

Co-creation results

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Judit Sandquist, Berta Matas Güell
SINTEF

ICARUS – Best practices and Concepts



The objective

To propose a set of
recommendations to accelerate the scaling up
of the three value chains addressed within ICARUS

The plan



Publicly available information



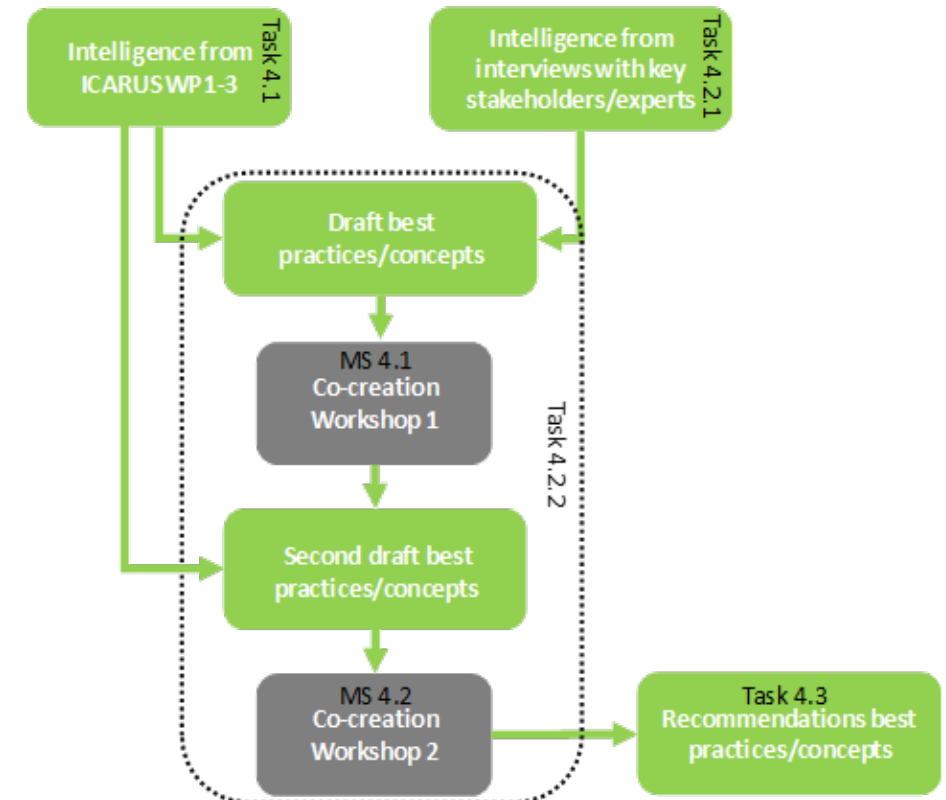
Extensive dedicated interviews with key stakeholders and R&I experts

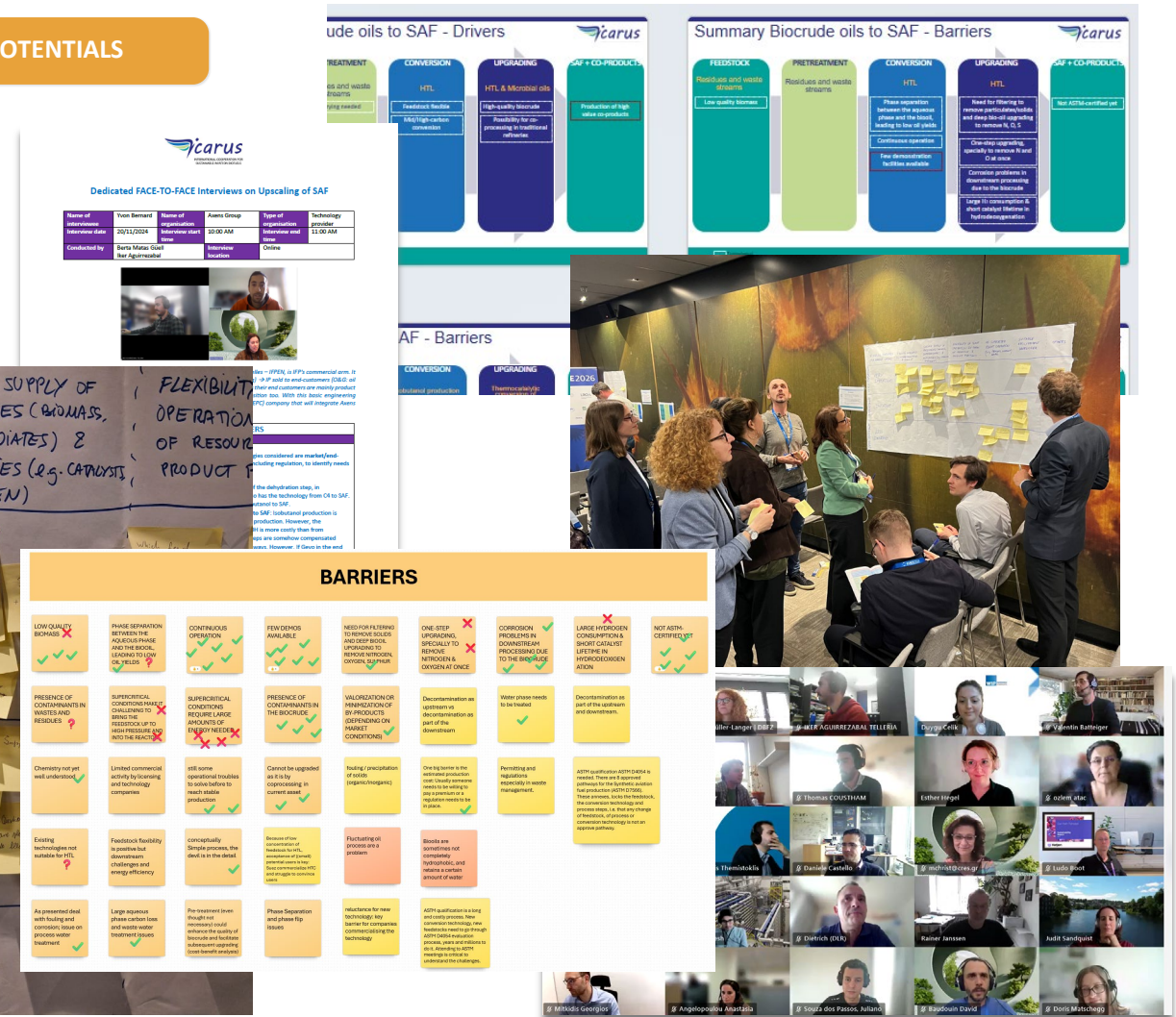


Co-creation webinars/workshops



Data generated within the project





The results:

What determines successful SAF production

1

ECONOMICS

Bankability, CAPEX, operating costs and predictable returns are the dominant constraints.

2

FEEDSTOCK

Secure quantity, quality and cost require diversification, logistics and flexible plants.

3

DEMO → MARKET

FOAK support and learning from failures must bridge the commercialization gap.

4

POLICY + CERTIFICATION

Demand mandates need production support, stable rules, traceability and workable certification.

5

PORTFOLIO + PARTNERSHIPS

No single route can meet demand; technologies, regions and actors must work in parallel.

OVERARCHING TAKEAWAY

Scale-up is now a coordinated deployment challenge: match pathways to feedstocks, de-risk investment and maintain a diversified SAF portfolio.

Main take-aways – Biocrude oils to SAF

Converts wet, difficult waste streams that other routes cannot readily use.

FEEDSTOCK FLEXIBILITY

CIRCULARITY POTENTIAL

EARLY COMMERCIAL STAGE

1 Best fit is wet and problematic biomass

HTL expands the feedstock pool to sewage sludge, digestates, wastewater-derived biomass and other high-moisture residues, without drying.

2 Scale-up depends on stable continuous operation

Recurring bottlenecks are contaminants, corrosion, fouling, solids handling, phase separation and large process-water streams.

3 Value recovery is central to the business case

Priority innovations are aqueous-phase and by-product valorisation, salt separation, robust catalysts and integration with green hydrogen.



Figure and layout: MS Copilot

KEY IMPLICATION

Demonstrate consistent biocrude quality over long campaigns and progress ASTM qualification before broad aviation deployment.

Main take-aways – Alcohols to SAF

Strong global potential, but European deployment is constrained by eligible alcohol supply and economics.

ASTM-CERTIFIED

EXISTING ALCOHOL KNOW-HOW

EU FEEDSTOCK CONSTRAINT

1 The route builds on established alcohol systems

Existing ethanol experience, logistics and certification support scale-up; isobutanol offers attractive conversion and fuel-quality characteristics.

2 The limiting step is sustainable alcohol production

In Europe, eligible lignocellulosic alcohol is scarce. Isobutanol production still faces high feedstock and enzyme costs plus fermentation limitations.

3 Integration must raise yield and capture more value

Priorities include improved microorganisms, membrane-based recovery, lower-cost enzymes, selective catalysts and multi-product biorefineries.

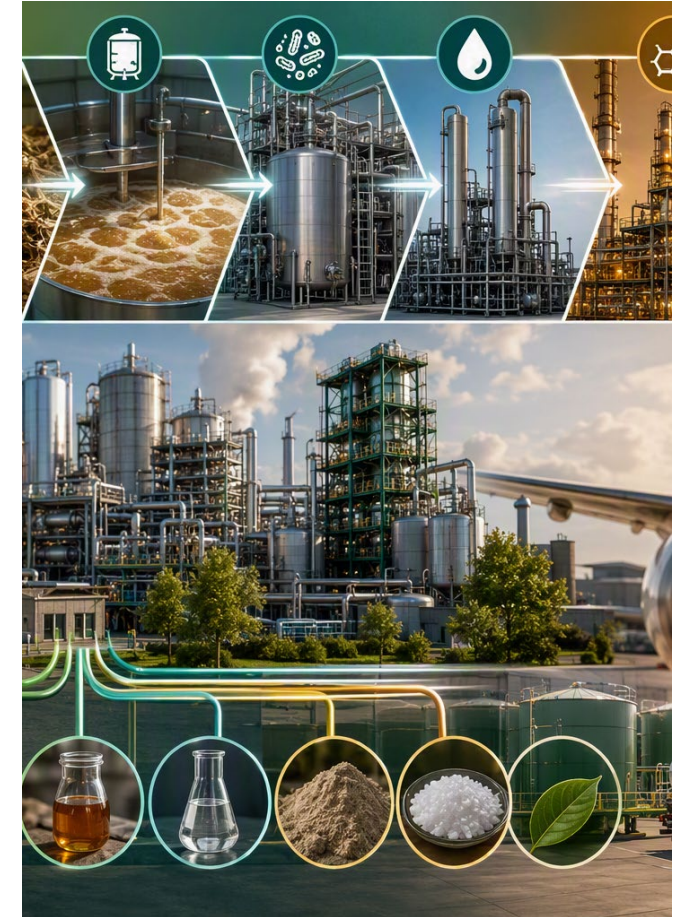


Figure and layout: MS Copilot

KEY IMPLICATION

Focus on competitive 2G alcohol supply and integrated biorefineries.

Main take-aways – Syngas to SAF

The most consistently supported candidate for large-scale SAF production in Europe.

ASTM-CERTIFIED

LARGE-SCALE POTENTIAL

HIGH CAPEX

1 Maturity and feedstock range provide momentum

Gasification-FT can use agricultural and forestry residues, wastes and other eligible feedstocks; FT synthesis is established and market-ready.

2 Capital intensity and integration dominate risk

Recurring constraints are high CAPEX, dispersed feedstock logistics, gas cleaning, contaminant-sensitive catalysts and the absence of integrated commercial biomass-to-SAF plants.

3 Improvement must target the whole system

Priorities are robust gasification and cleaning, better catalysts, renewable-hydrogen integration, higher carbon use and support for FOAK facilities.

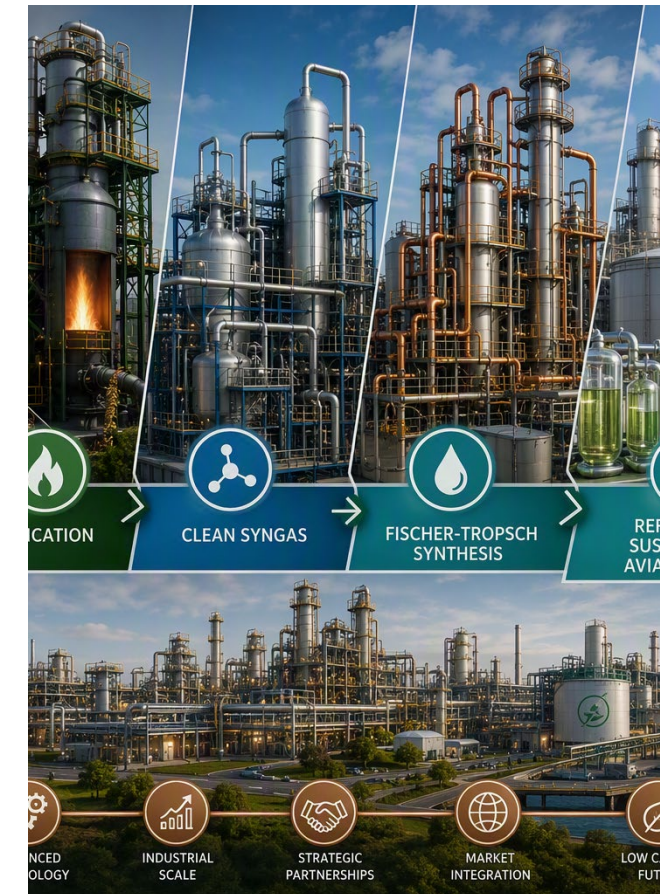
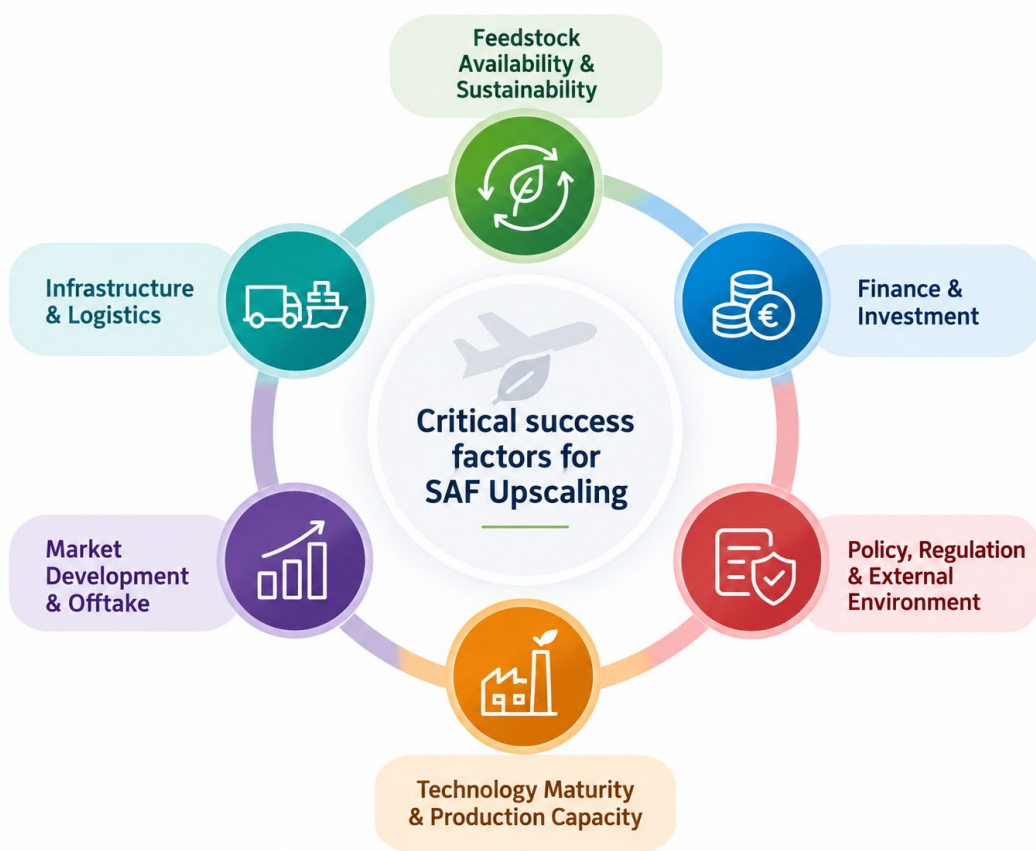


Figure and layout: MS Copilot

KEY IMPLICATION

Align plant scale with realistic regional biomass supply and de-risk integrated demonstration

The follow up: Guidelines on SAF Upscaling



Challenge

Solution

Stakeholder responsibility

5 to 6 guidelines for SAF upscaling



Thank you for your attention!