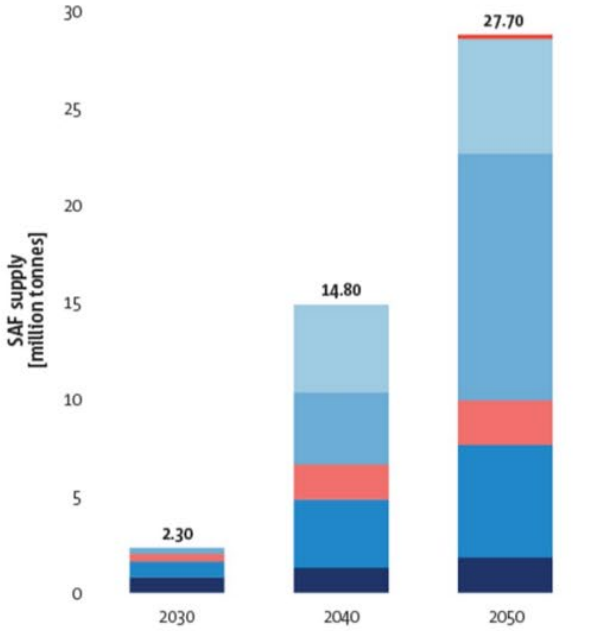


The current CO2 content is 420 ppm of which 40 % is from industrial era i.e.100 – 50 Gt

www.pmel.noaa.gov/
GeoLog | Knowing the ocean's twists and turns (egu.eu)
www.earth.com

ReFuel EU Aviation





	2030	2040	2050
Electricity	0.00	0.00	0.20
Gasification+FT	0.00	4.50	5.90
PtL	0.30	3.70	12.70
Imports	0.40	1.80	2.30
ATJ	0.80	3.50	5.80
HEFA	0.80	1.30	1.80

Synthetic fuels = e-fuels

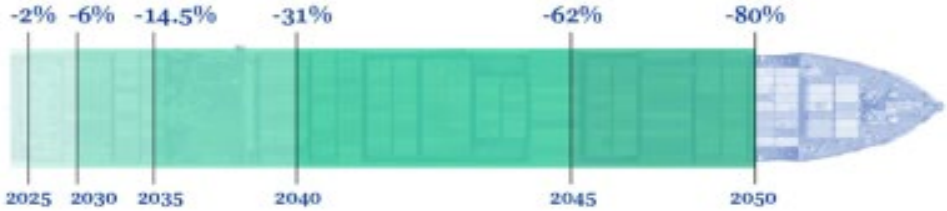
ReFuelEU aviation - (sustainable-aviation.net)
Current landscape and future of SAF industry | EASA Eco (europa.eu)

FuelEU Maritime

The FuelEU maritime regulation will oblige vessels above 5 000 gross tonnes calling at European ports (with exceptions such as fishing ships):

→ to **reduce** the **greenhouse gas intensity** of the energy used on board as follows

Annual average carbon intensity reduction compared to the average in 2020

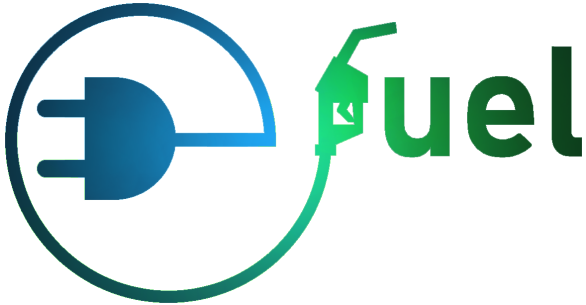


E-fuels needed for marine transport to reduce carbon intensity:

- Methanol
- Ammonia
- E-diesel

Special reward (double counting) for e-fuels in 2025 - 2033

Basics and some numbers



- Business Finland's co-innovation project
- 14 partner companies, VTT as research organisation
- Duration 3 years (1.1.2021-31.12.2023)
- VTT's budget 3.3 M€, total budget ~ 7 M€
- In addition to VTT, Neste's project for demonstration at Bioruukki Convion & Elcogen projects for SOE development and Andritz project for CO_2 capture development

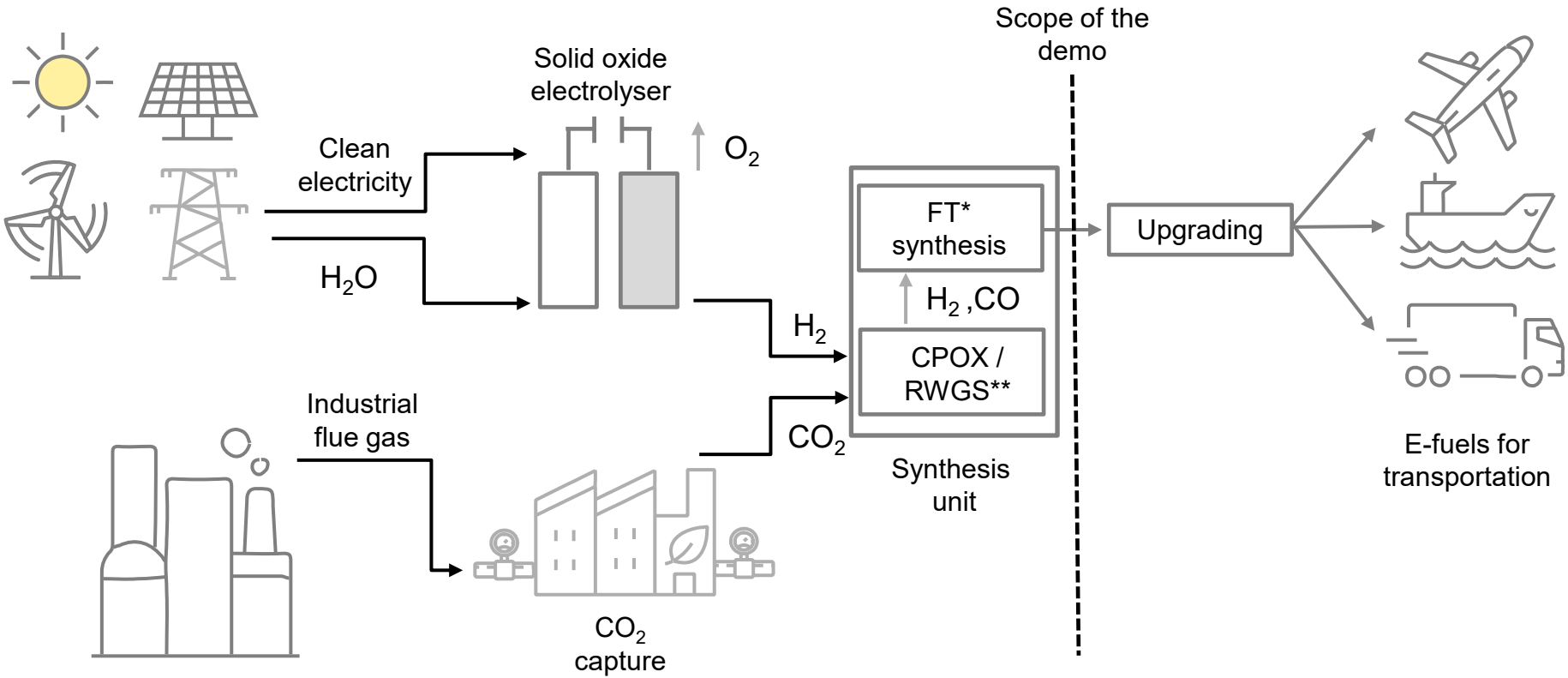
Parallel company projects

ANDRITZ · convion · Fuel cell technology elcogen · NESTE

Companies supporting the public project

ABB · AGCO POWER · AW-ENERGY OY · HELEN · CarbonReUse · ESL Shipping · INERATEC · KLEENER POWER SOLUTIONS · MERIAURA · PROVENTIA

E-fuel Power-to-X concept



* Fischer-Tropsch
**Catalytic partial oxidation / Reverse water-gas shift

E-fuel demonstration – Integration of 6 units

VTT

Renewable electricity
130 kW

Steam
35 kg/h

VTT

VTT steam generator

Flue gas
30 kg/h

Excess H_2 out

Convion SOEC with Elcogen stacks

Lean flue gas out

Andritz-CRUF CO_2 capture

0.5 kg/h

H_2

H_2 compression (30 bar)

3 kg/h

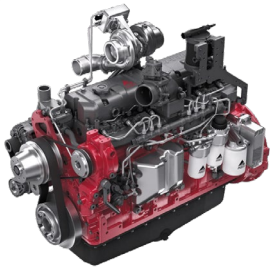
CO_2

CO_2 compression/liquefaction (60 bar)

VTT MOBSU
(mobile synthesis unit)

FT products upgrading (by Neste)
0.3 kg/h (liquid fraction)

60 liters (diesel)
E-fuels for testing (by AGCO Power)

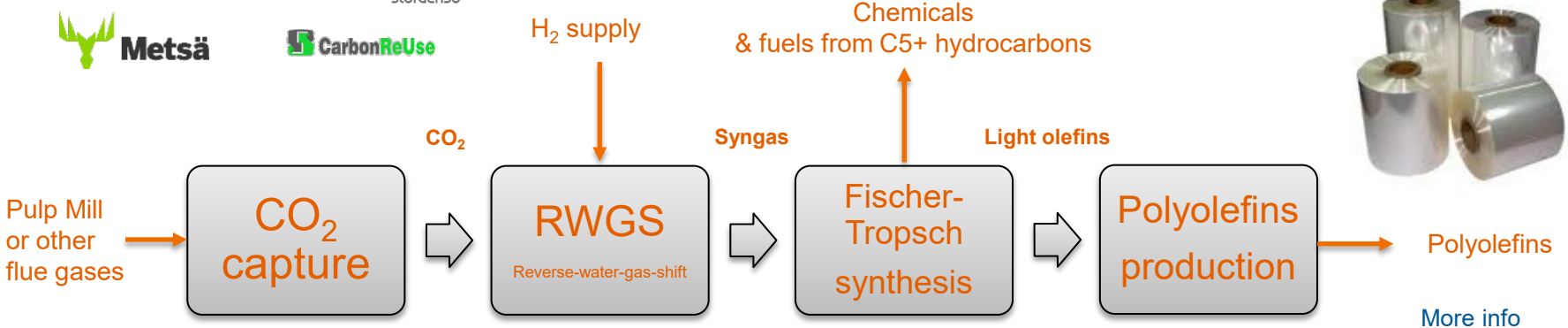


Forest industry Carbon dioxide Utilisation for Materials and Plastics

ForestCUMP

VTT's budget: 2.66 MEUR

Schedule: Aug/2022 – Aug/2024



More info

Biogenic vs. fossil CO2

Fit for 55: EU reaches new milestone (2023) to make all new cars and vans zero-emission from 2035

https://climate.ec.europa.eu/news-your-voice/news/fit-55-eu-reaches-new-milestone-make-all-new-cars-and-vans-zero-emission-2035-2023-03-28_en

According to e-Fuel project results 20 Mt/a of CO2 will yield 5,5 Mt/a e-fuels.

This requires 203,5 TWh electricity.

The total electricity consumption in Finland is 85 TWh.

beyond
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Tom Granström
Tom.granstrom@vtt.fi
+358 50 512 42 32

@VTTFinland
linkedin.com/in/aaltomg

www.vtt.fi

Contact information:

Tom Granström, research manager

Industrial Chemistry

Sustainable Products and Materials

tom.granstrom@vtt.fi

linkedin.com/in/aaltomg