Techno-Economic Studies for COMSYN process

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Main Agenda

- Introduction to Wood
- Overview of Comsyn concept
- Validation of the concept at industrial scale
- Basis of Techno-Economic assessment
- Rewiew of Heat integration concept
- Results of preliminary techno-economic assessment
- Next steps

Introduction to Wood

Full services provider

Consulting

- Economic analyses
- Acquisition studies
- Feasibility assessments
- Market research, segmentation and pricing analyses
- Environmental and permitting
- Due diligence marketing and customer reviews
- Supply/demand analyses
- New technology evaluations

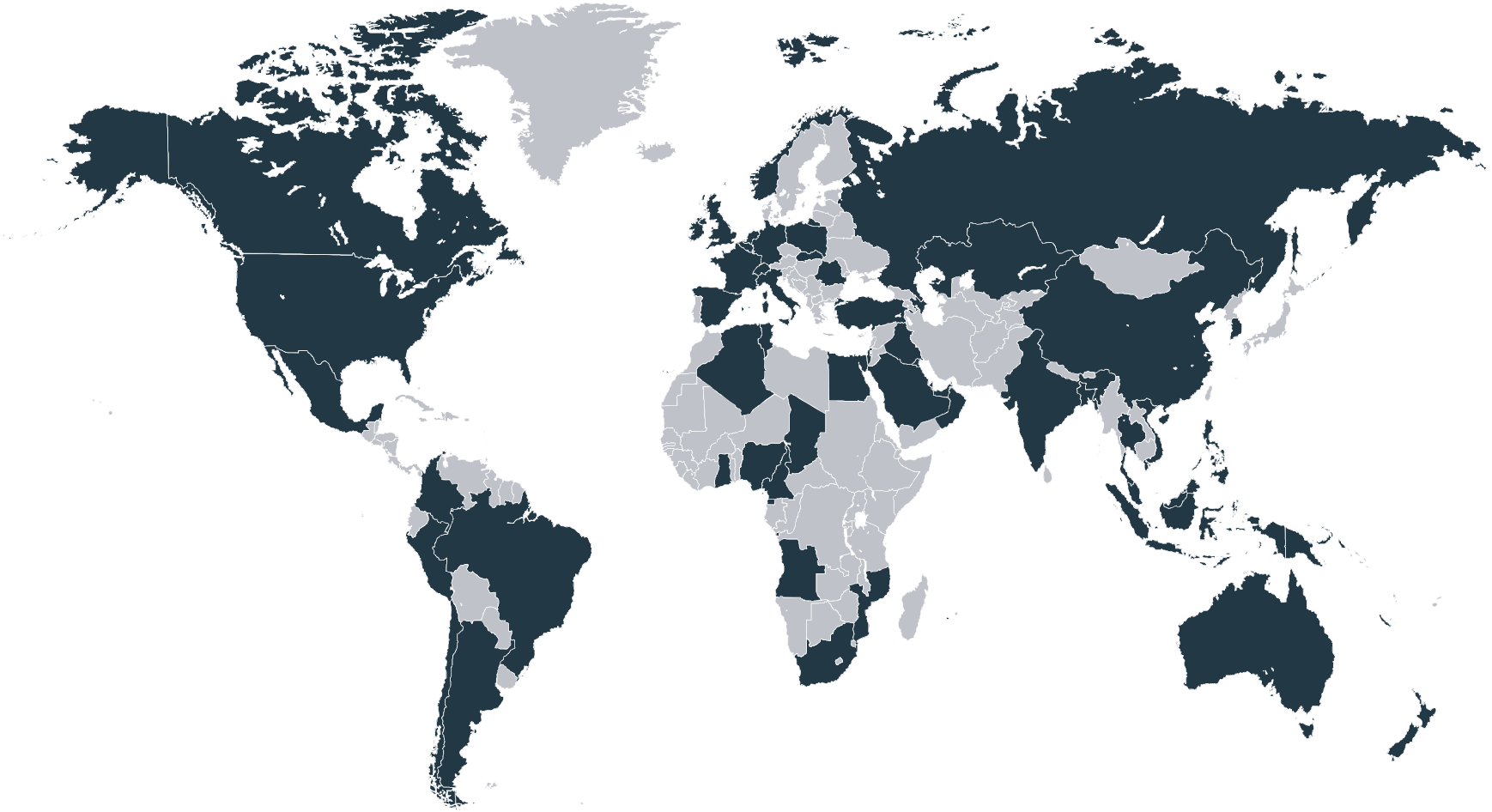
Engineering

- Planning
- Engineering all disciplines
- Design
- Project support
- Supply chain management
- Commissioning & start-up
- Process simulation and modeling

Project Delivery

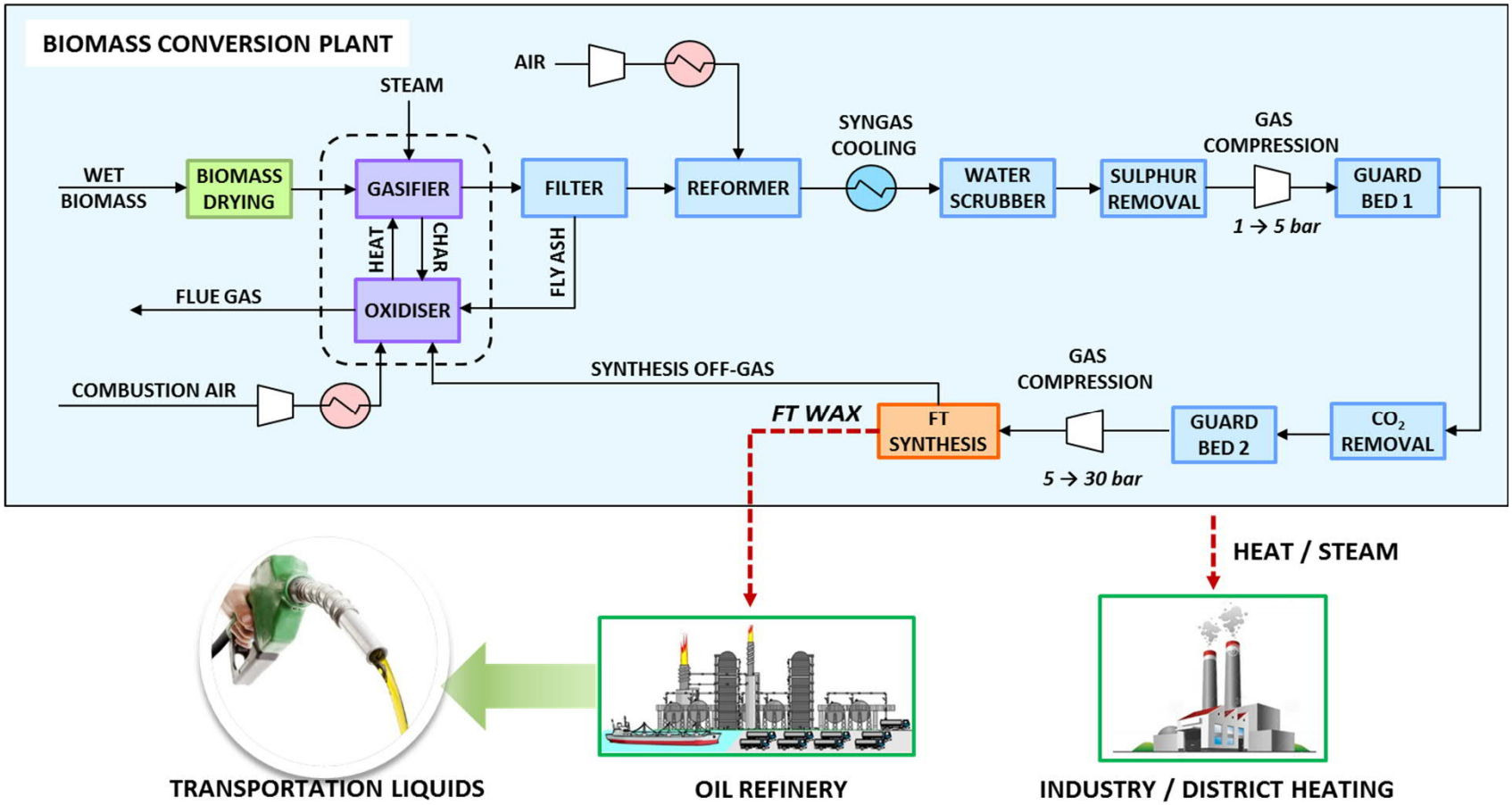
- Planning and support
- Cost management
- Risk management
- Procurement
- Vendor surveillance
- EPC
- General contractor
- Construction management
- Integrated safety program

Our global footprint



Overview of COMSYN plant concept

COMSYN plant concept



Concept validation at industrial scale

Validation at industrial scale

Full Process Engineering Design Package

- Process Flow Diagrams
- Heat &Mass Balance
- Equipment list:
  - Main dimensions / sizing parameters
  - Material Of Construction
- Equipment Datasheets
- Control operating philosophy
- CAPEX and OPEX estimate

Main basis & assumptions

Main basis & assumptions

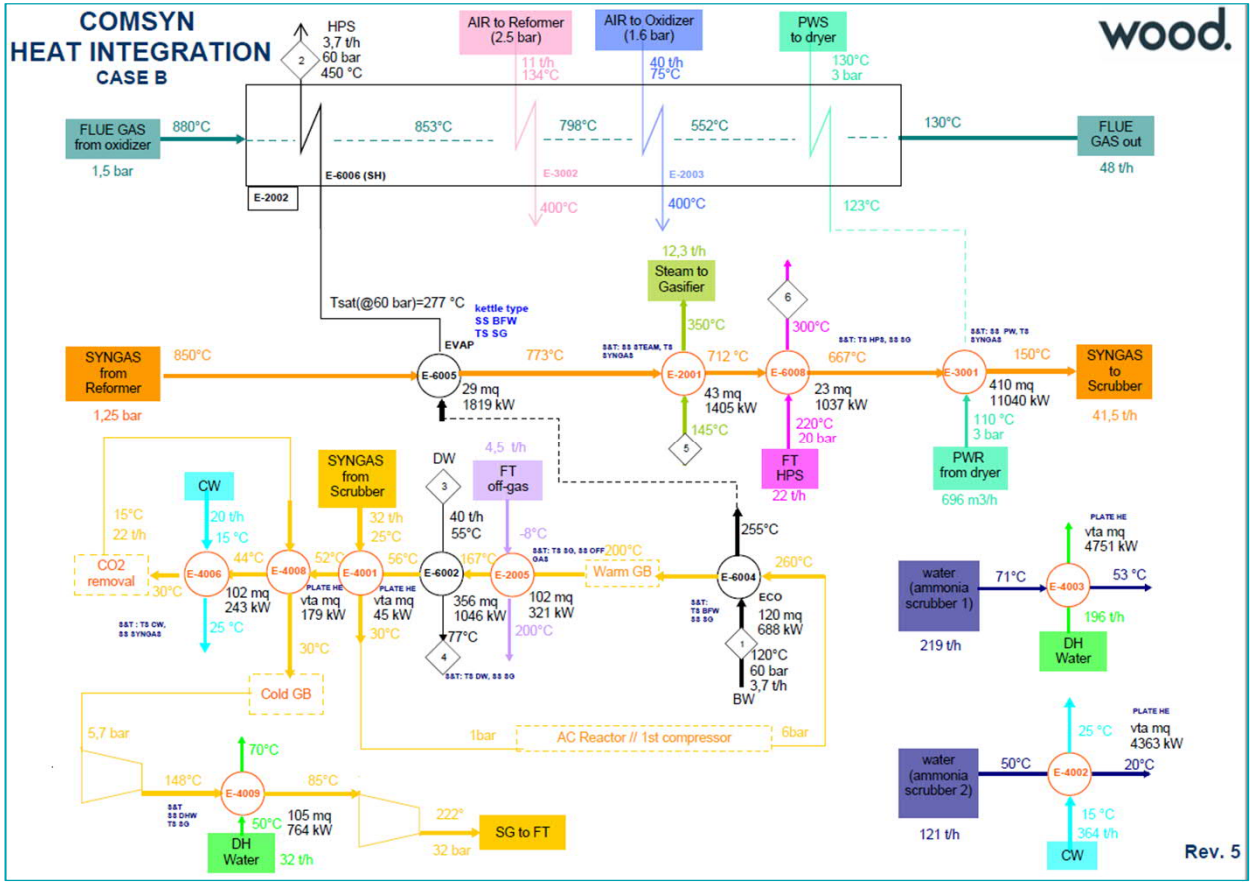
- Feedstock: forest residue
- Plant capacity: 100 MWt as feedstock thermal input, i.e approx. 31 kta of biocrude production
- Excess heat used for:
  - District Heating supply
  - Internal Power generation for plant own needs
- Configuration cases:
  - Case 1 : No CO2 removal
  - Case 2 : Partial CO2 removal (approx. 80%)
- Plant life: 20 years
- Target IRR for calculation of production cost: 12%
- Plant onstream factor: 94%

Heat Integration Review

Heat Integration Review

Heat integration in COMSYN is crucial for energy optimization:

- Heat rejection from FT reactions
- Heat recovery form Syngas Cooling and Oxidizer Flue Gas
- FT offgas re-use
- DH production and Steam Integration with Power Plant



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Main results & conclusions

Main Results

- Case 2, compared to Case 1:
  - Higher CAPEX (reduction in FT is overcome by the increase in the syngas treatment)
  - Higher OPEX (effects of optimized FT operation are overcome by O&M cost increase in the other units)
- Sensitivities to:
  - Financial Leverage
  - Target IRR

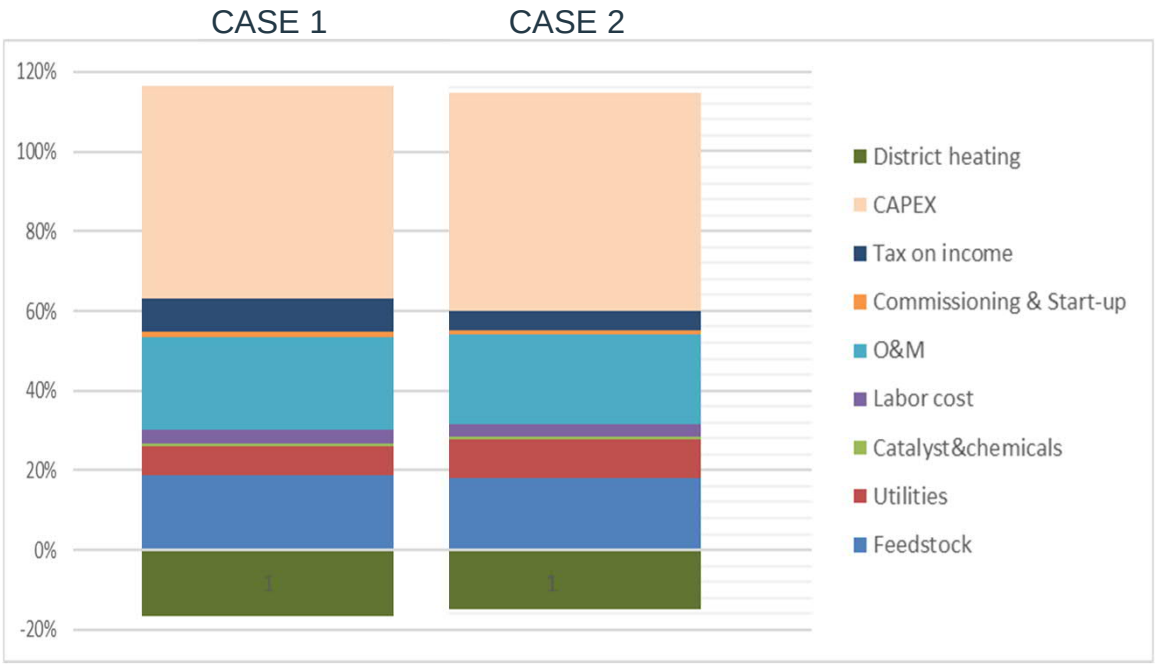
Results Summary

	Case 1 No CO2 capture		Case 2 80% CO2 Capture	
CAPEX (M€)	186.0		199.0	
O&M Cost (M€/y)	22.32		23.37	
Financial Leverage	None	50%	None	50%
Bio-crude Prod. Cost (€/l)	1.22	1.06	1.33	1.15

Main Results

Production Cost breakdown:

- Case 1 and Case 2 show the same behaviour
- Highest contribution by:
  - CAPEX
  - O&M (other than feedstock)
  - feedstock



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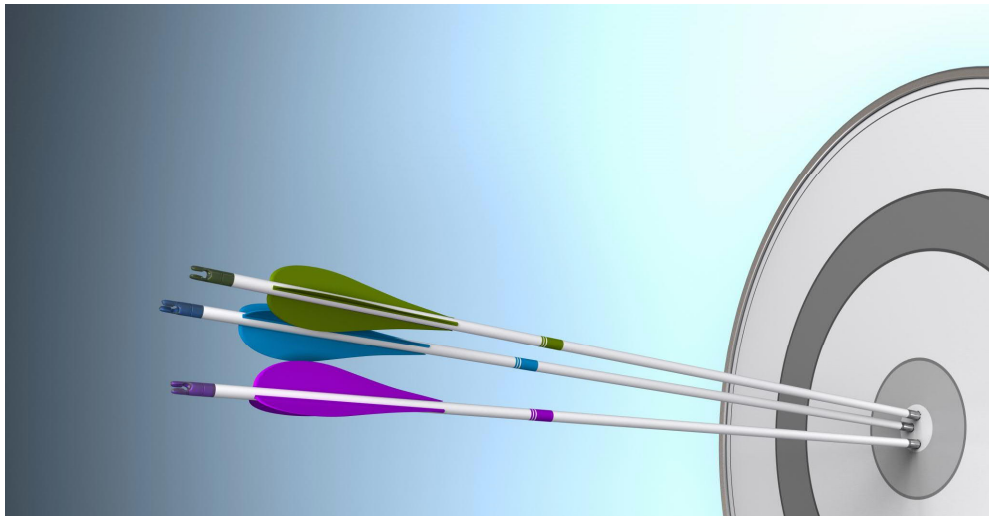
Conclusions

Preliminary results show that:

- The estimated bio-crude production cost is promising but still higher than the initial project target (bio-fuel @ 0.8 €/l)
- The CO2 capture does not appear to be beneficial for the overall techno-economic perfomance



More in-depth analysis will be carried out in the next months (study of business cases)

Next steps for COMSYN

Next steps – Business Study Cases

Northern Europe case:

- Feedstock: forest residue (e.g. bark)
- Plant size: 150-200 MWt (feedstock)
- DH generation
- Steam Integration with pulp mill / sawmill
- Possible sale of excess offgas to lime kilns

Central Europe case:

- Feedstock: agricultural residue (e.g. straw)
- Plant size: 150-200 MWt (feedstock)
- DH generation
- Steam Integration with industries (paper mill / chemical plant)

Thank you!
Any questions?

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wood.