

Plant design and materials

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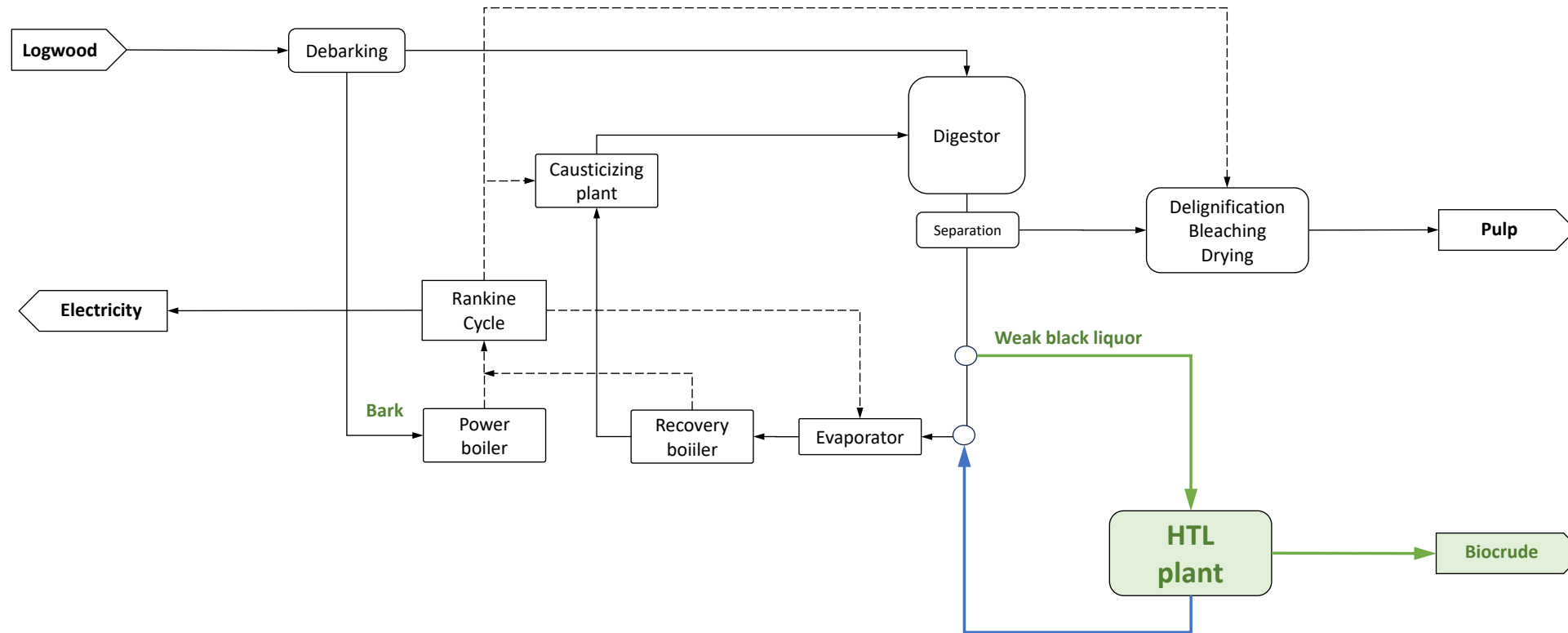
Outline

- Black liquor to HTL biocrude
 - Process design (integration into Kraft pulp mill)
 - Yields and cost
 - Materials corrosion tests (HTL equipment)
- Upgrading of HTL biocrude (refinery)
 - Process design
 - Yields and cost



Black liquor to biocrude

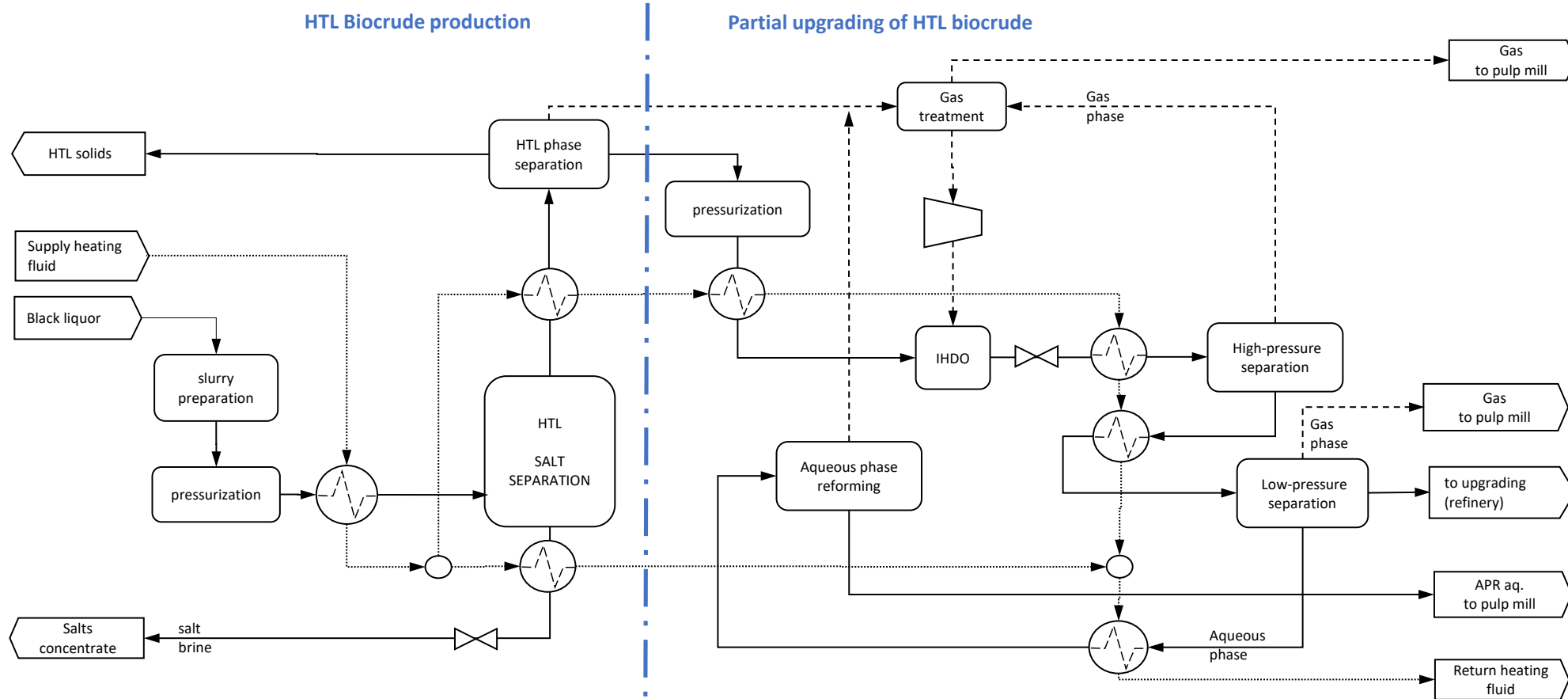
Integration with Kraft pulp mill



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Black liquor to biocrude

HTL plant design (integrated into Kraft pulp mill)



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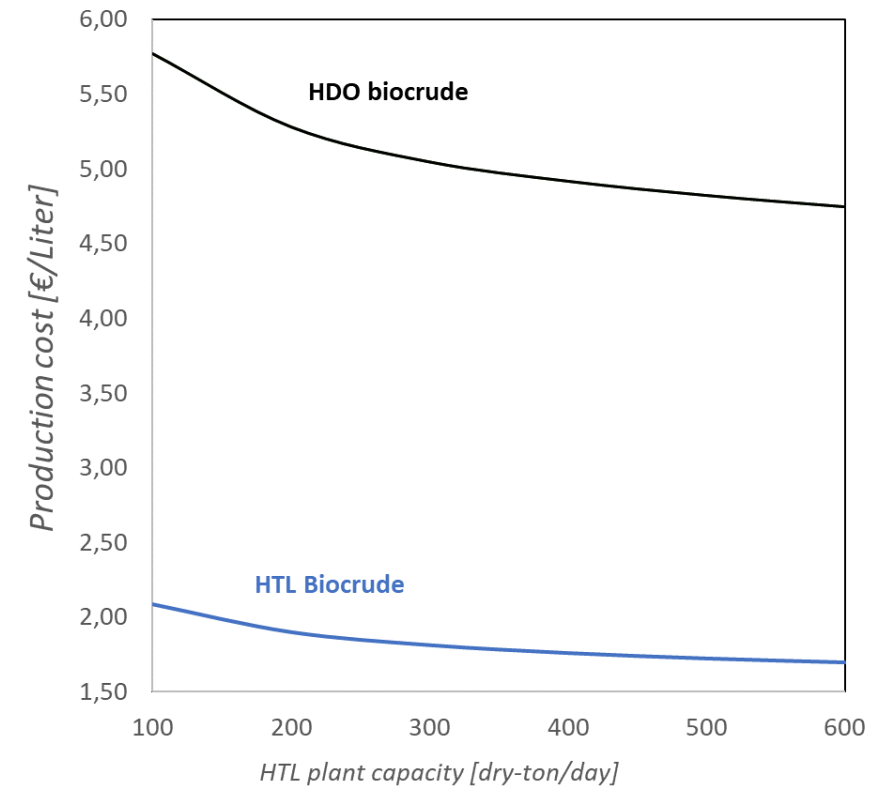
Black liquor to biocrude

Biocrude yield and cost

Pulp mill capacity: **500 kt pulp /year**

Black liquor to HTL: **5-30%**

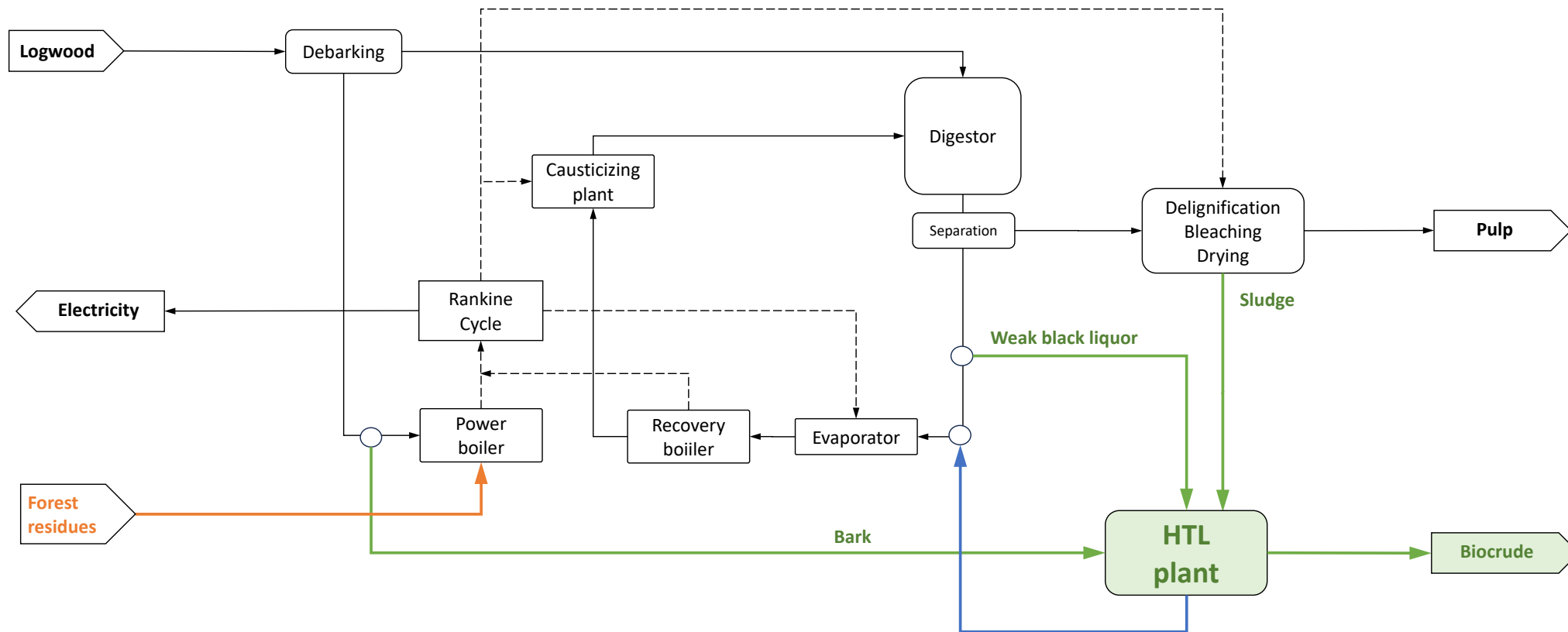
Case	HTL biocrude	HDO biocrude
Mass yield (% wt. dry basis)	21.5	19.0
Energy yield (%)	50.0	45.3



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Black liquor+bark to biocrude

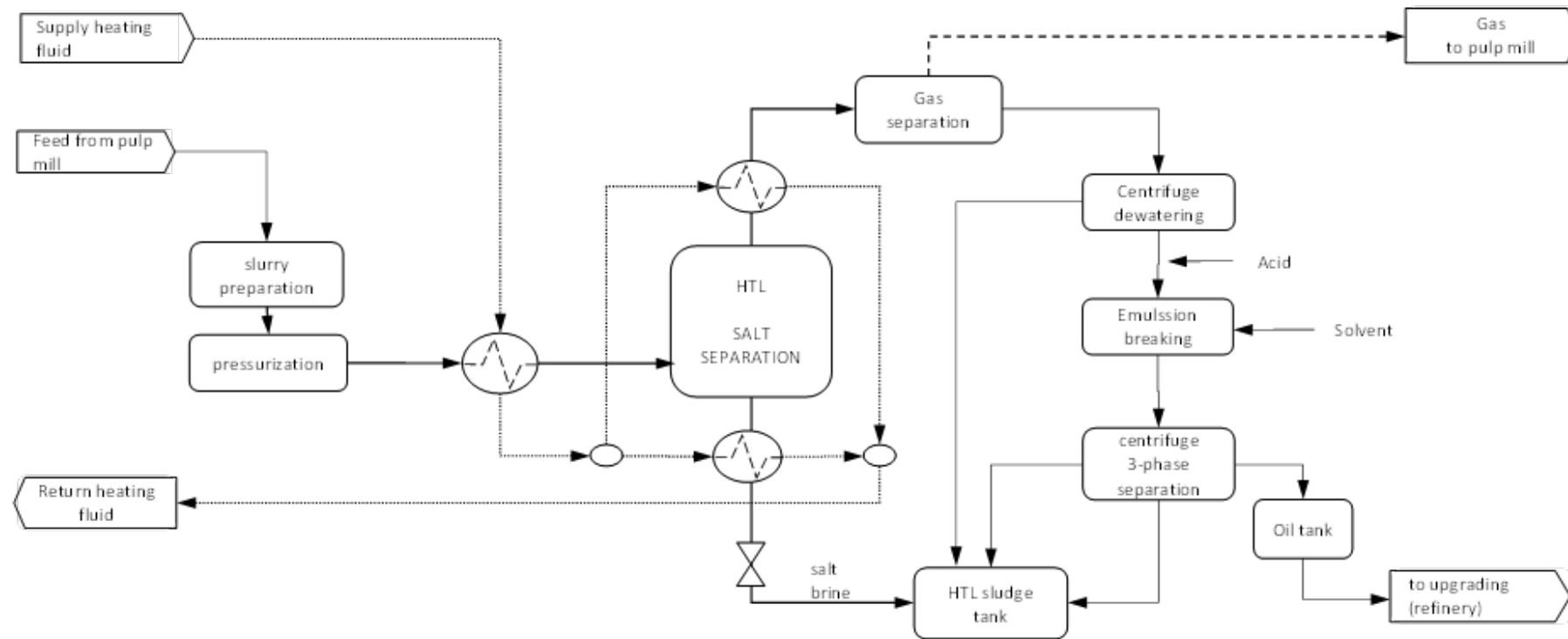
Integration with Kraft pulp mill



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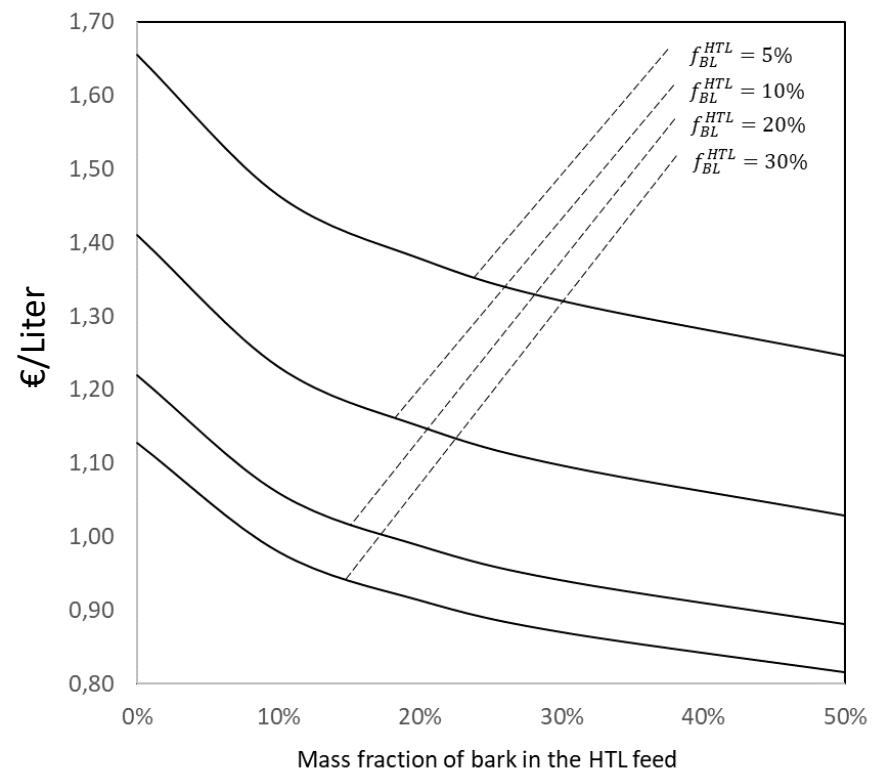
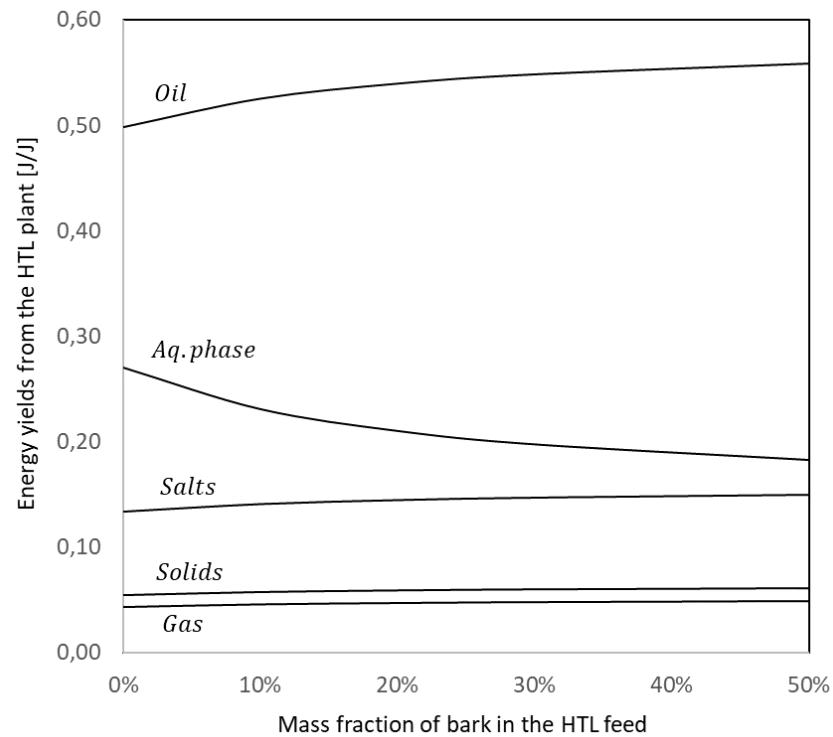
Black liquor+bark to biocrude

HTL plant design (simplest)



Black liquor+bark to biocrude

Biocrude yield and cost



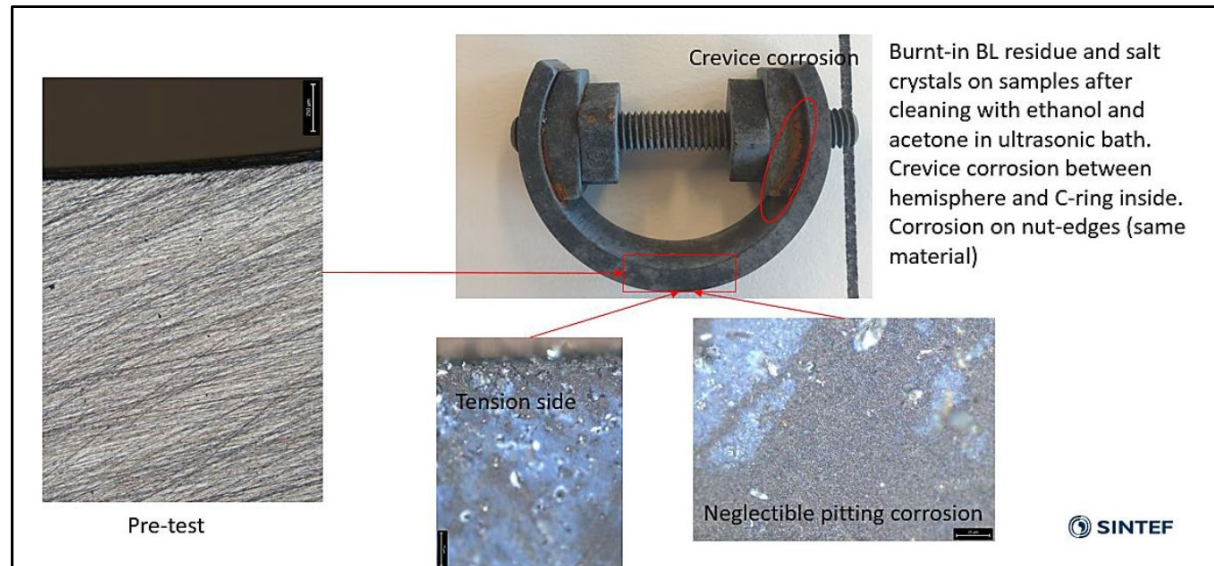
HTL equipment materials

Corrosion test

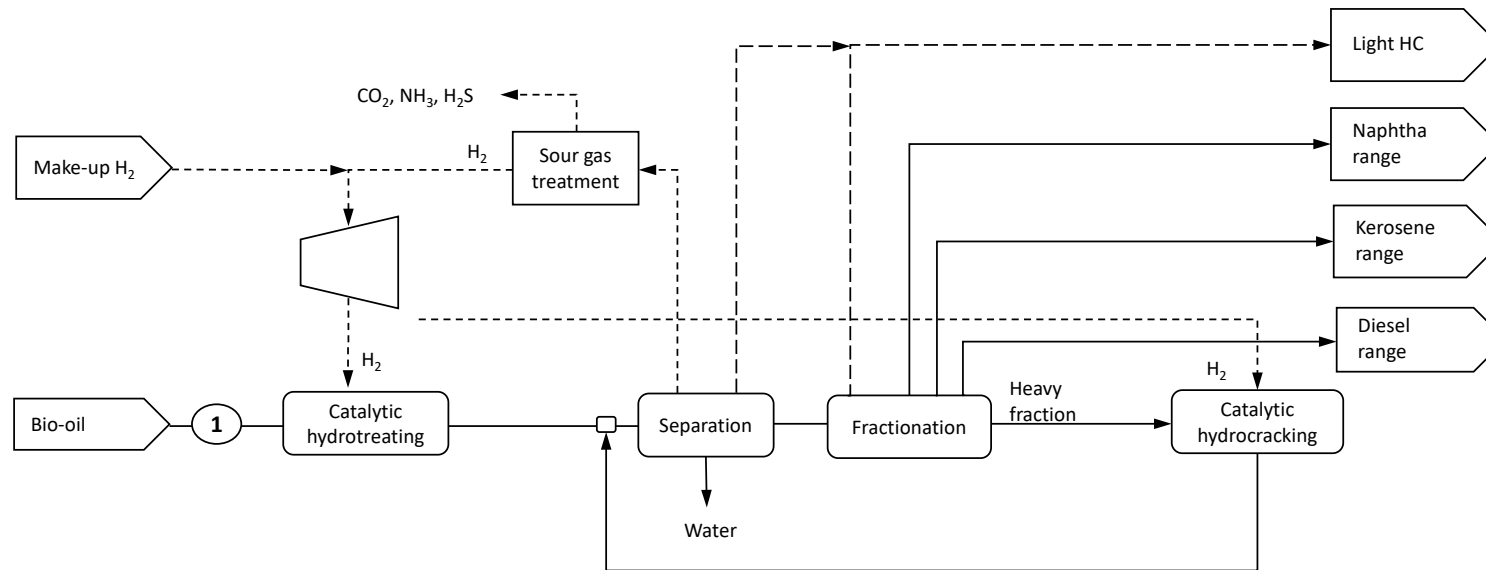
4-week tests with simulated black liquor at super-critical conditions

- ✘ Ti grade 2
- ✘ SS 316
- ✘ SS SAF2507
- ✘ SS 254 SMO
- ✘ SAF 2507
- ✘ NiCrMo alloy Inconel 625
- ✘ NiCrMo alloy Hastelloy C276
- ✘ NiCrAl alloy 602CA/699 XA

✓ CS CrMo P91



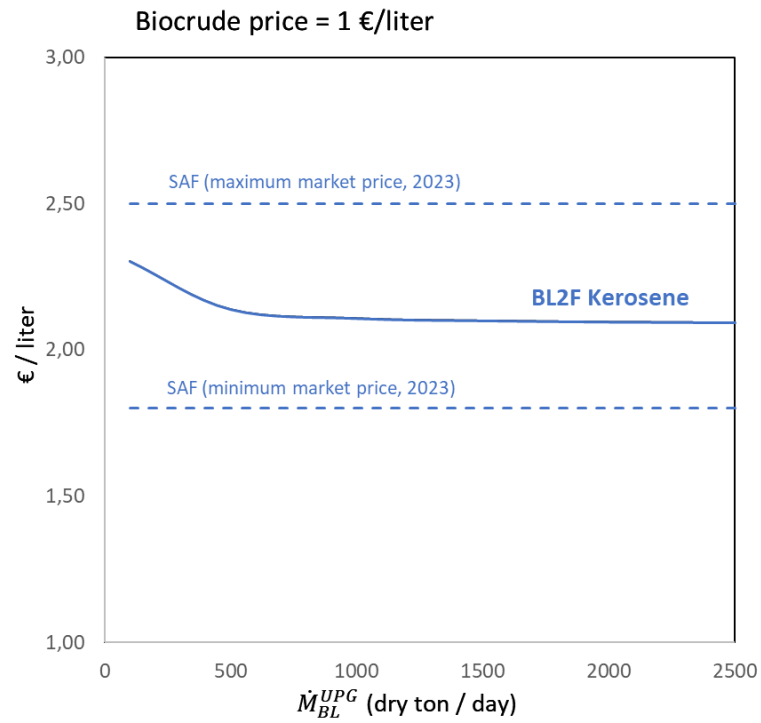
HTL biocrude upgrading (at refinery)



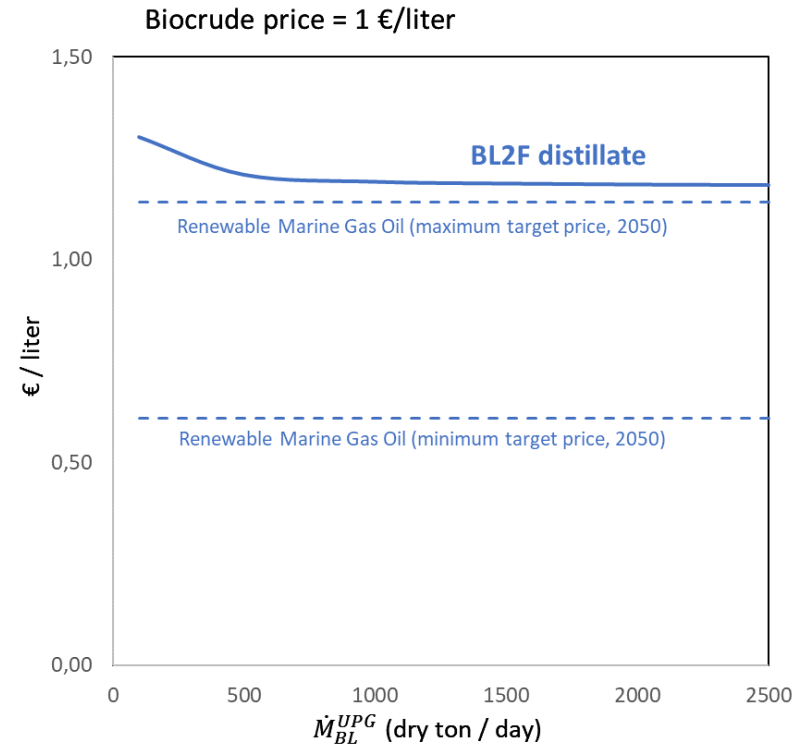
Fuel	Naphtha	Kerosene	Distillate
Mass yield (% wt. db)	47.2	13.4	24.0
Energy yield (%)	52.5	15.0	27.3



Minimum Fuel selling price



[Reuters]



[DNV data]



Conclusions

- Optimal integration with pulp mill
 - 30% Black liquor to HTL + 20% bark in the HTL feed
- **53%** biocrude energy yields, **< 1 €/liter**
- **15%** kerosene energy yield, **< 2.5 €/liter**
- **27%** distillate energy yield, **< 1.3 €/liter**



BL2F Partners:



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Thank you!

Get in touch with the project:

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