

REFOLUTION - Refinery integration, scale-up and certification for aviation and marine biofuels production

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ETIP Bioenergy Stakeholder Plenary meeting,
Brussels, Belgium, September 28. 2023

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement no. 101075503.

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Energy Efficiency – Process Design – Scale-up - Low capital costs

Health & Safety – Environment – Societal Acceptance

Representative Biomass Feedstocks

Primary Conversion technologies
⇒ Upgrading efficiency



Diversifying Upgrading technologies
⇒ Alternatives for upgrading conversion efficiency



Scenarios for integration into existing (Bio)refineries
Toolbox – Business models – Interface to refinery models

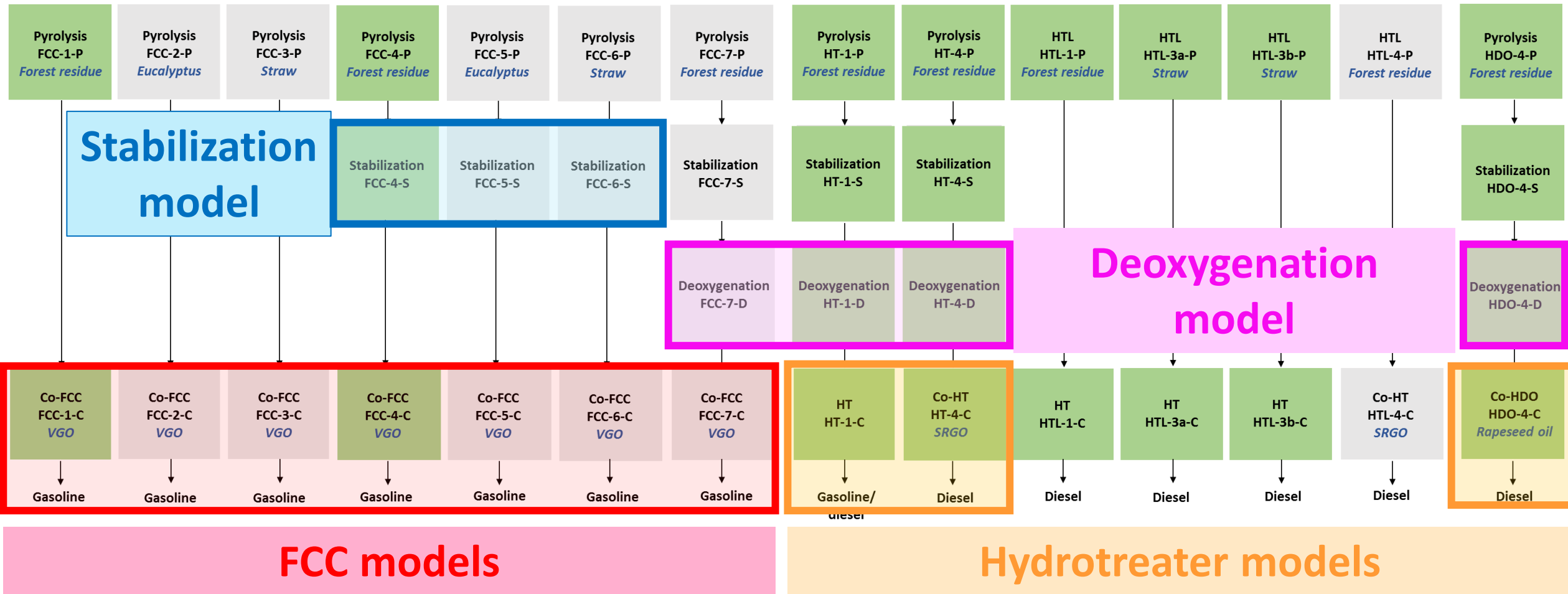
Green Gasoline

Green Diesel

Wood	
Straw	
Eucalyptus	



Techno-Economic Evaluation building MODELS for range of alternatives for Refinery integration



Feedstock/Location: Final selection of value chains

✓ **Forest residue:**

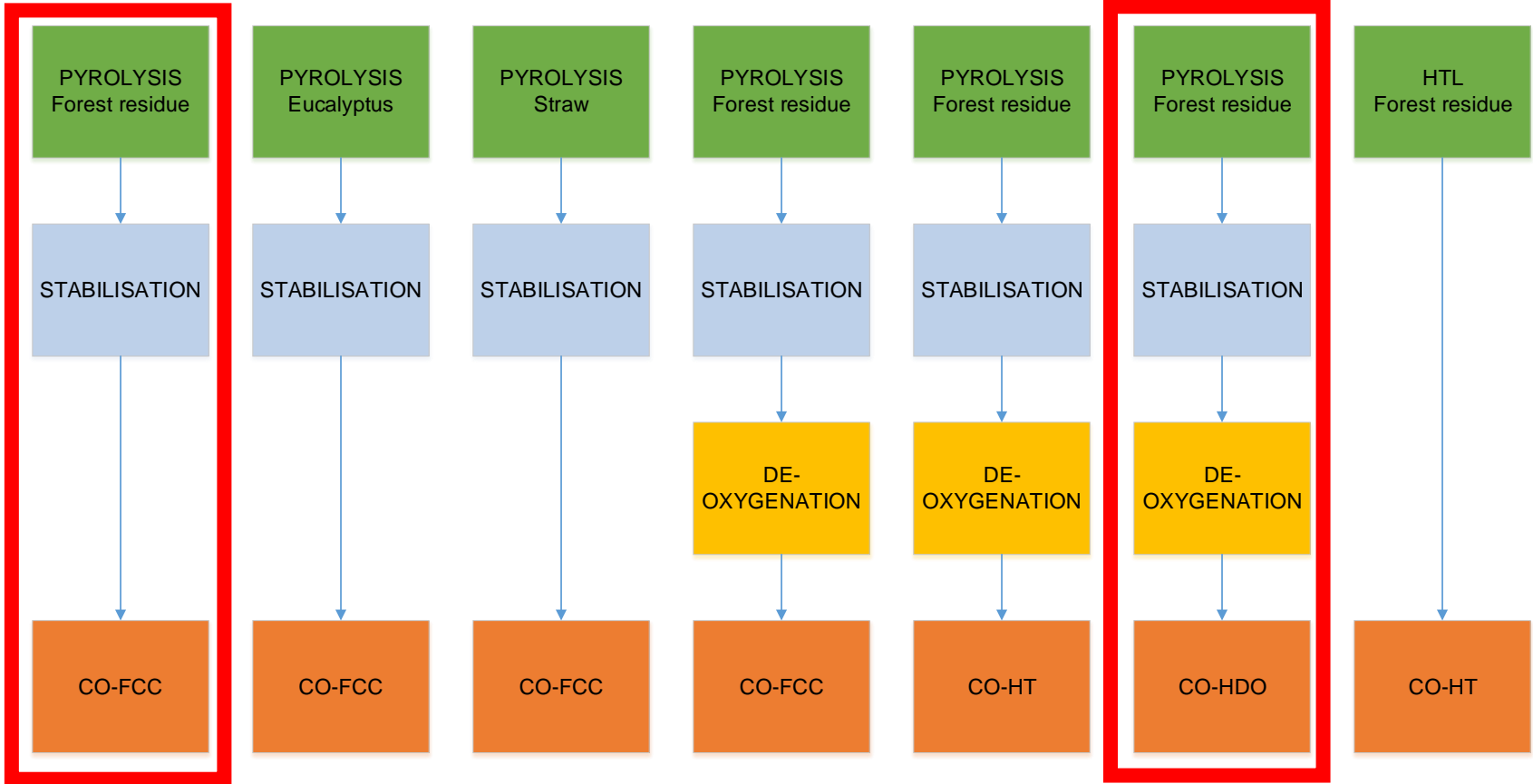
- Northern Europe
- Baltics

■ **Eucalyptus:**

- Southwestern Europe (Spain)

■ **Straw:**

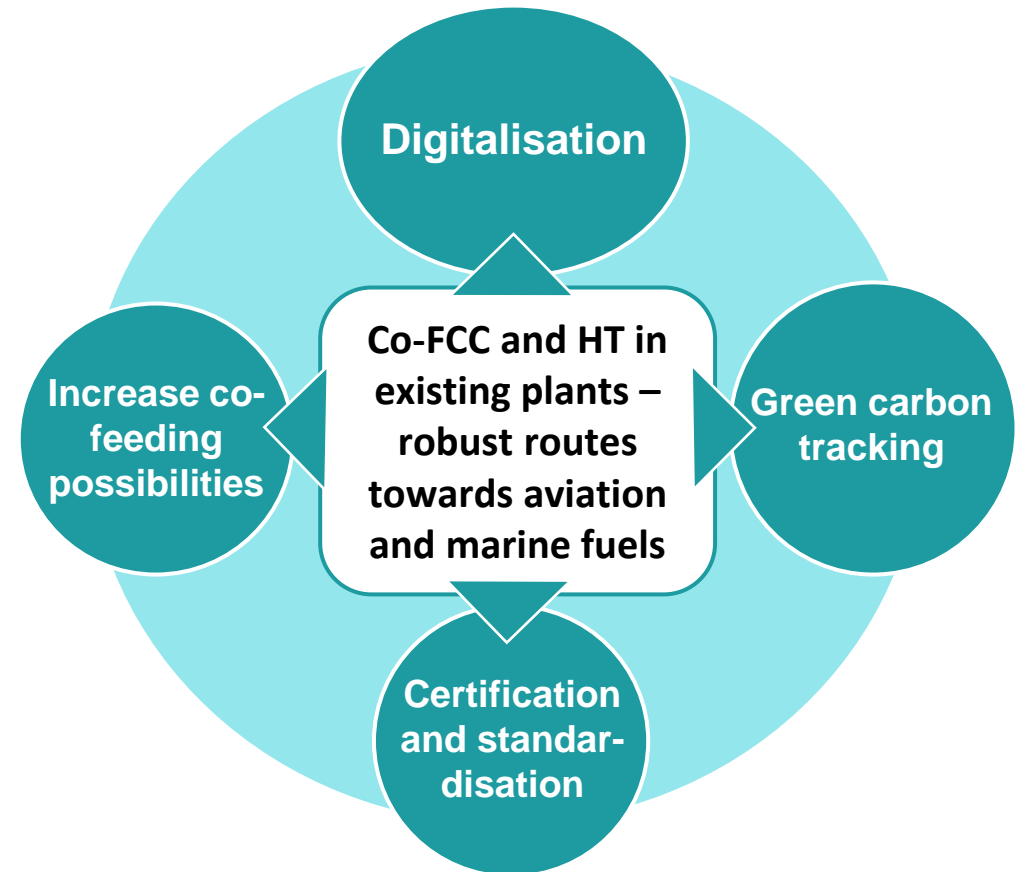
- Central Europe
- Denmark



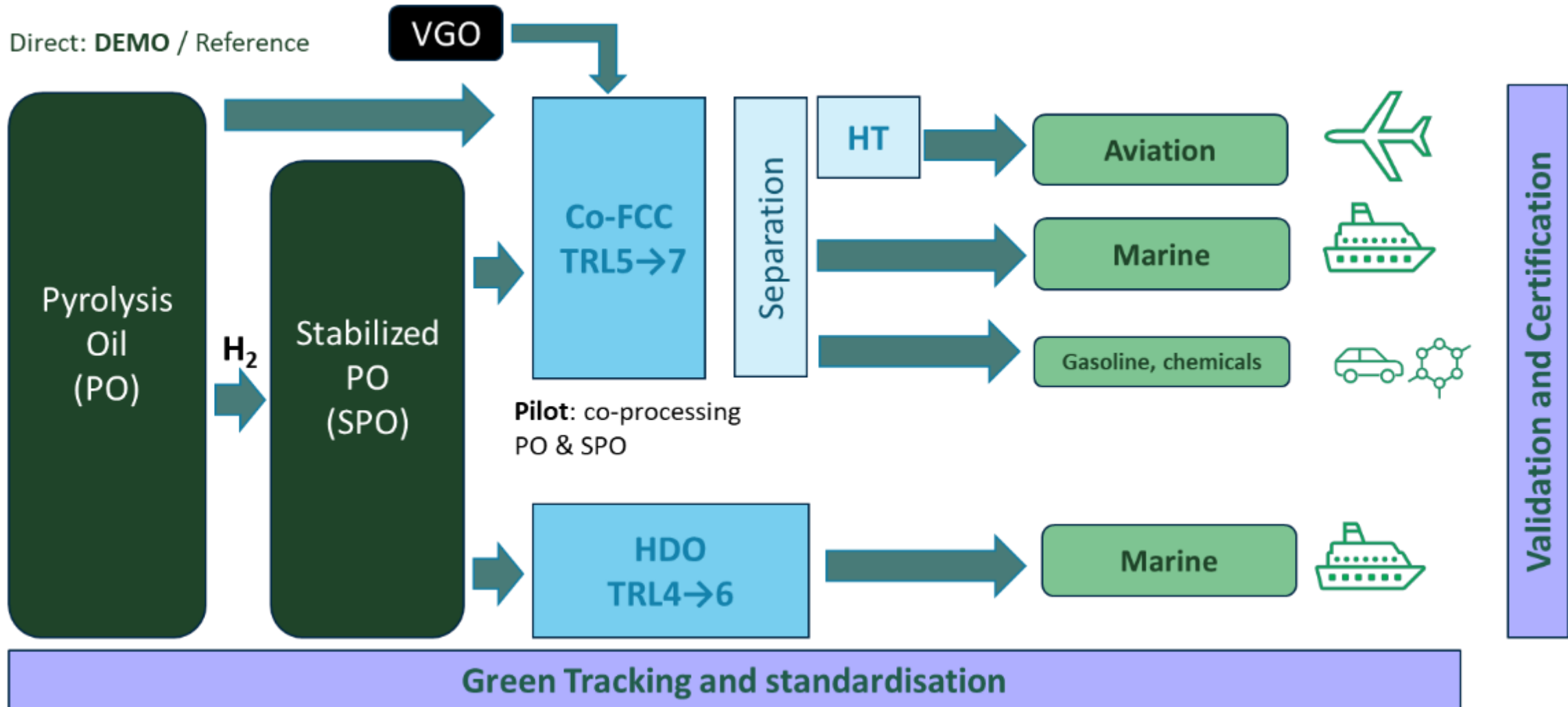
REFOLUTION -

Refinery integration, scale-up and certification for aviation and marine biofuels production

- **Challenge:** Unlock the full potential of advanced biofuels production in Europe from European Refineries.
- **Collaboration:** European consortium with expertise from the entire value chain and strong commitment from industry to maximise exploitation of results.
- **Impact:** Increasing cost-effectiveness of the production of advanced biofuels, while enhancing sustainability in a circularity approach, and preparing market up-take in EU.

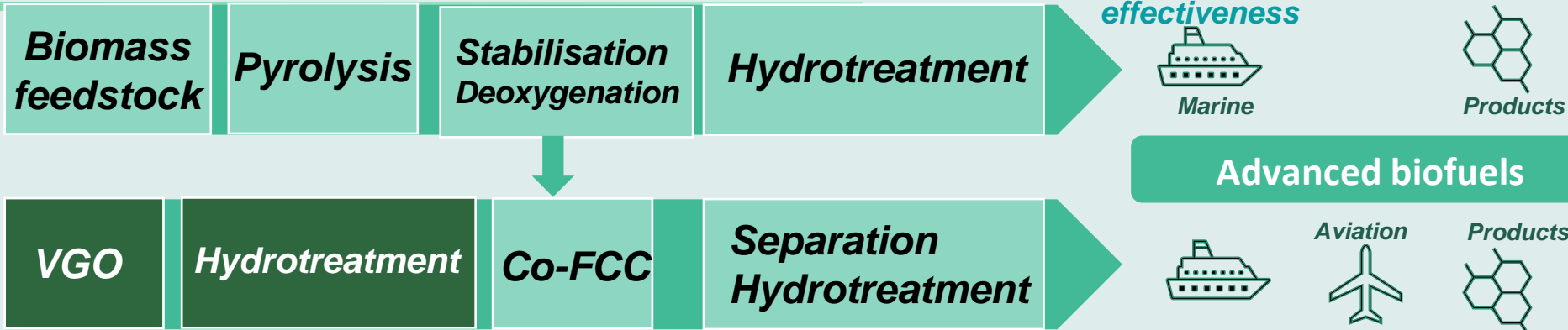


Project structure



Demonstration of advanced biofuels production from European refineries for aviation (TRL7) and marine sectors (TRL6)

- 60% decrease in CO₂ footprint
- 50% improvement cost-effectiveness

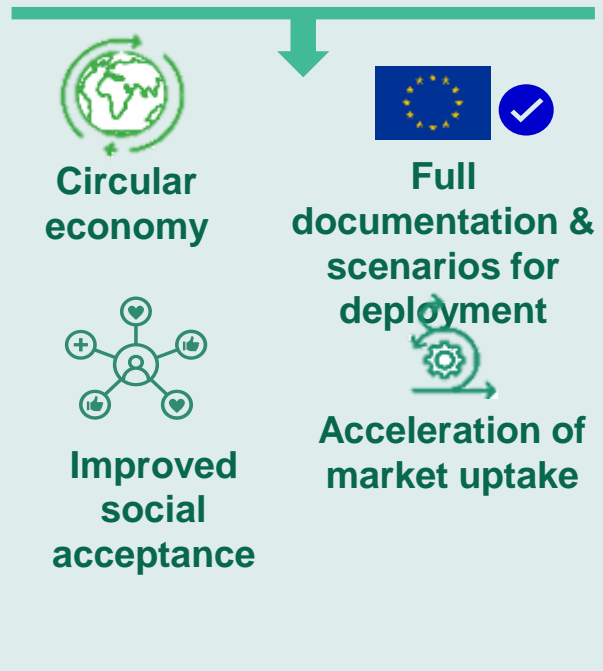


Advanced biofuels



Main innovations of REFOLUTION



- Optimised biomass conversion processes into biofuels for aviation and marine, with improved product yield and cost-effectiveness
- Clear routes towards biofuels certification and standardisation
- Optimised process design, increased digitalisation and green carbon tracking
- Decision tool and scenarios for optimised deployment

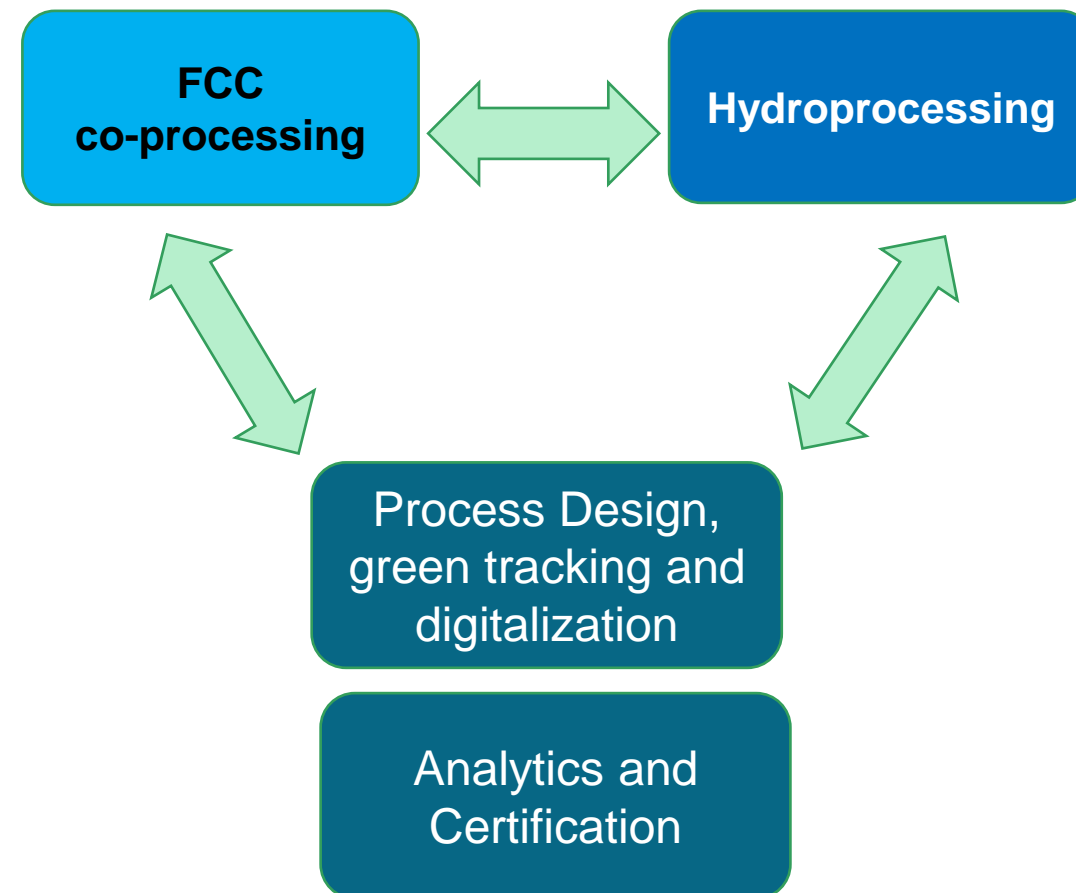


Research to be performed

- Experimental work on three different scales



- Up-grading of intermediates to **marine/aviation fuel**  
- **Certification** of samples with respect to existing standards or develop approval strategy where needed
- Develop a framework for **digitalization of biogenic carbon tracking** in a refinery setting based on integration of estimation and measurement
- Closed **green carbon mass balance** for the advanced bio-jet production pathway
- Evaluation of the **economical performance** of the envisaged co-feeding process

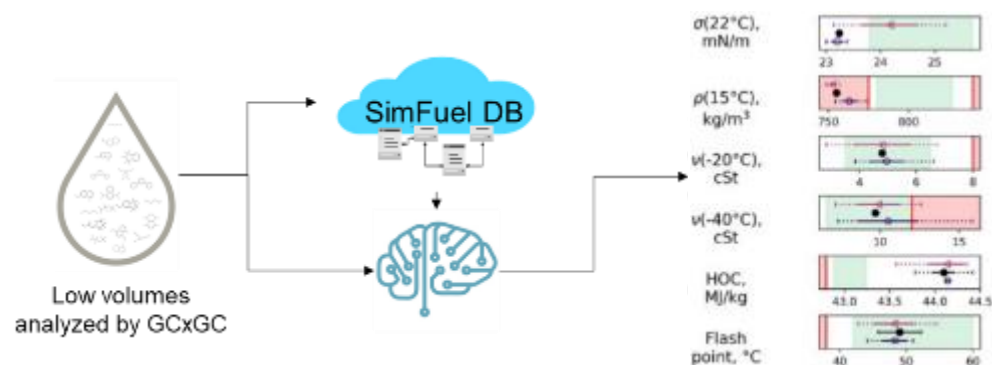


Fuel validation, standardization and certification

Aviation fuels



- Low fidelity assessment with machine learning based property models (SimFuel platform)



- High-fidelity analysis of selected samples in analogy of ASTM D4054¹ Tier 1 and Tier 2
- Development a concerted fuel approval strategy

¹ ASTM D4054 used as a reference. Co-processing is currently regulated by ASTM D1655

² Very low-sulphur fuel oil.

³ Marine diesel oil

Marine fuels



- Fuel assessment for samples according to DIN EN ISO 8217
- Stability and blending tests
- Comparative measurement with standard marine fuel (VLSFO¹, MDO²)
- Documentation of consumption and emission behavior

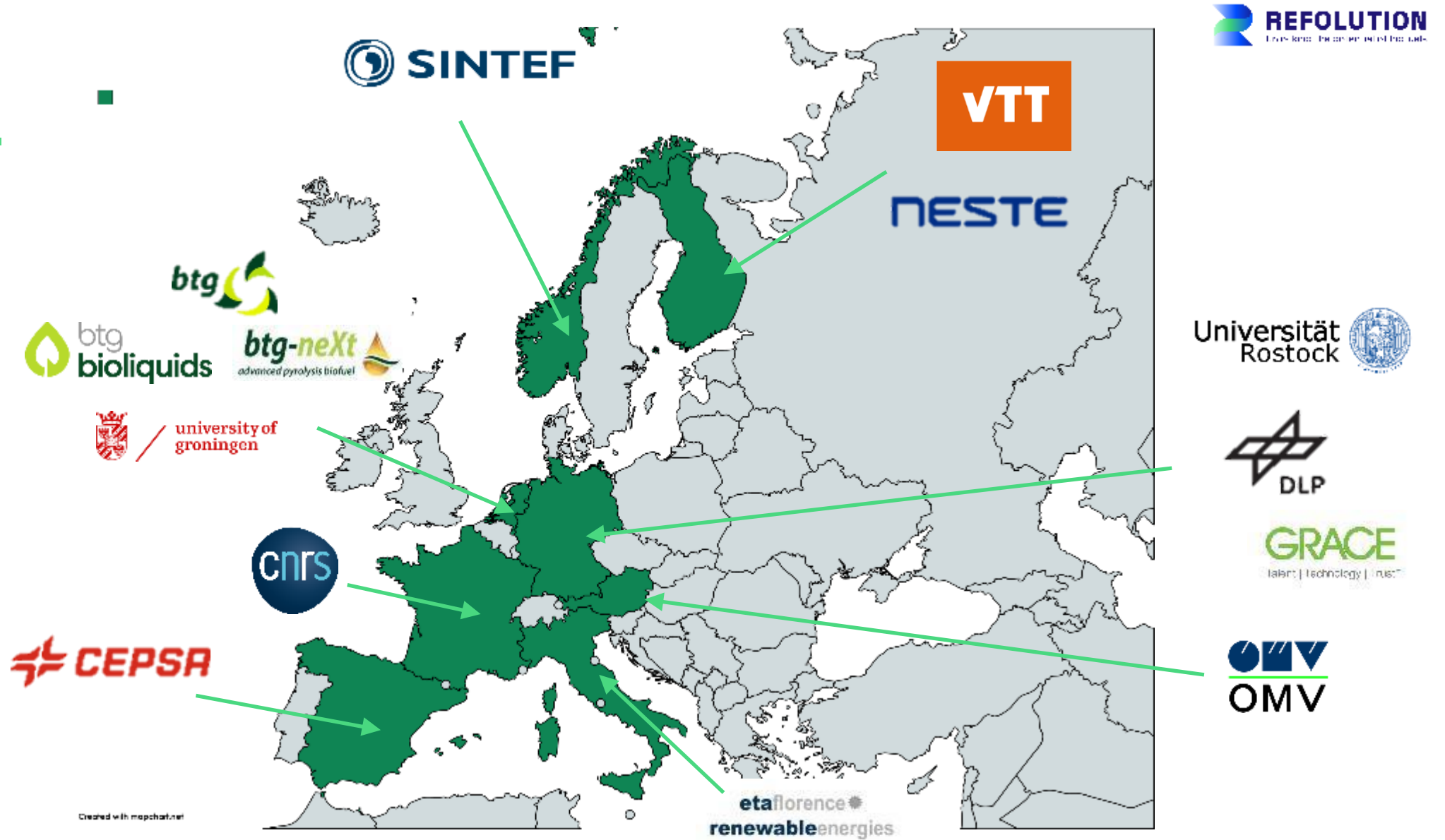


Single cylinder medium speed engine
1VDS 18/15
© LKV Rostock

Roadmap to sustainable business

- Socio-technical aspects and societal acceptability of the new biofuel are studied in the following tasks:
 - Responsible Research and Innovation framework and process
 - Sustainability indicators
 - Roadmaps to sustainable business
- Responsible Research and Innovation (RRI) is a co-creative practical process creating interaction between the project actors and societal stakeholders. With RRI approach we develop and ensure high quality R&I process & outcomes, which will be ***societally desirable and environmentally sustainable***.
- ***The environmental and economic impacts*** of the developed biofuels are assessed based on life cycle assessment (LCA) and techno-economic assessment (TEA).
- ***A multi-level perspective roadmap*** tackling the socio-technical aspects and societal requirements as well as business aspects towards sustainable biofuel business is created.

Partners



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