

**International  
Marine Ingredients Conference 2013**  
SEPTEMBER 22-24 / OSLO, NORWAY



**A**  
**biorefinery**  
**model**



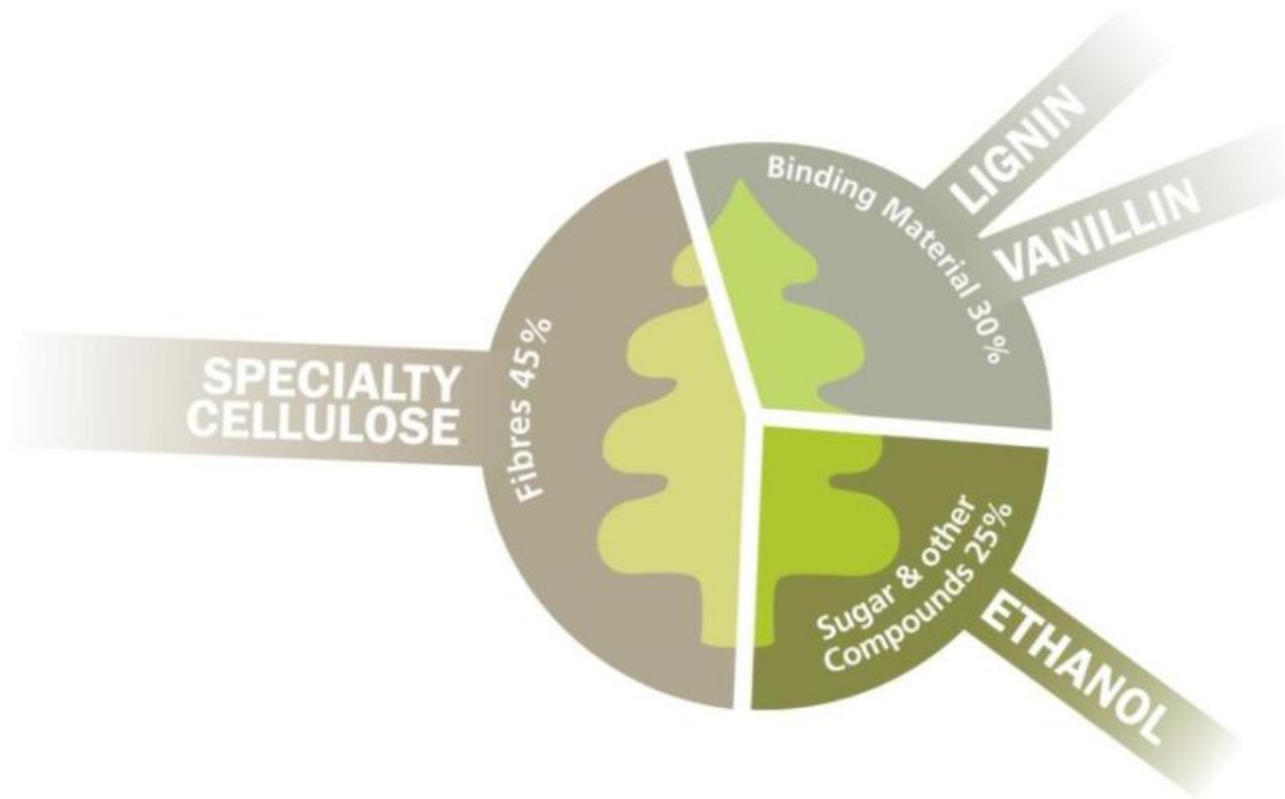
**Borregaard**

The Sustainable Biorefinery

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*Borregaard is the global leader in biobased chemicals*

High value added through full raw material utilisation

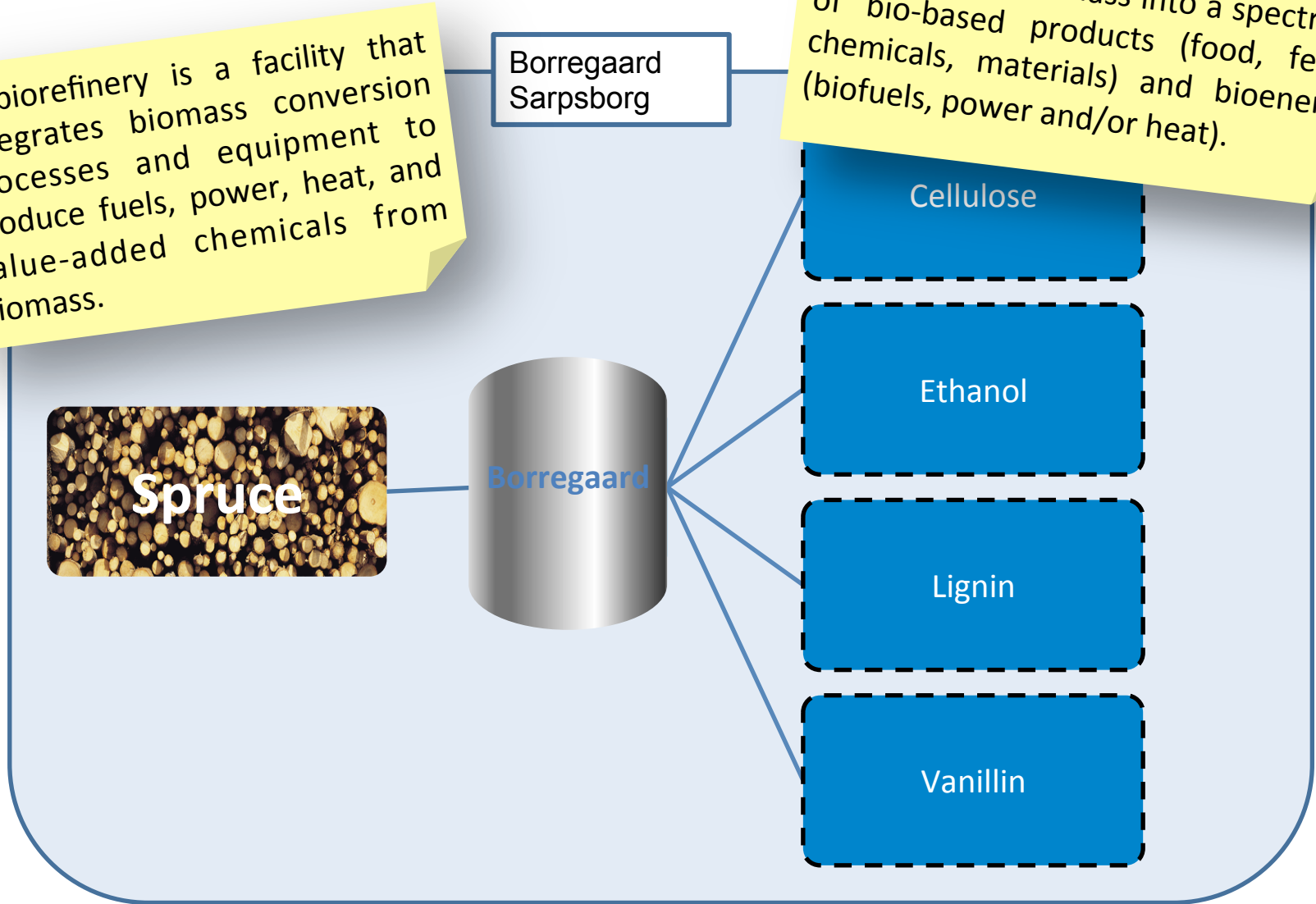


Borregaard's biochemicals are sustainable and environmentally friendly substitutes to petrochemicals

# A biorefinery model

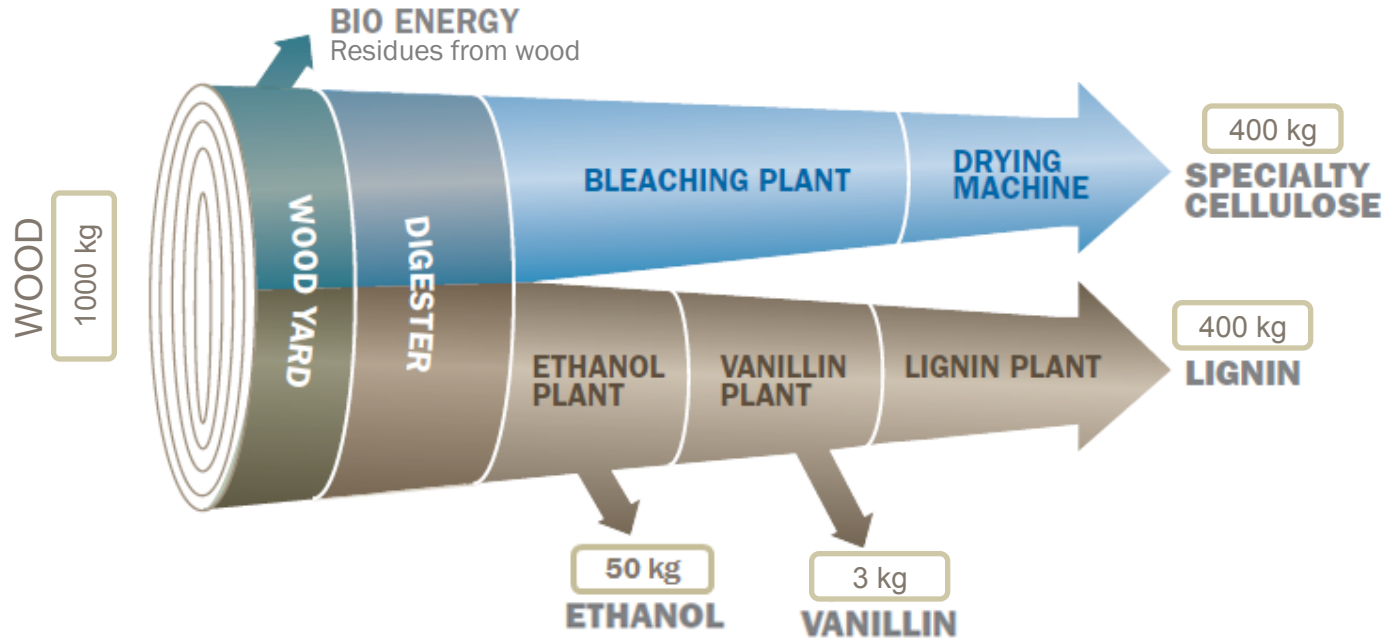
A biorefinery is a facility that integrates biomass conversion processes and equipment to produce fuels, power, heat, and value-added chemicals from biomass.

IEA Task 42:  
Biorefining is the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat).



*Borregaard is the world's most advanced biorefinery*

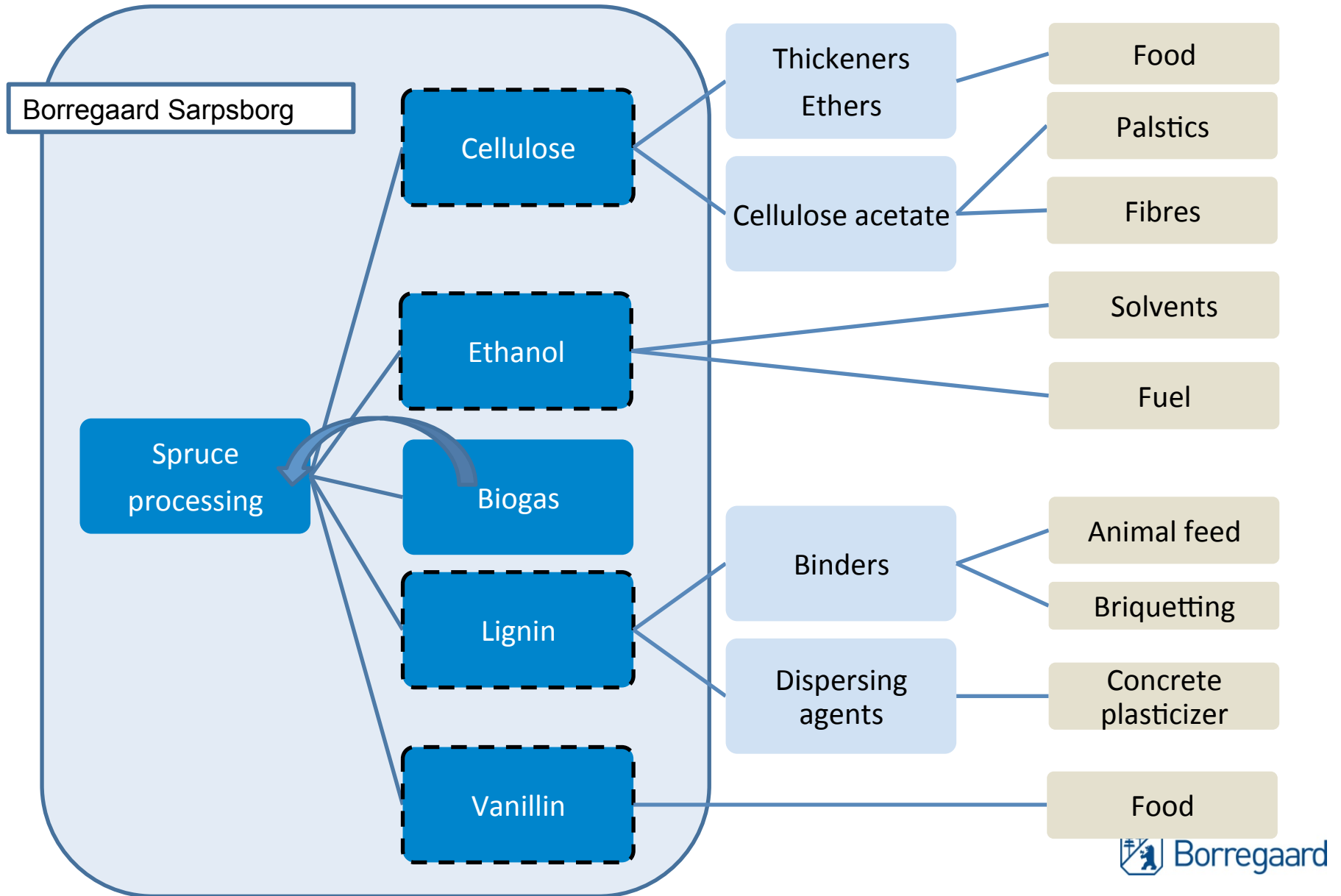
## Integrated production system serving diverse markets



Specialty cellulose	Lignin	Vanillin	Bioetanol
Construction materials	Concrete additive	Food	Car care
Cosmetics	Animal feed	Perfumes	Paint/varnish
Food	Dyestuff	Pharmaceuticals	Pharmaceutical industry
Tablets	Batteries		Bio fuel
Textiles	Briquetting		
Filters	Mining		
Paint/varnish	Soil conditioning		

# Borregaard Sarpsborg today

## Worlds most advanced biorefinery in operation



## Global presence

# An international business with global customers

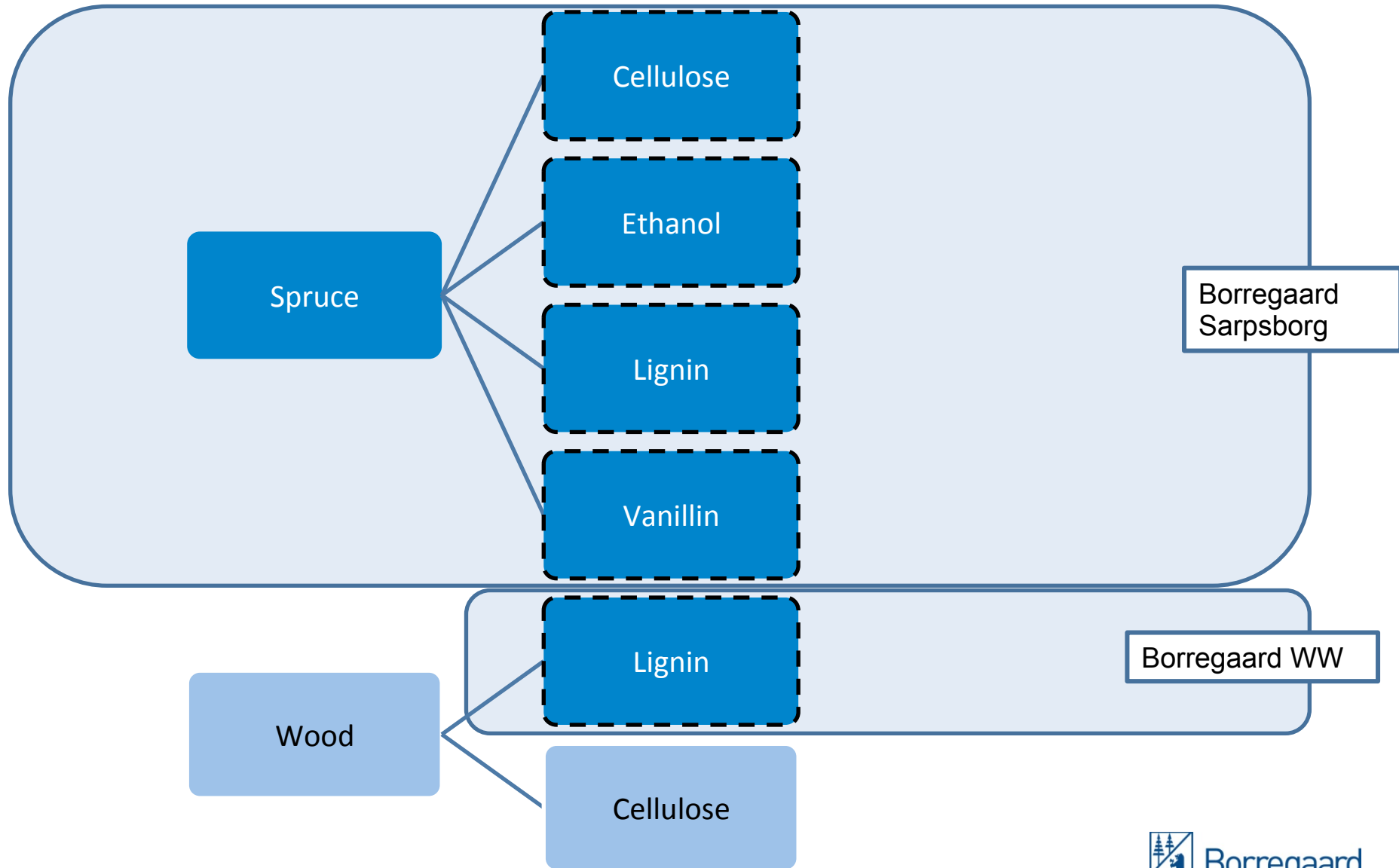


### Borregaard

Turnover: NOK 3,6 bill  
1050 employees in  
17 countries

- ▲ Head office
- Sales office
- Production

# Borregaard ww concepts today

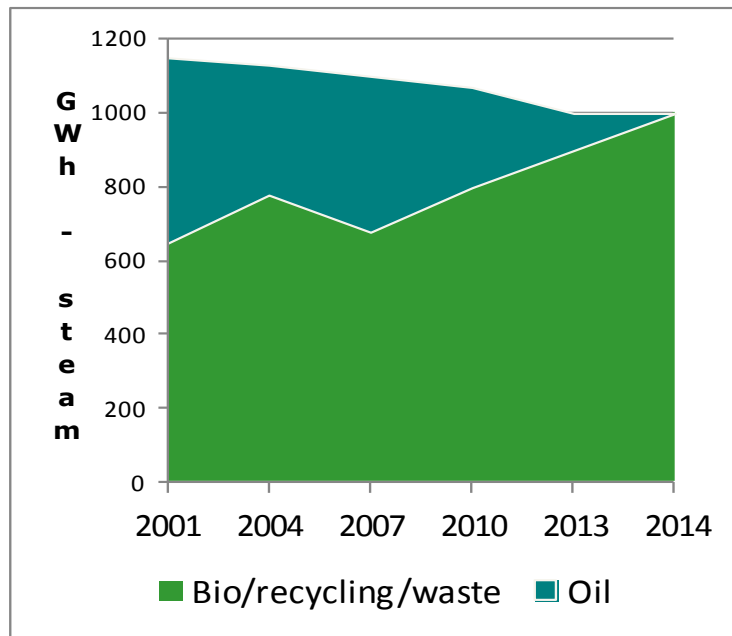


Not all biorefineries are sustainable or have a low CO2 footprint.





## Significant environmental investments at Borregaard: NOK 2 billion during the last 20 years

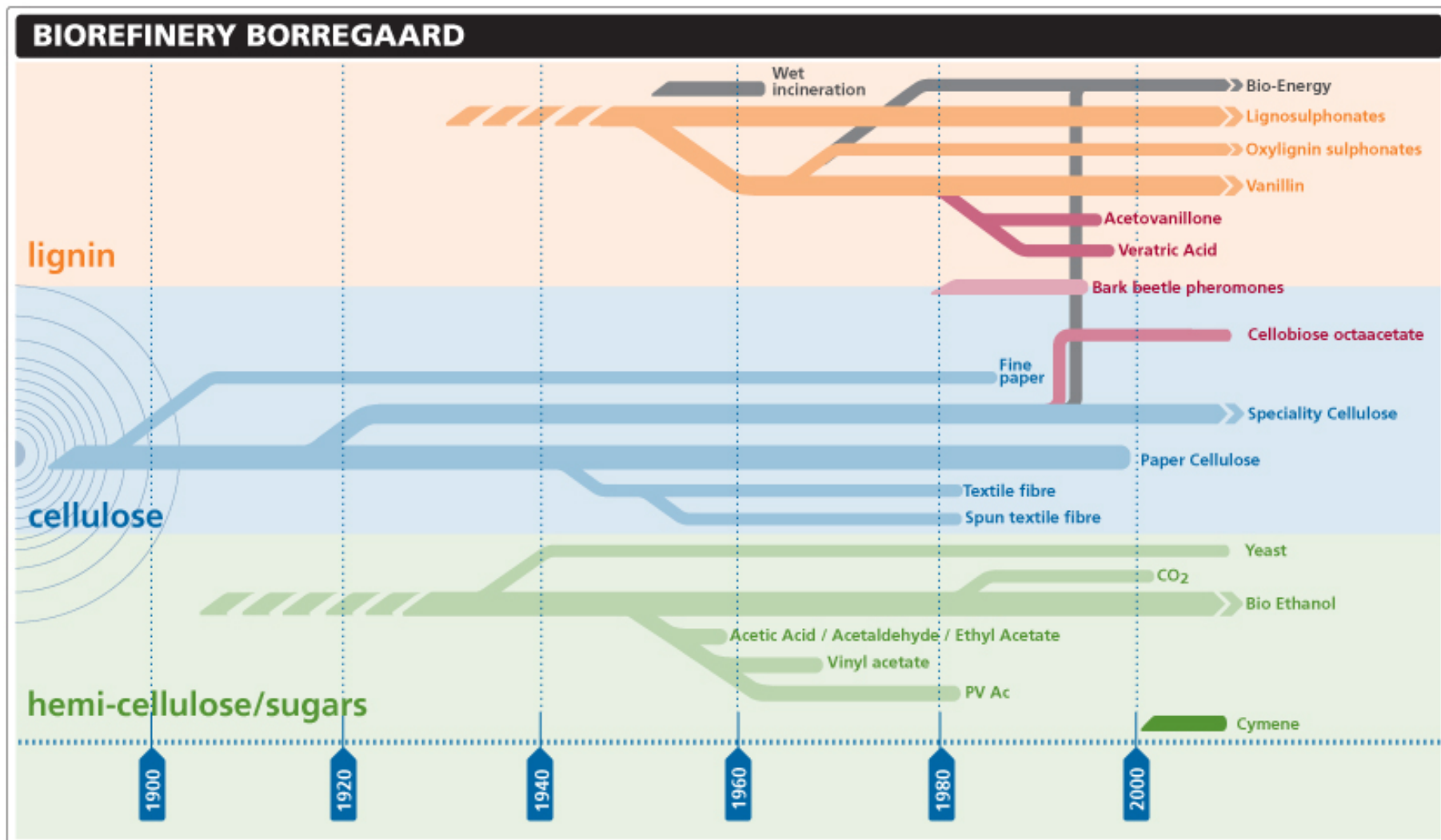


- Reduced emissions to air and water
  - New technology
  - New operations
  - Cleaning measures
- More renewable energy
  - Oil is being phased out, replaced by biofuel and waste

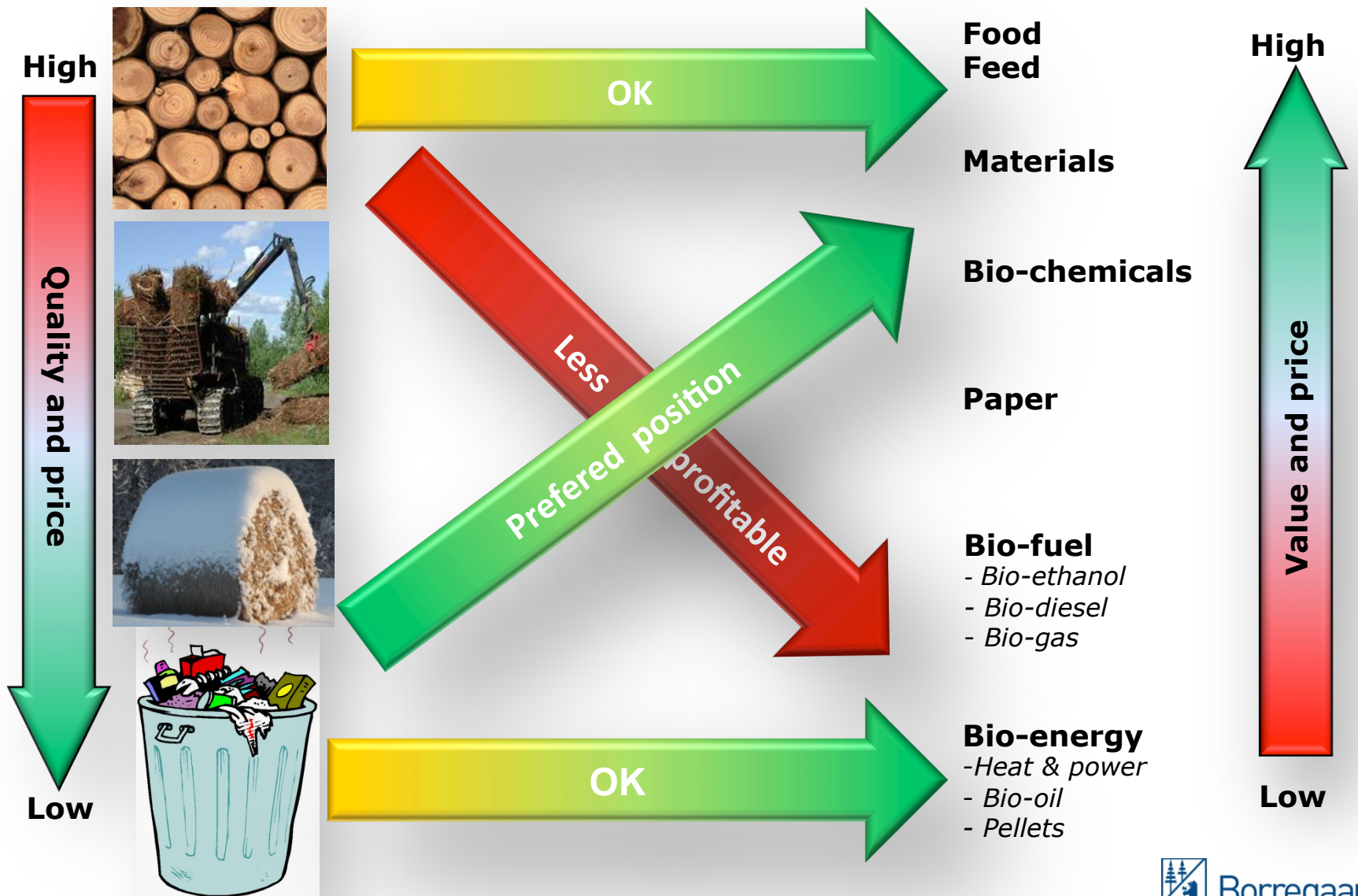
➔ Independent of heavy oil for all purposes by the end of 2013

Reduced energy costs and greener products

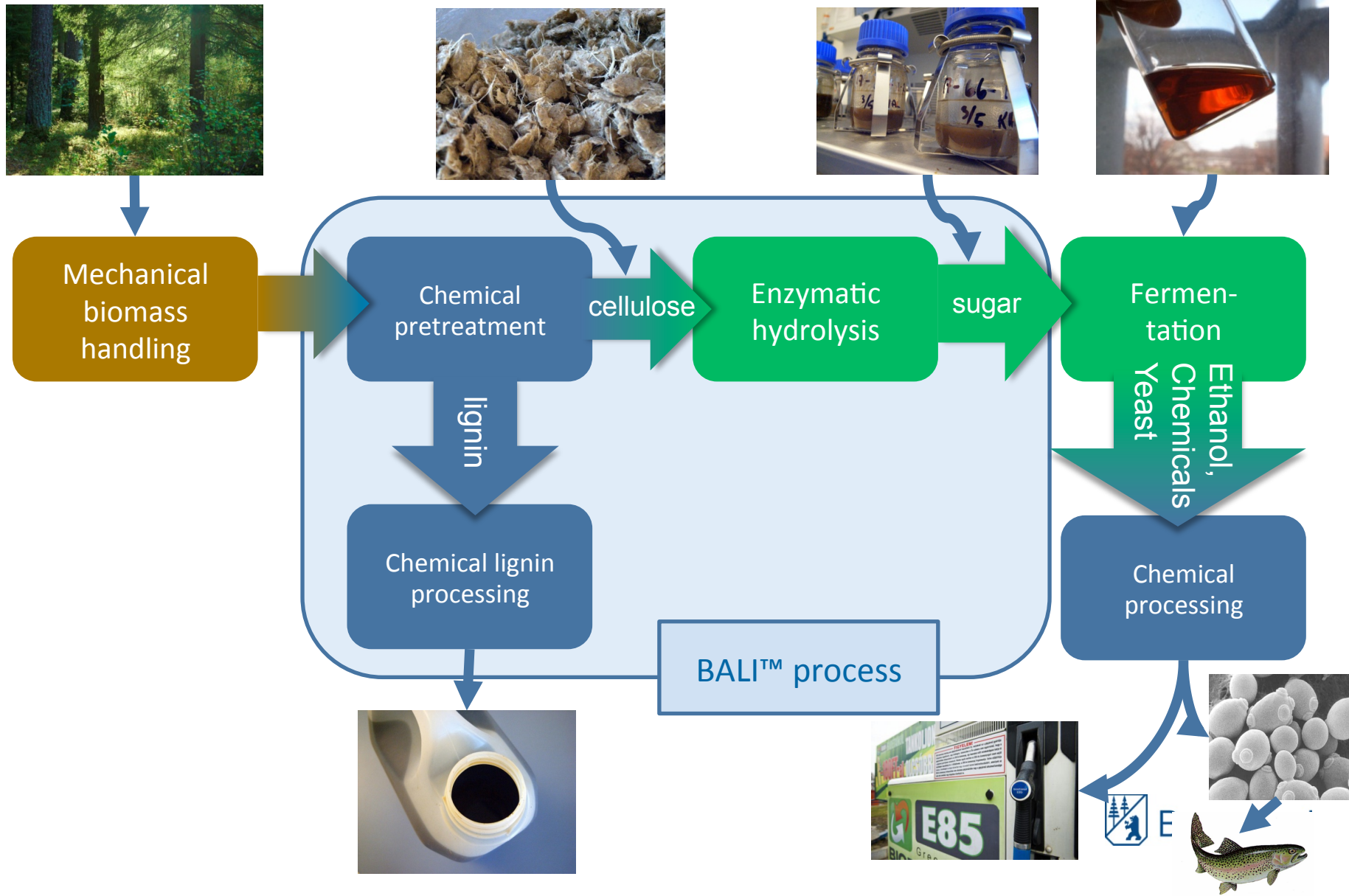
# From paper mill to biorefinery



# Optimal use of biomass - differentiation



# BALI™ process in a nutshell

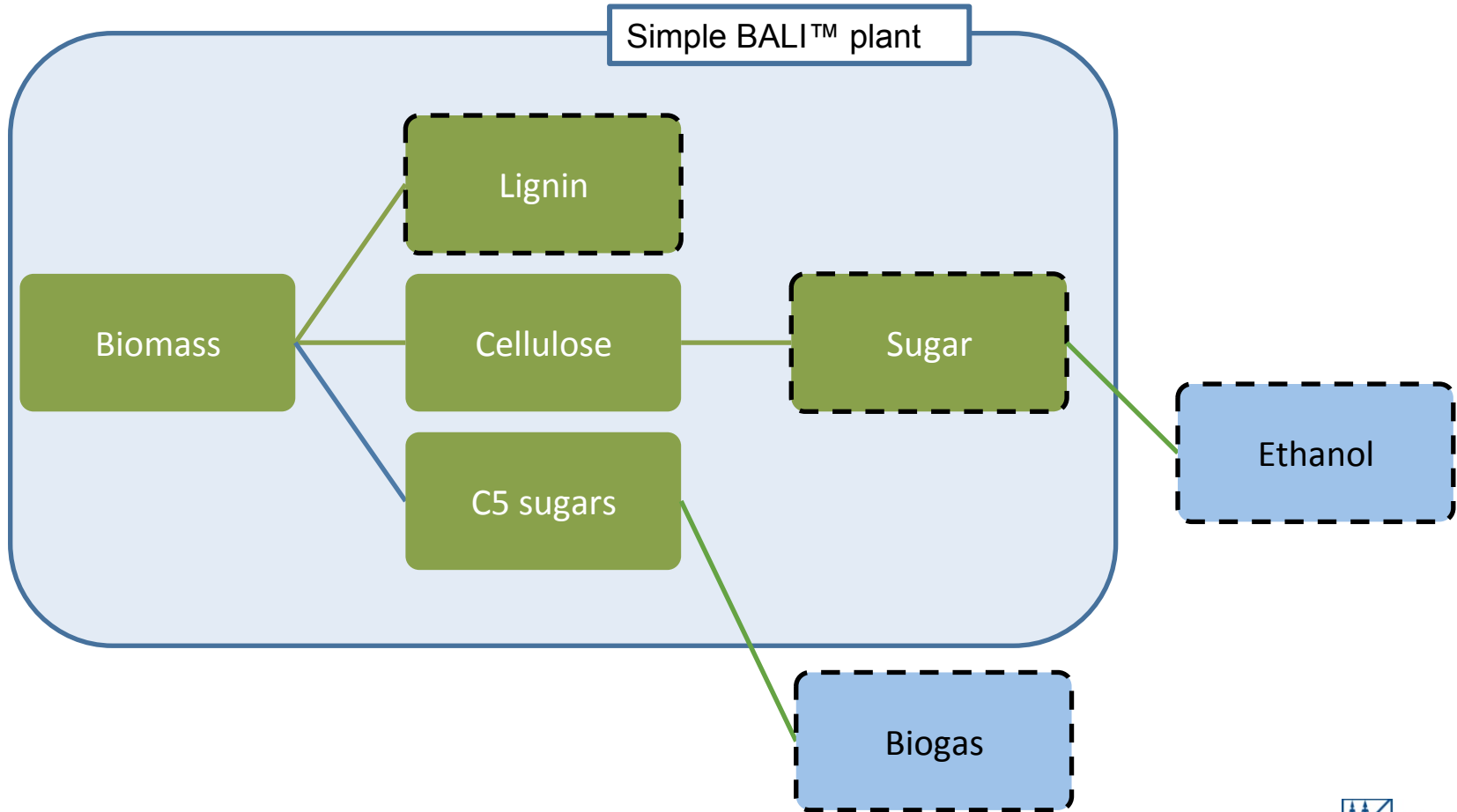


# Borregaard BALI™ Demo Plant

- Location: Borregaard: Sarpsborg, Norway
- Feed: 1-1.5 metric ton DM/day
- Construction started May 2011
- Ready end 2012
- 800 m<sup>2</sup> total area
- Budget cost: NOK 130 mill (EUR 16.5 mill )
- 45% cash support from Innovation Norway
- Currently exploring partnership opportunities for full scale production plant

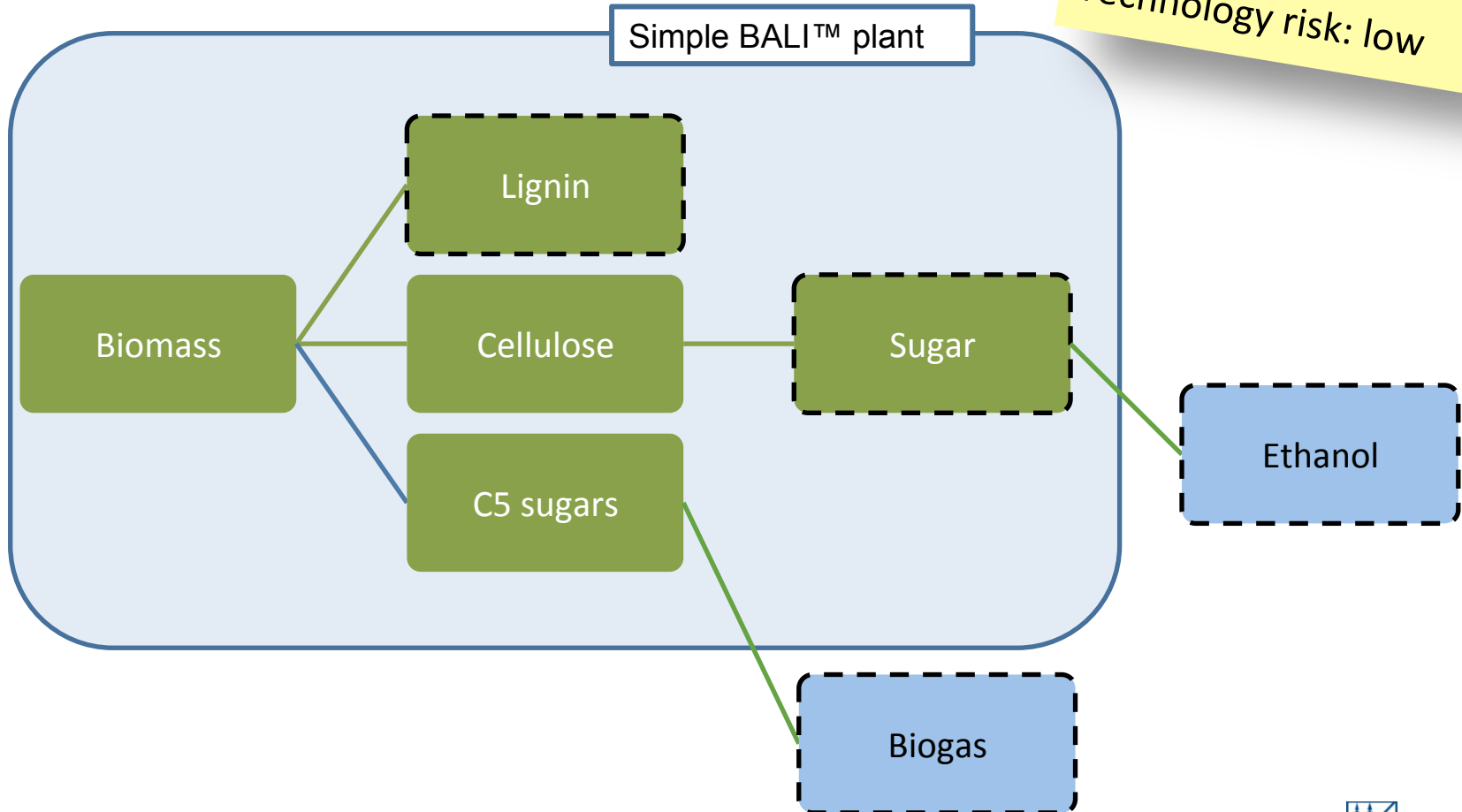


# Borregaard biorefinery extended with BALI™ technology

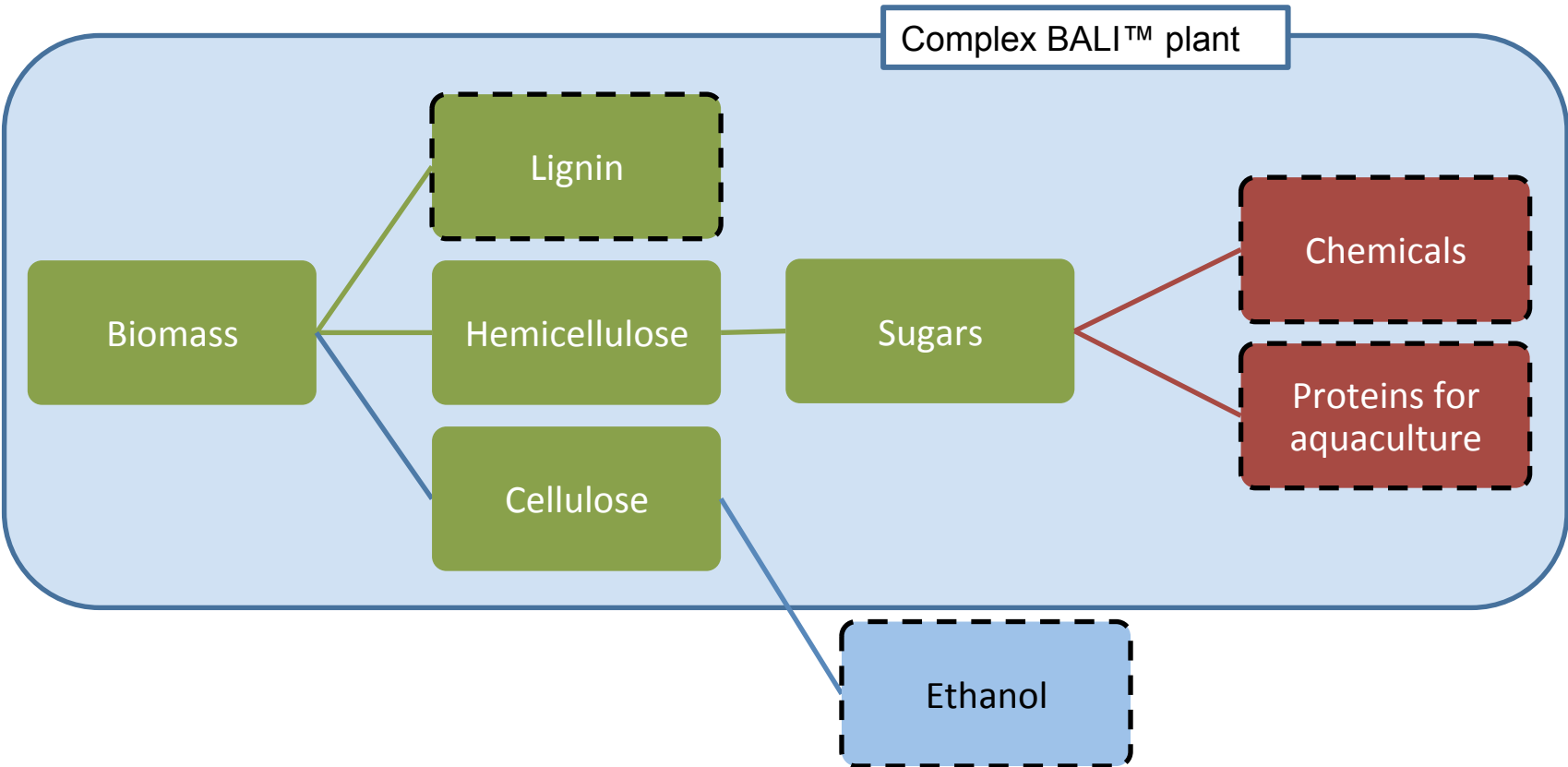


# Borregaard biorefinery extended with BALI™ technology

Concept: simple  
Value creation: not very high  
Site: Where conditions are very good  
Technology risk: low

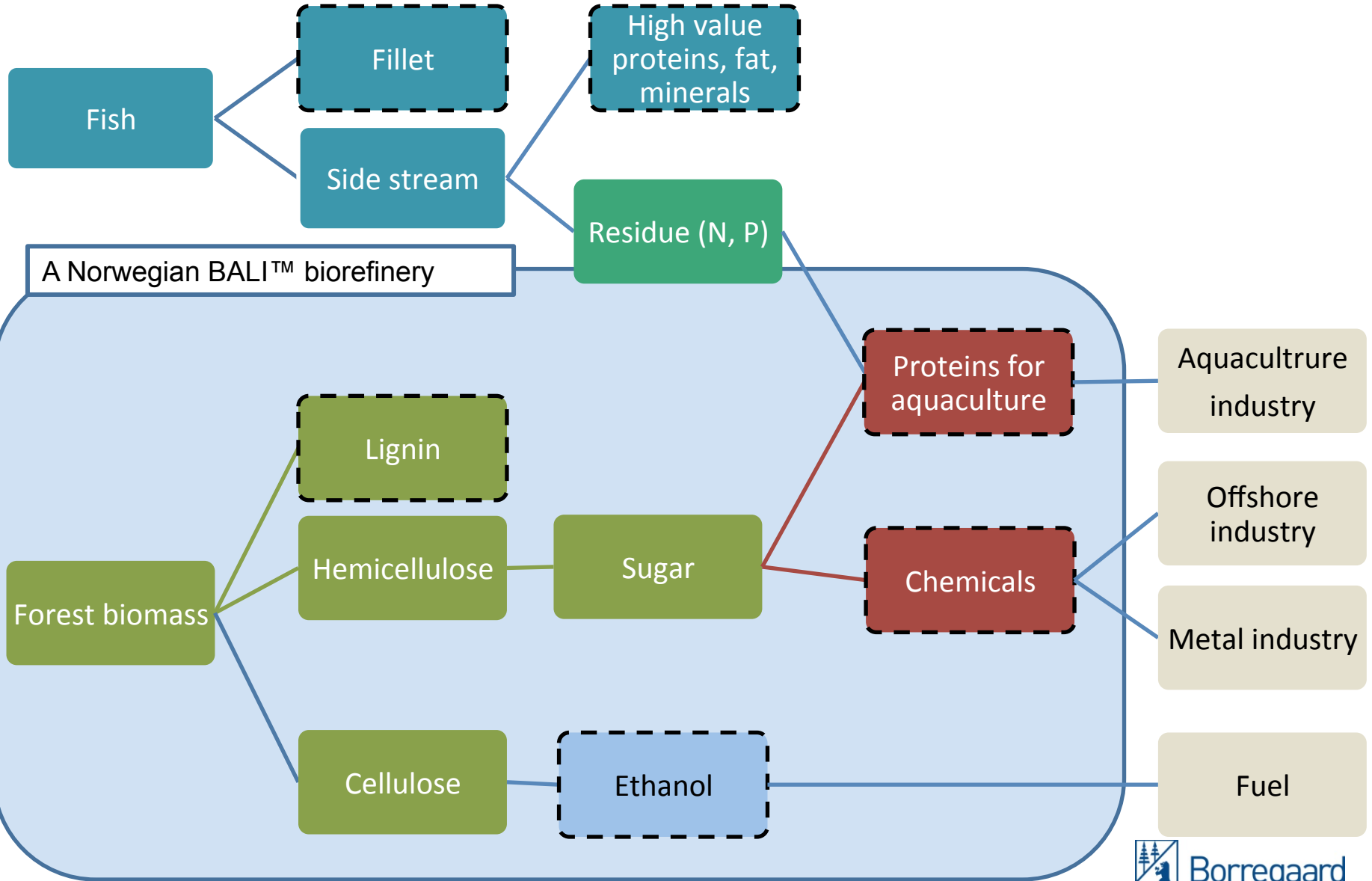


# Increased value creation





# A biorefinery model adapted to a Norwegian environment



# Conclusions



- Norway have lots of unused biomass (wood, fish) and potentials for more (straw, macro algae, energy crops)
- Biomass is expensive in Norway
- There are opportunities to build biorefineries that are particularly adapted to local conditions
- Biorefineries need to be flexible and have the option to develop further to cope with changes in market demand
- Focus on high value creation is needed, high volume commodity products whenever there is no better option.