

# Drop-in fuels via thermochemical conversion of black liquor: Combining increased pulp capacity with biofuel production

**Bio4Energy Researchers' Meeting**

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# Pulping and chemical recovery

– black liquor processing often bottleneck

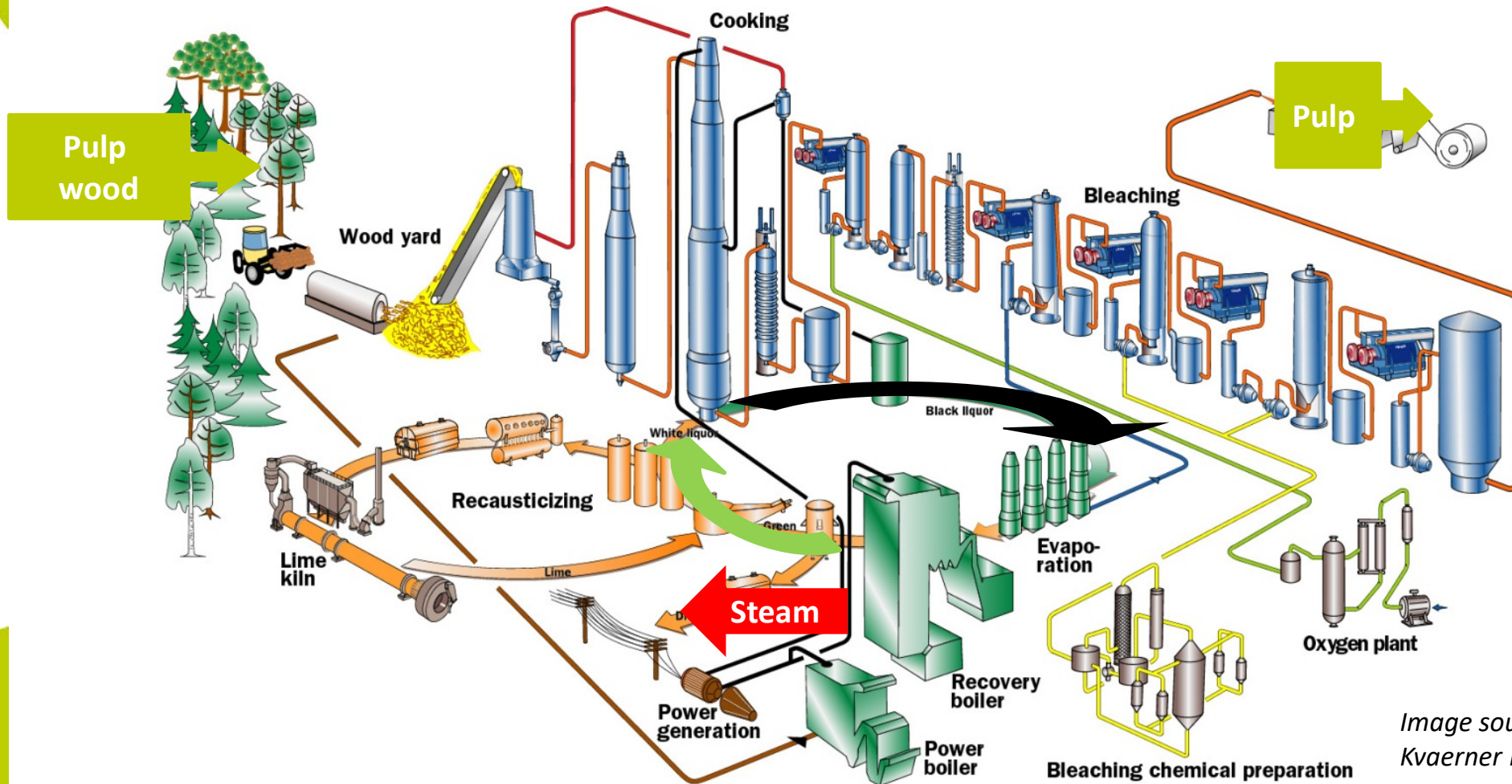


Image source:  
Kvaerner Pulping

# Studied technology tracks

## Lignin separation and upgrading to diesel and gasoline

- Lignin membrane-based separation
- Purification, stabilization in VGO matrix
- Hydrodeoxygenation and -cracking
- Partly validated in pilot scale, partly in lab
- Overall TRL 4-5



## Black liquor gasification with methanol-to-gasoline (MTG)

- BL gasification + methanol synthesis
- Methanol-to-gasoline (and LPG)
- Gasification pilot 3 MW >28,000 h operation
- Exxon Mobil MTG Commercial operation
- Overall TRL ~7



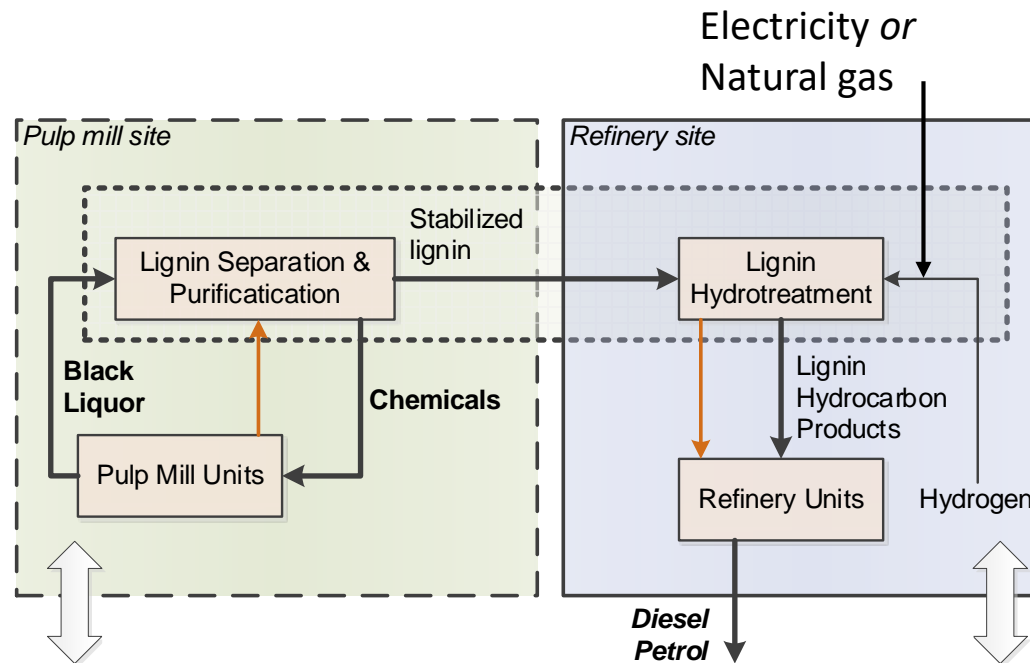
SCHMIDTSCHACK



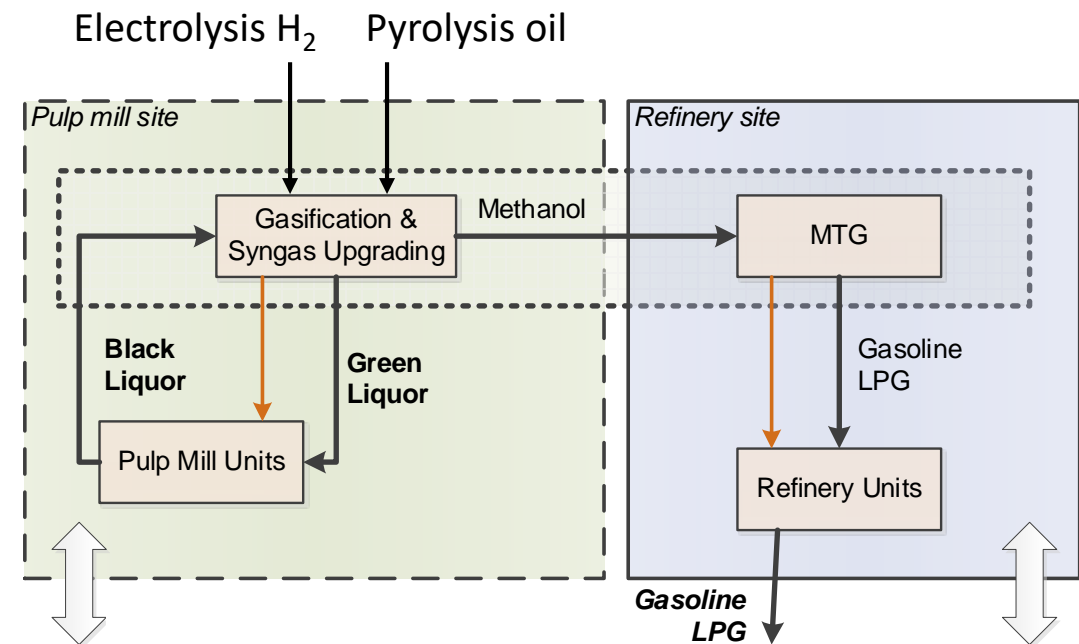
**CHEMREC**  
Energy to succeed

# Studied technology tracks

## Lignin separation and upgrading to diesel and gasoline

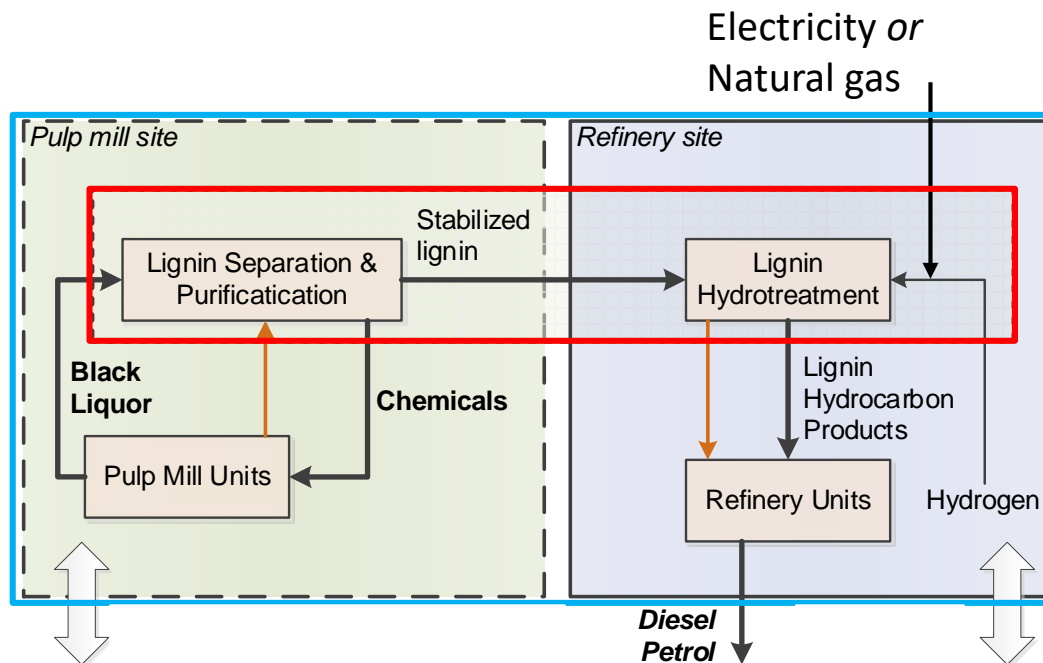


## Black liquor gasification with methanol-to-gasoline (MTG)

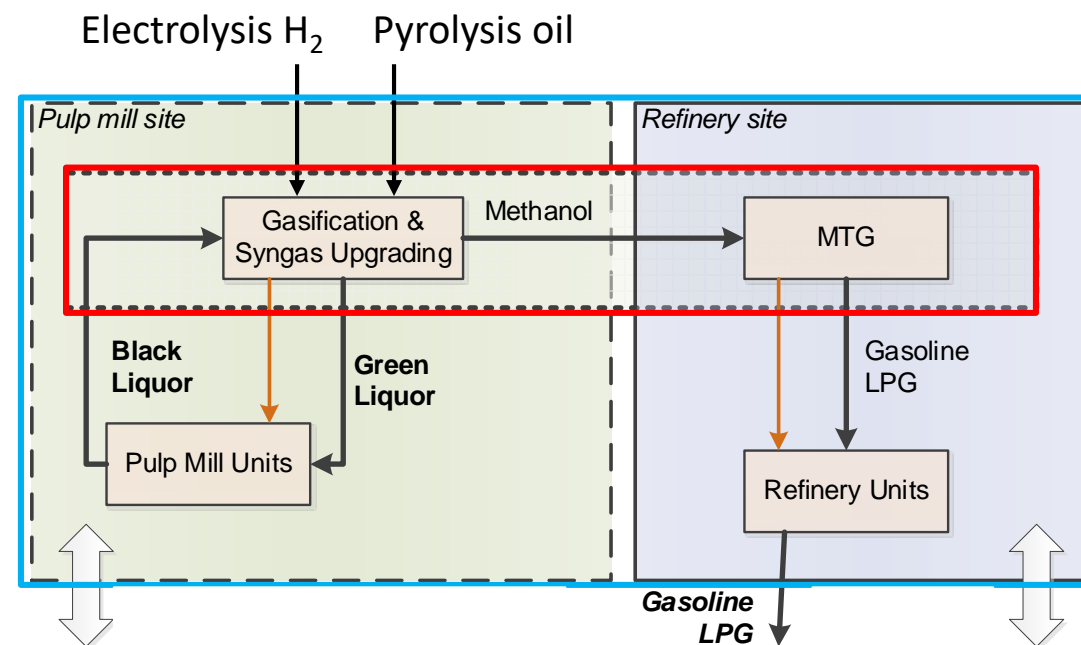


# Studied technology tracks

## Lignin separation and upgrading to diesel and gasoline



## Black liquor gasification with methanol-to-gasoline (MTG)



- Direct conversion efficiency
- Expanded system efficiency

# Technology evaluation



ENERGY  
EFFICIENCY

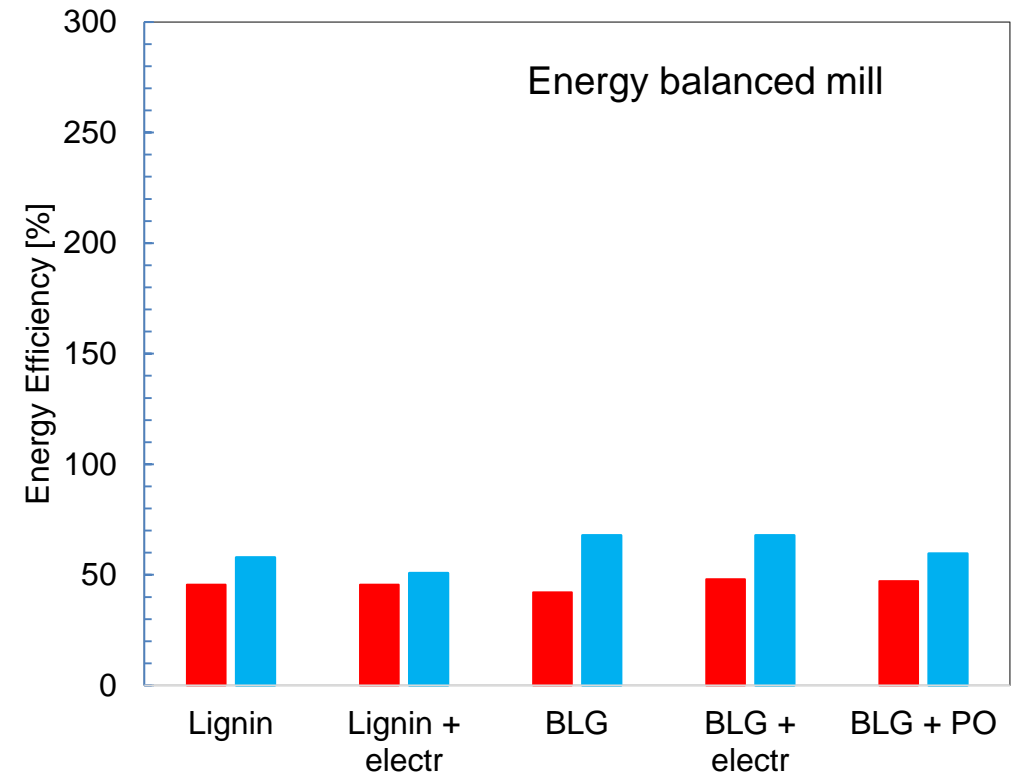
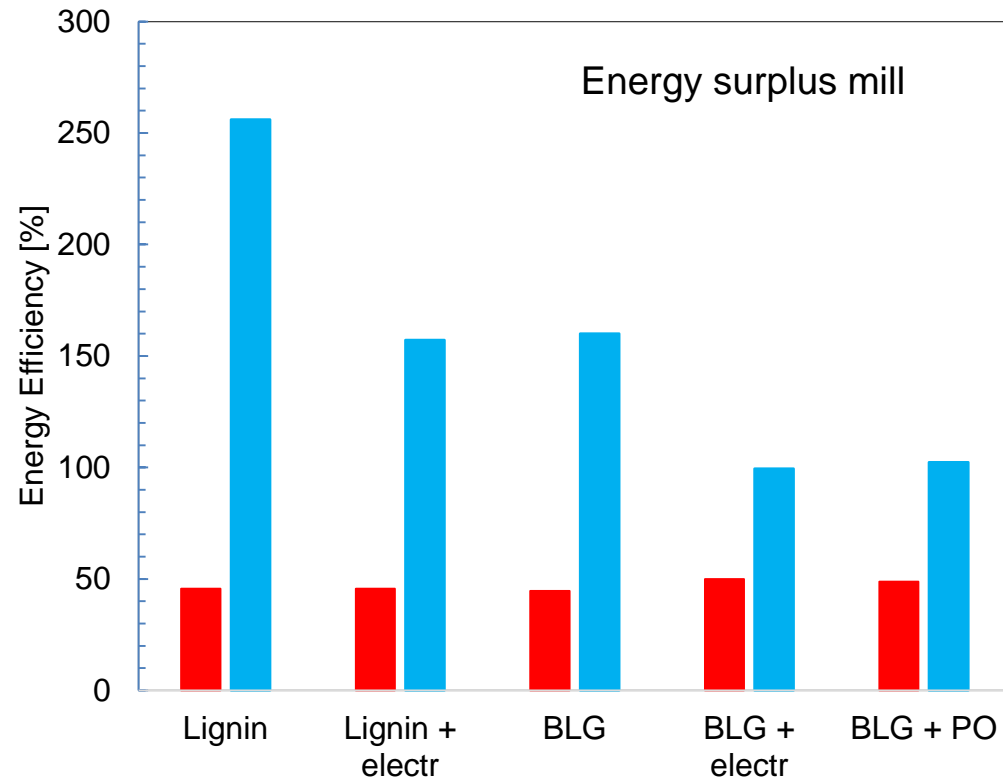


PRODUCTION  
COST



GREENHOUSE GAS  
PERFORMANCE

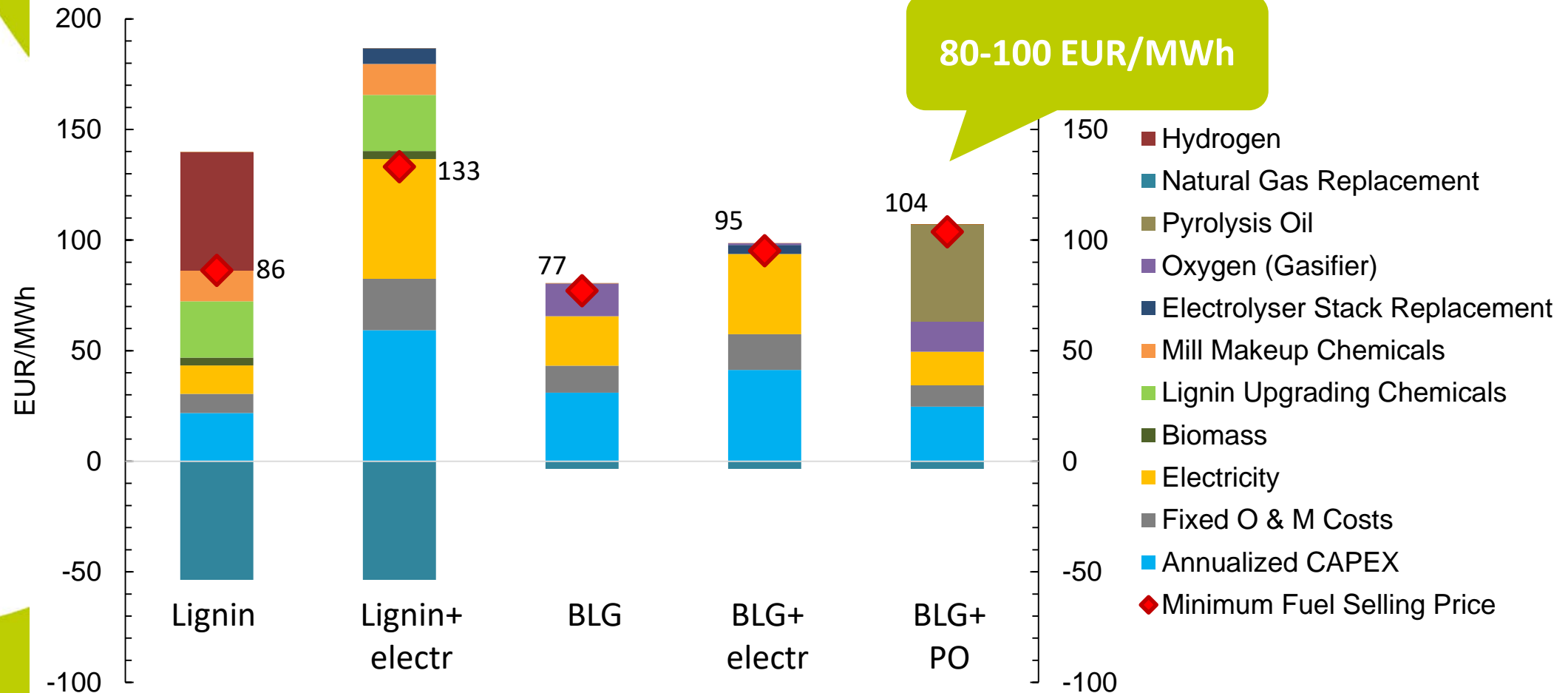
# Energy efficiency



- Direct conversion efficiency
- Expanded system

# Production costs

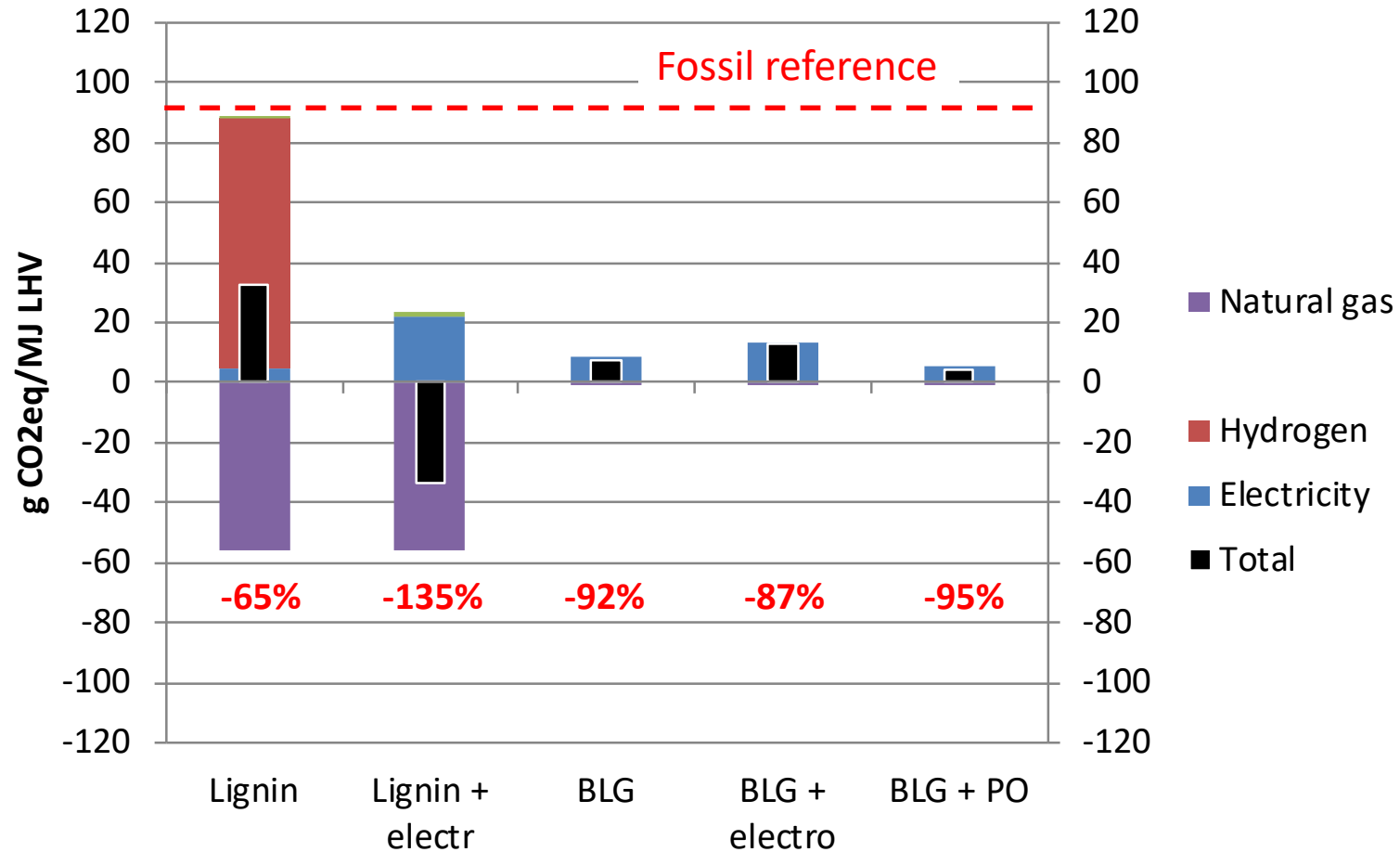
- Energy surplus mill (similar for balanced mill)





# Greenhouse gas performance

- Energy surplus mill (similar for balanced mill)



Results valid for low carbon electricity production!

# Conclusions

- Drop-in biofuels from Kraft BL are cost competitive
- Added value from increased pulp production capacity
- Biofuel production is an efficient way to utilize a pulp mill energy surplus
- Hydrogen supply and refinery energy integration are critical issues for lignin separation and upgrading

Thank you for listening

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