

Developments in "Liquefaction" routes for the production of advanced biofuels

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Future of Biofuels,

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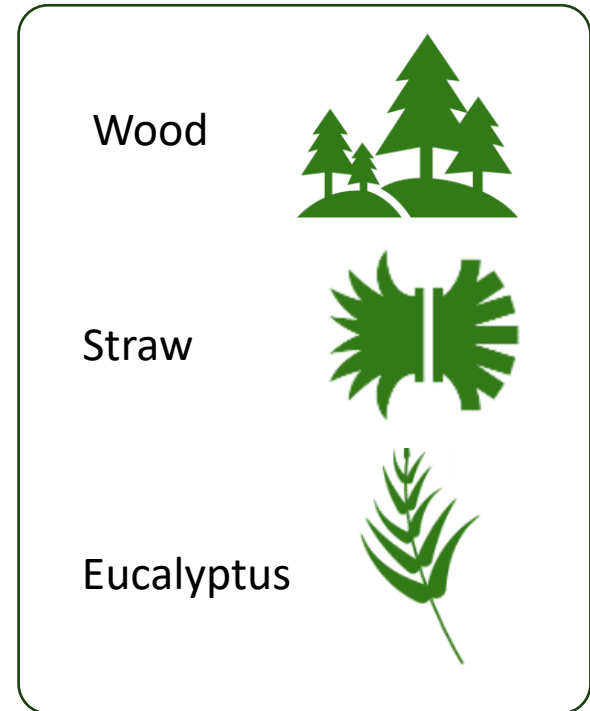
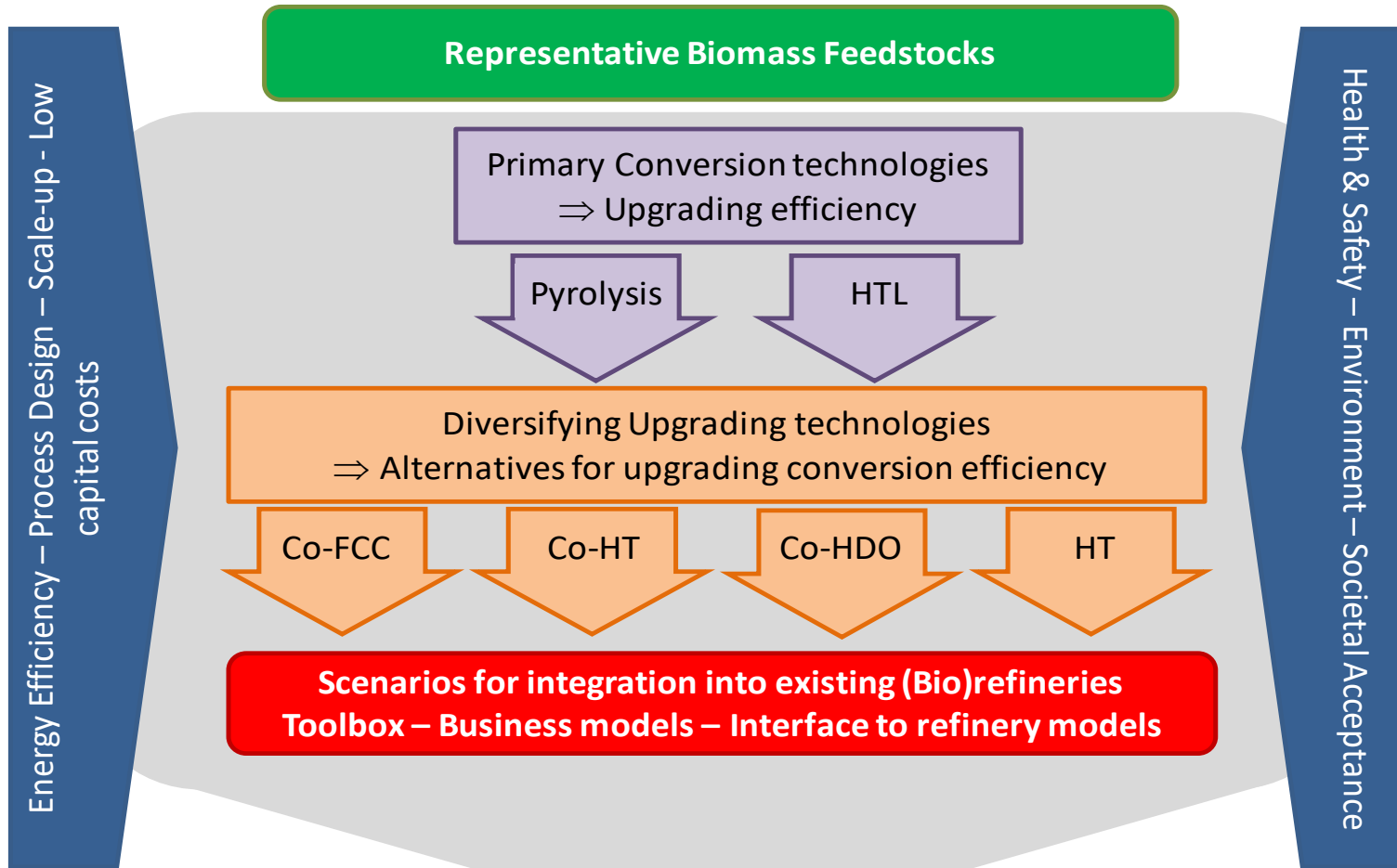
Technology for a better society

Biobased fuels: a helicopter view

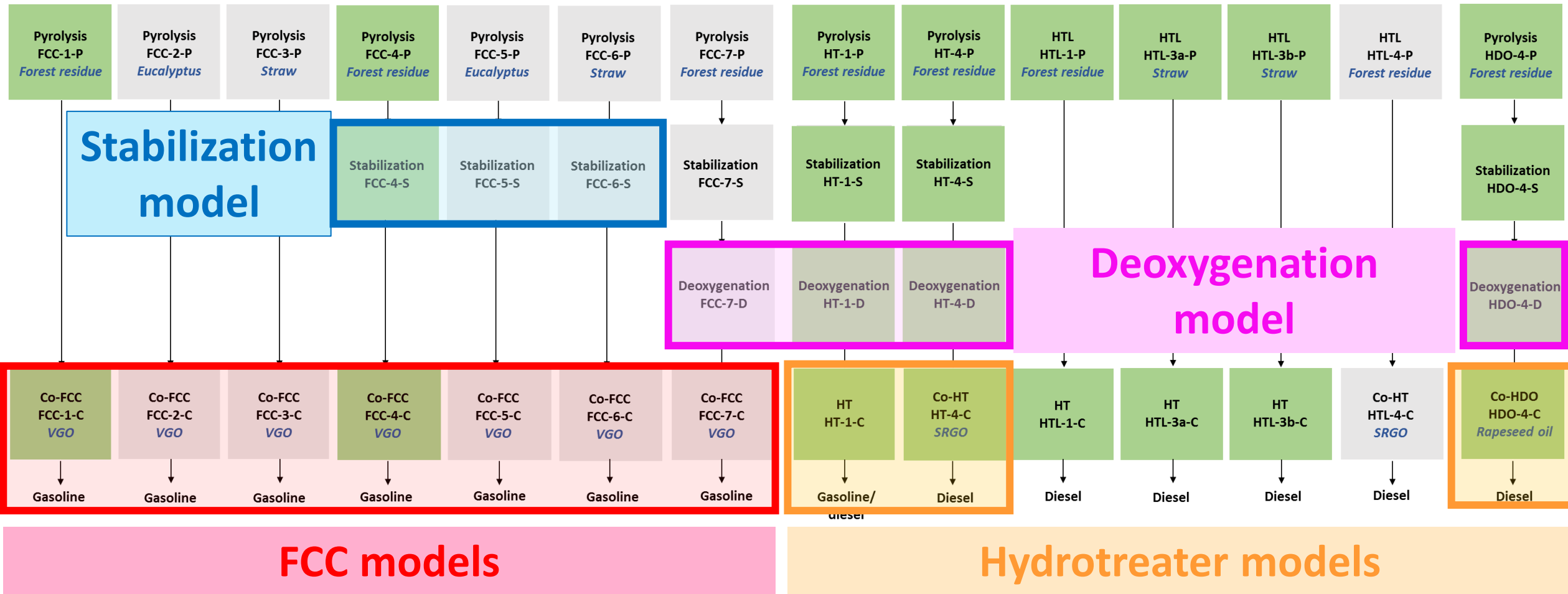


EC Sustainable Transport Forum: Sub Group on Advanced Biofuels. Final Report, 2017.





Techno-Economic Evaluation for range of alternatives for Refinery integration



FCC models

Hydrotreater models



Feedstock/Location: Final selection of value chains

✓ **Forest residue:**

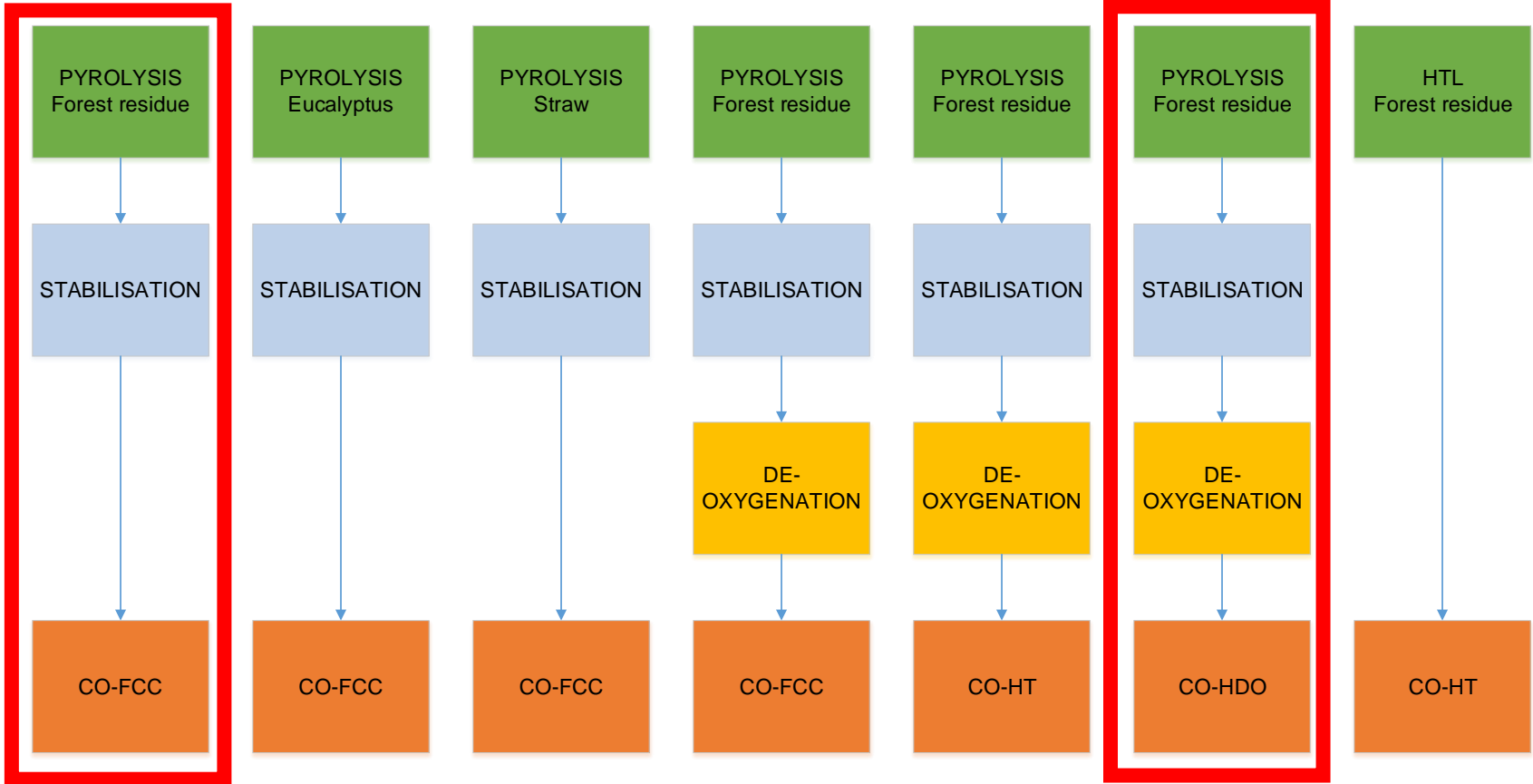
- Northern Europe
- Baltics

▪ **Eucalyptus:**

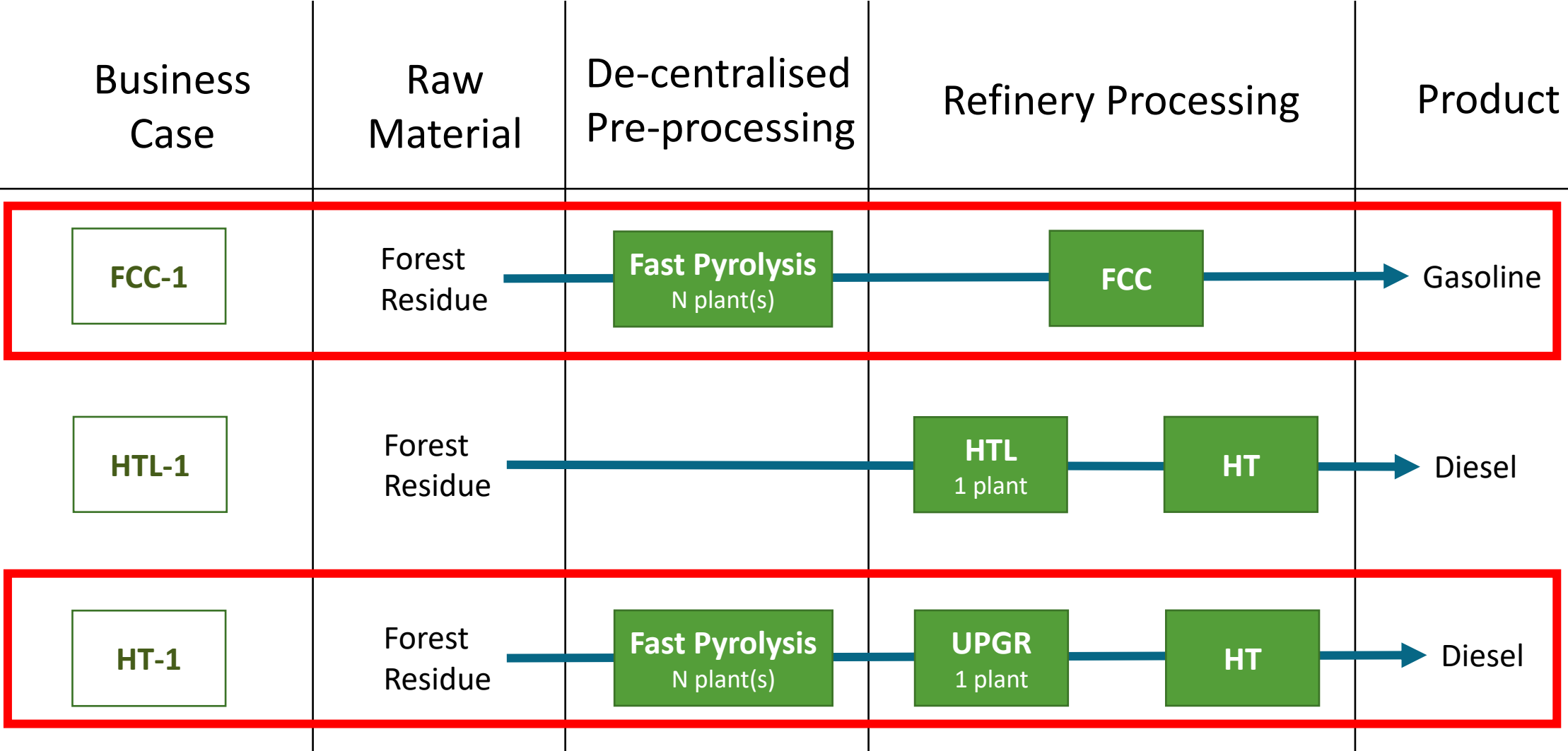
- Southwestern Europe (Spain)

▪ **Straw:**

- Central Europe
- Denmark



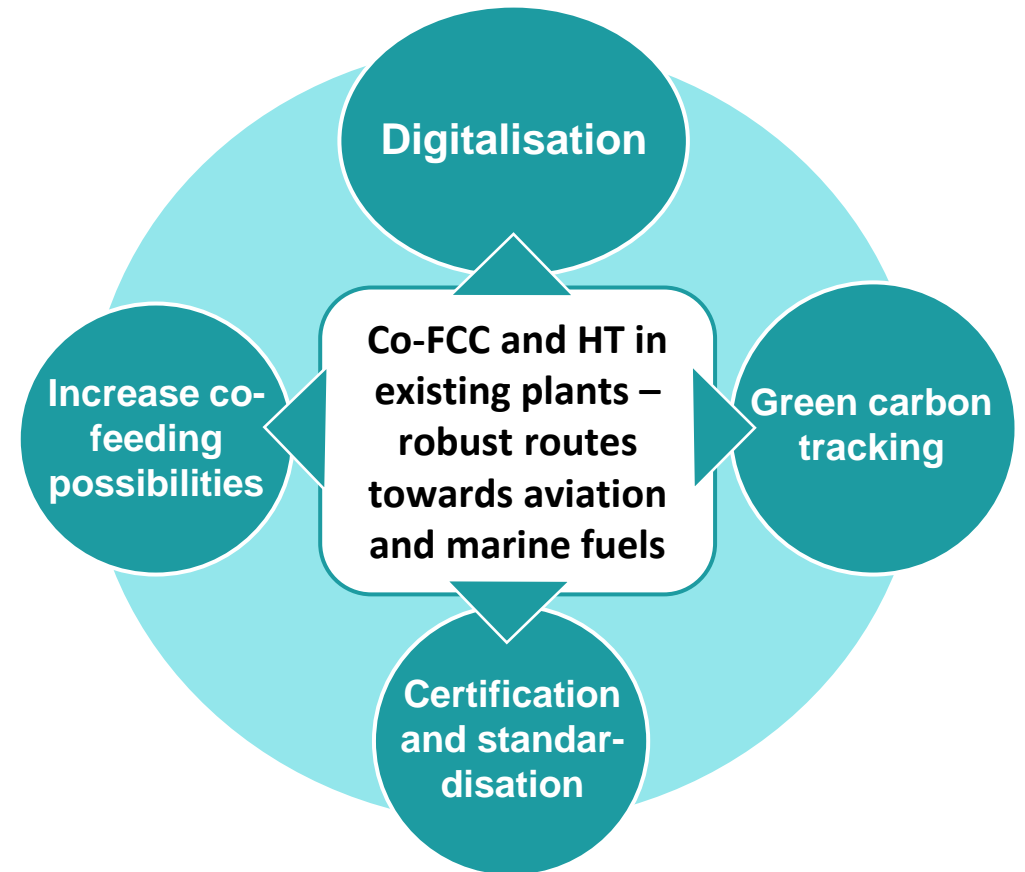
Focus of Business Case scenarios



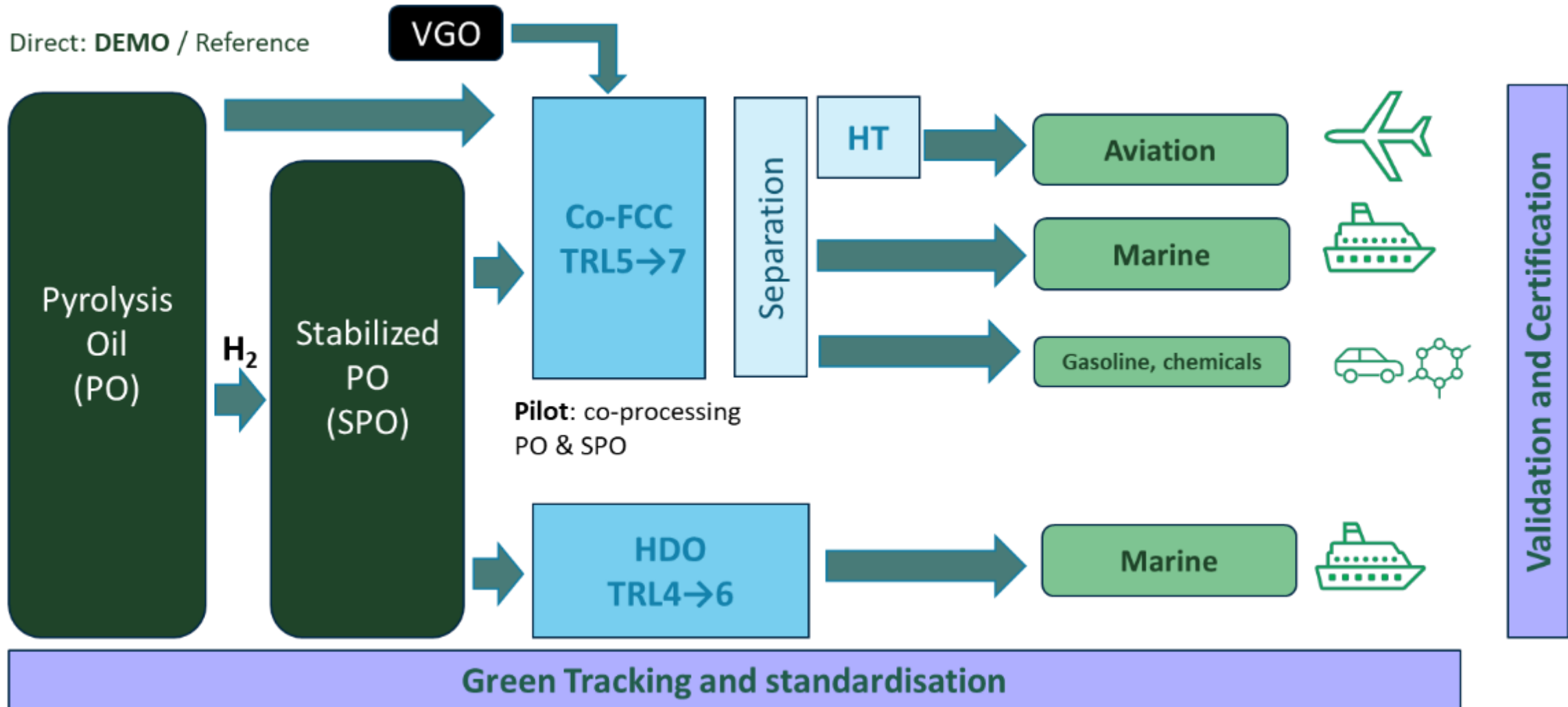
REFOLUTION -

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.

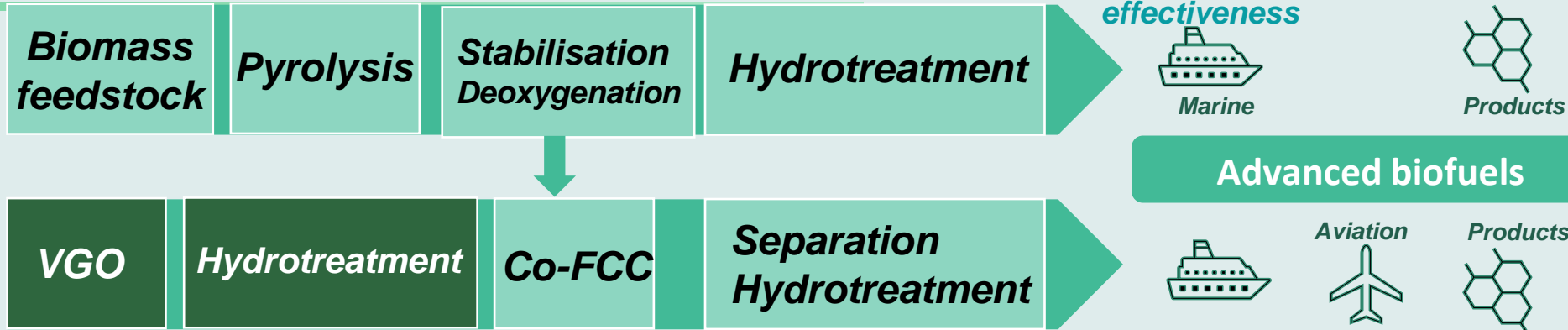


Project structure



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

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



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

Circular economy

Improved social acceptance



Full documentation & scenarios for deployment

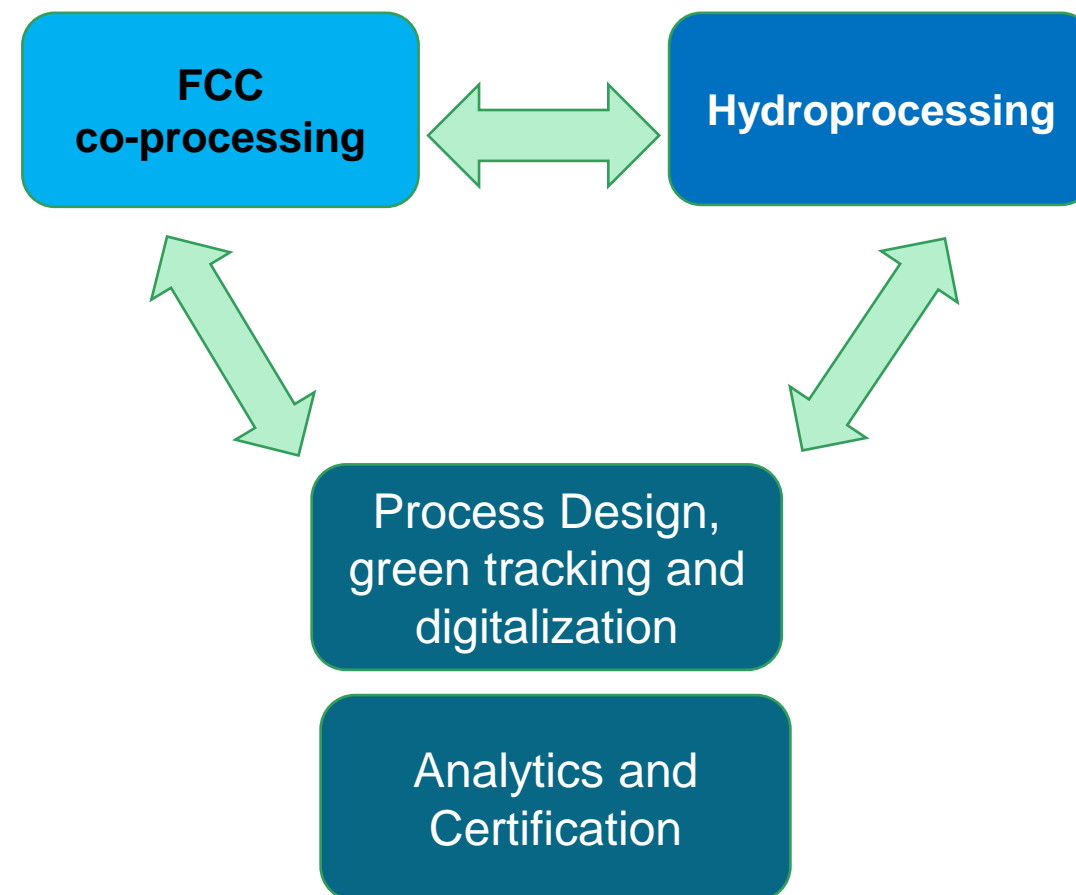
Acceleration of market uptake

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

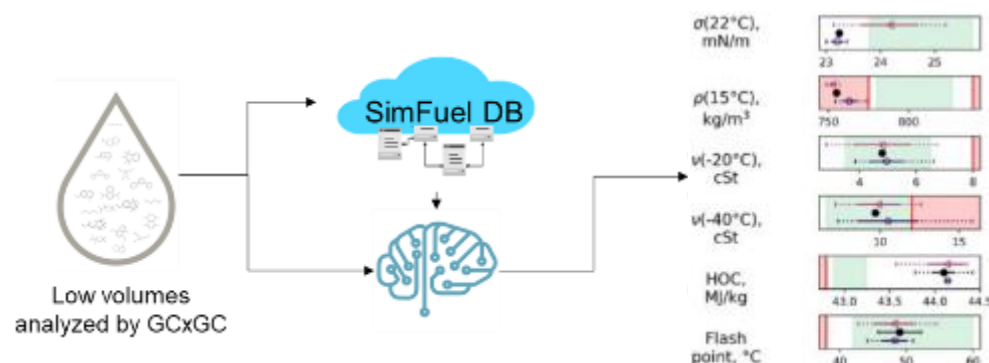


Fuel validation, standardization and certification

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



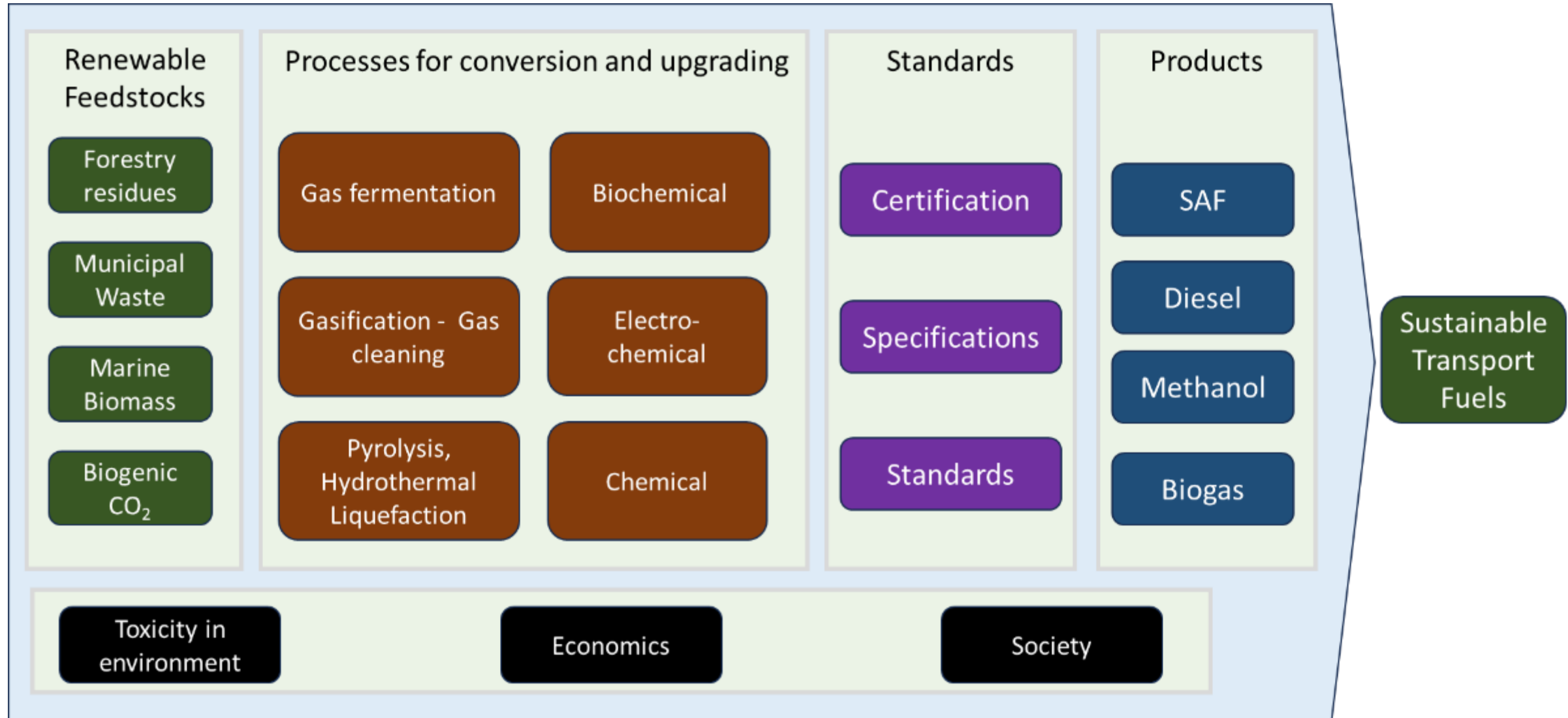
Single cylinder medium speed engine
1VDS 18/15
© LKV Rostock

SusFuels

Norwegian Centre for
Research and Development
for Deployment of
Sustainable Transport Fuels



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