

CREATING VALUE FROM WOOD: THE BORREGAARD BIOREFINERY



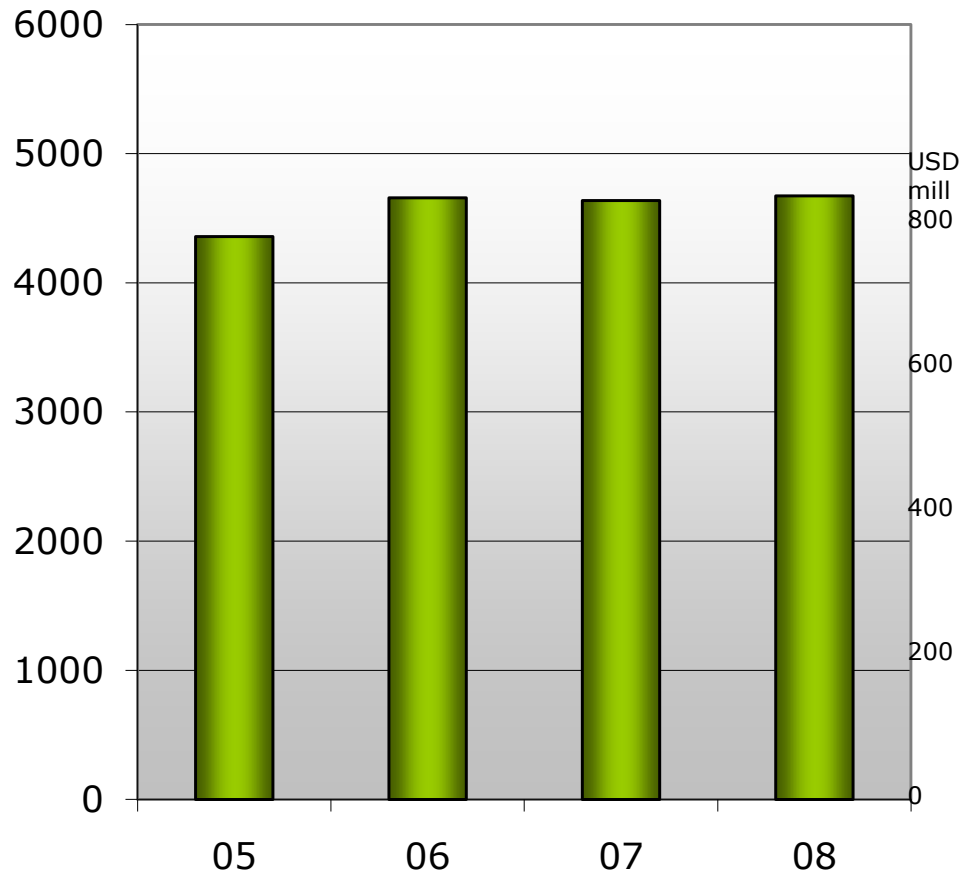
“Biofuels & Bioenergy: A Changing Climate“
IEA Bioenergy Multi Task Conference -Vancouver 2009
Gisle Løhre Johansen
Senior Vice President Business Development and R&D
Borregaard

Borregaard

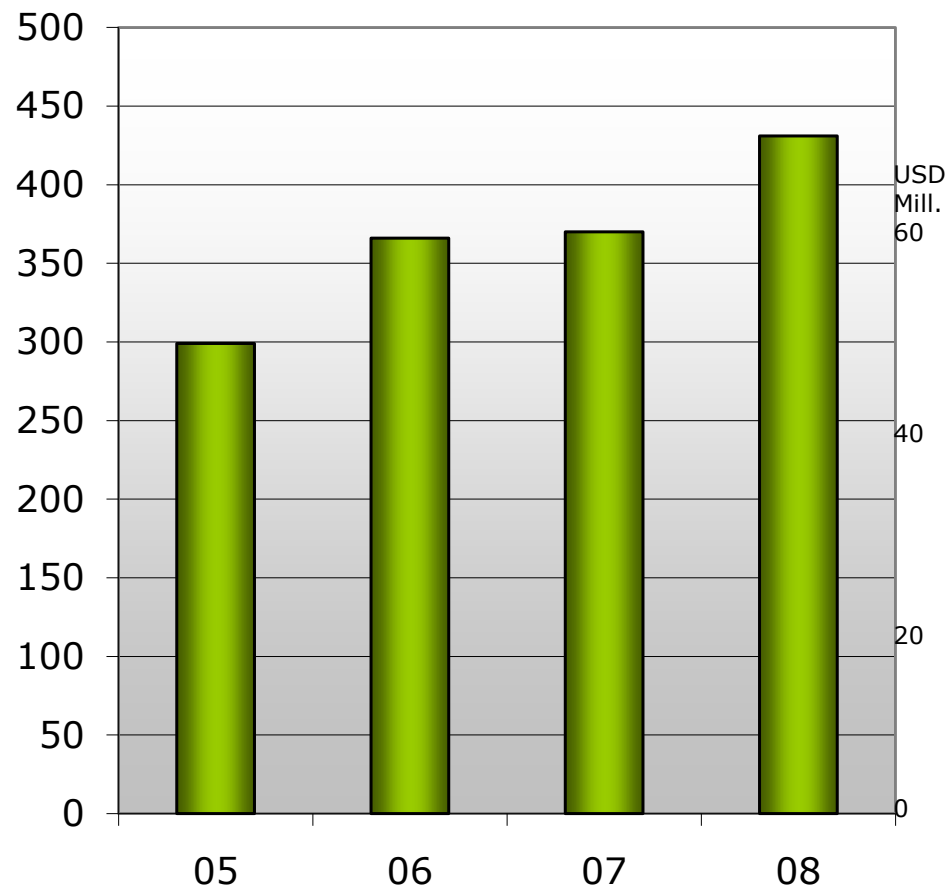
Key Figures



Sales (NOK mill)

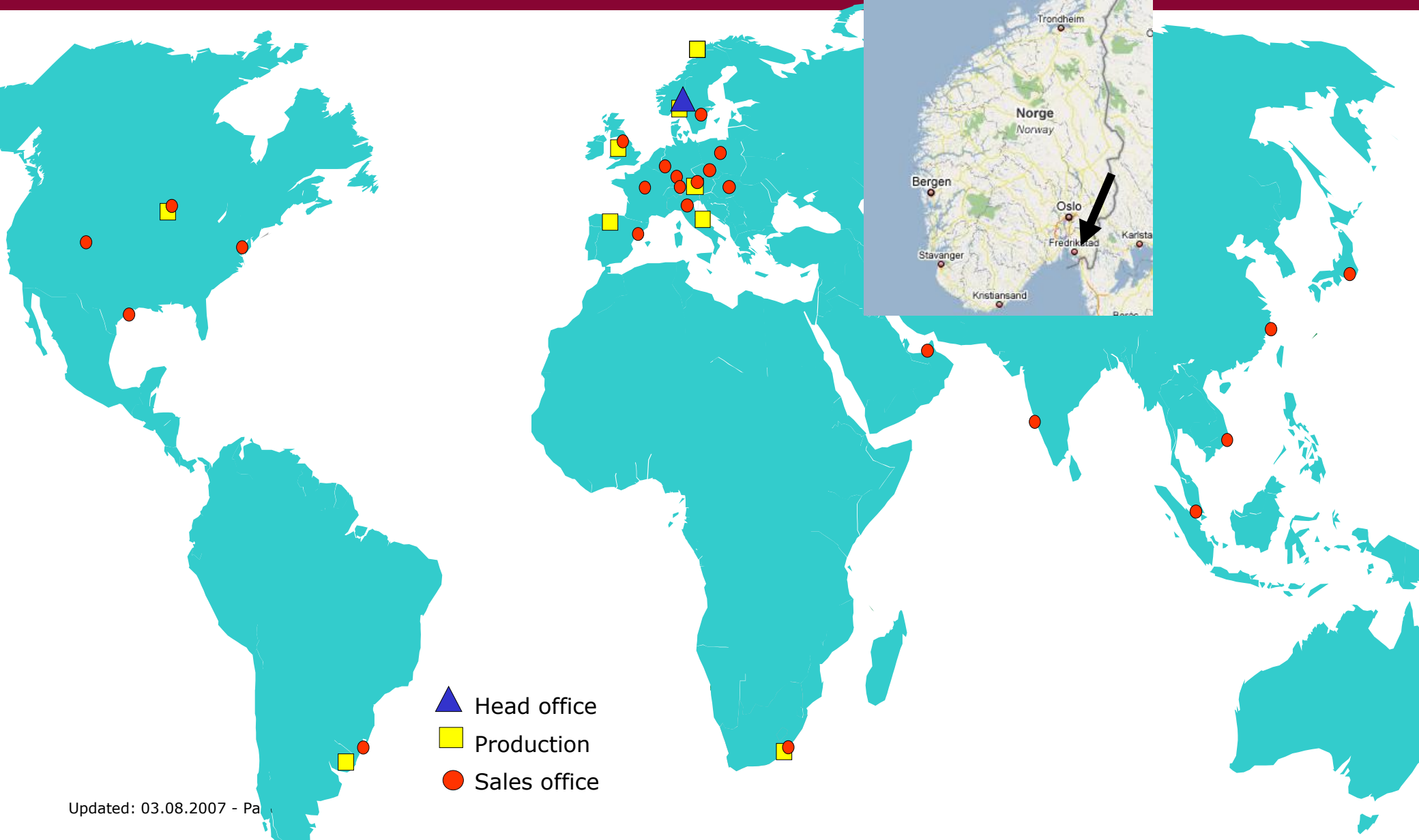


Operating Profit (NOK mill)



USD=5,64 NOK

Borregaard presence



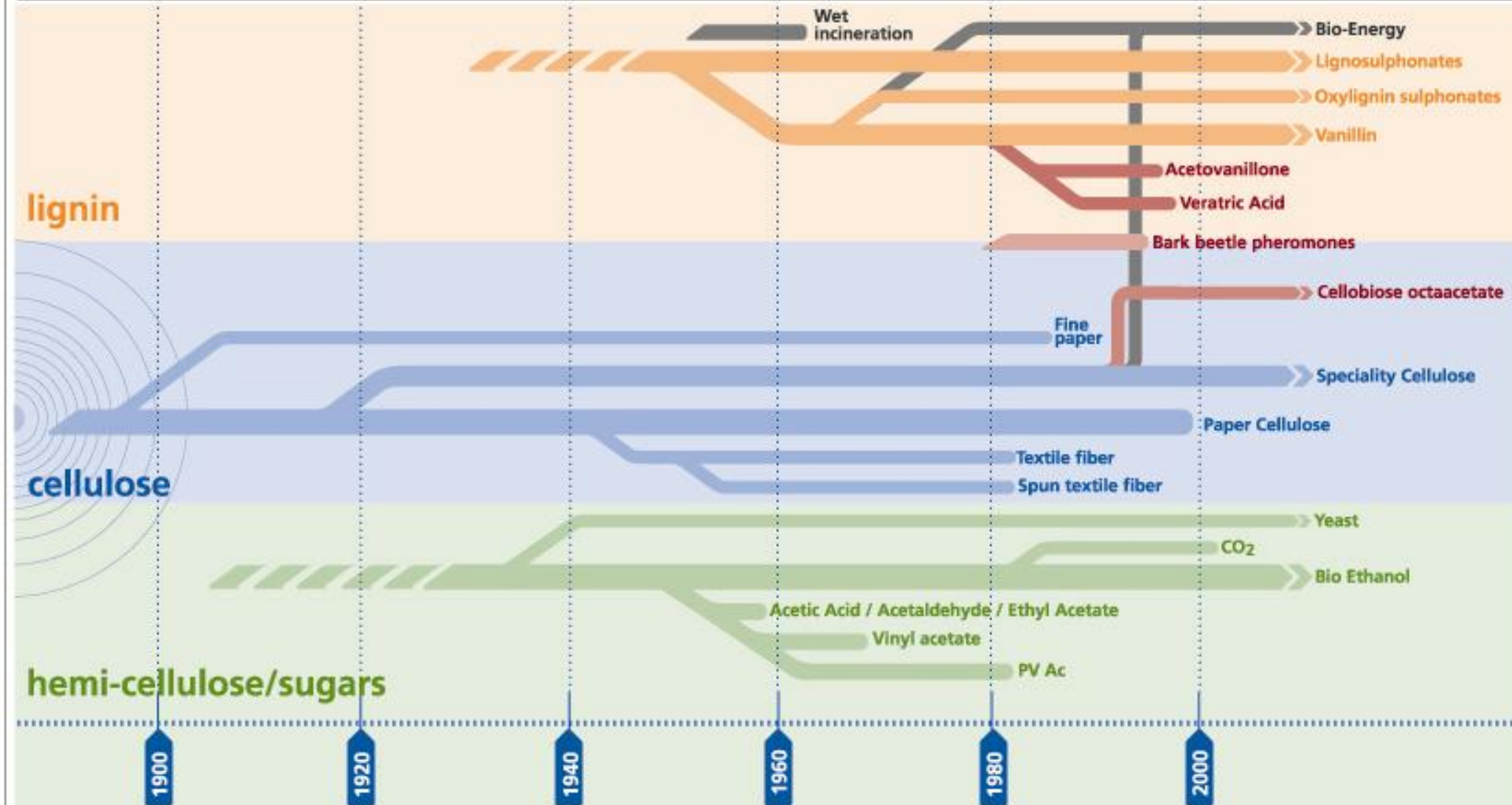
- ▲ Head office
- Production
- Sales office



- 450 mill. USD turnover
- 900 employees
- 70 - 80 man years dedicated R&D and innovation
- 20 % new products last 5 years (100 mill. USD)
- Consumes 1 mill. sm³ (400.000 BDT) spruce pr. year and produces:
 - 160.000 ton speciality cellulose
 - 170.000 ton speciality lignin
 - 20 mill. l 2.generation bioethanol
 - 1.300 ton bio vanillin
 - 200 GWh bio energy
 - 30 GWh bio gas (anaerobic digestion)

Borregaard Biorefinery

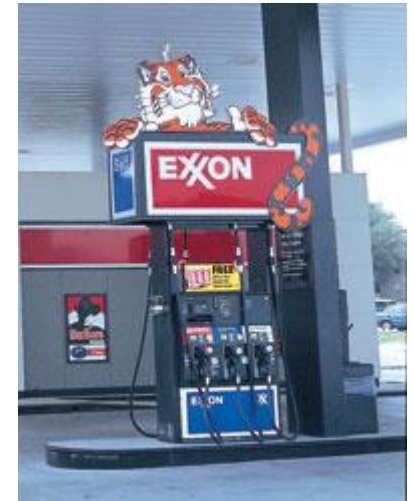
BORREGAARD'S BIOREFINERY



Biofuel - a possible new value chain for us ?



→
Biorefinery
(diesel, ethanol)
→



Raw material supplier

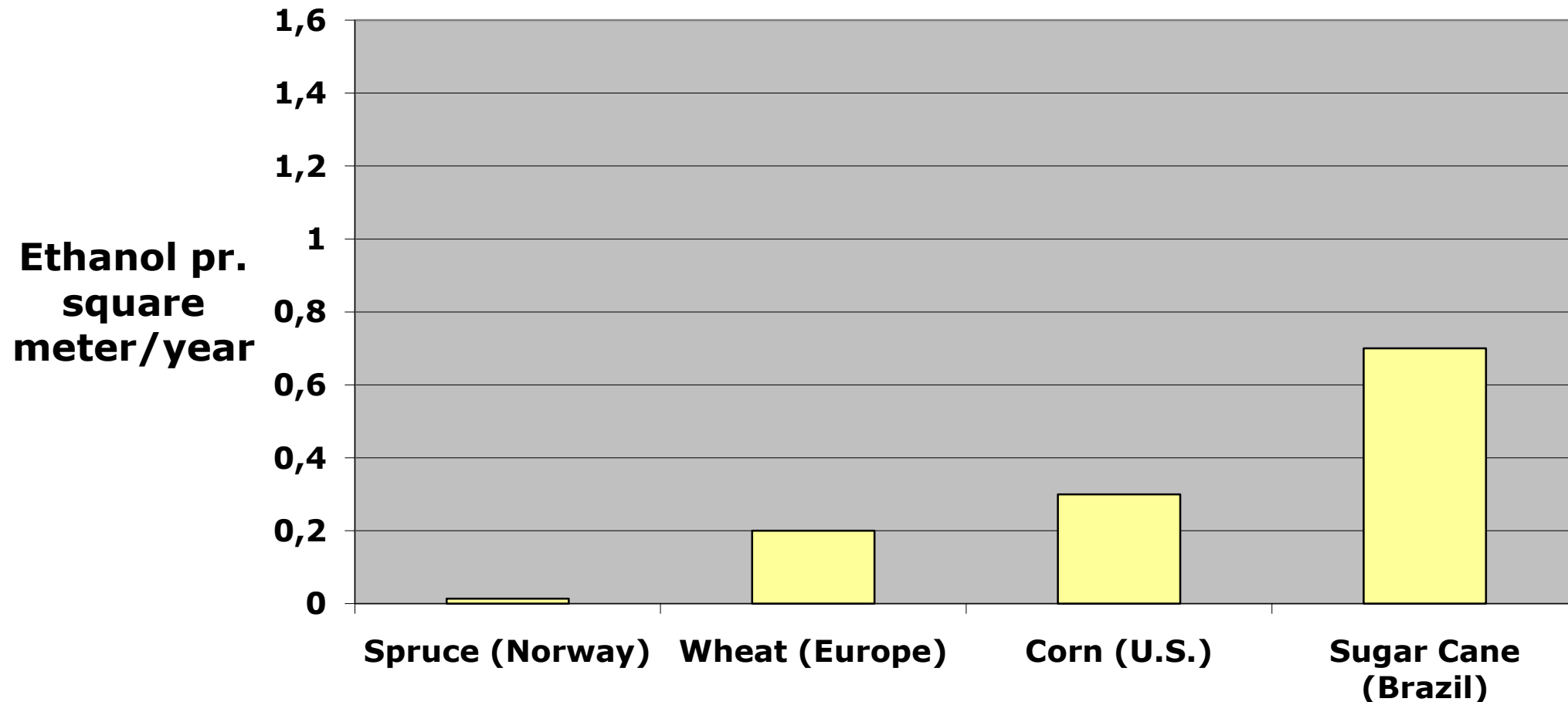
Distributor

Biofuel crucial question:

Are you better off than today in the middle of a commodity value chain at the mercy of the politicians ?

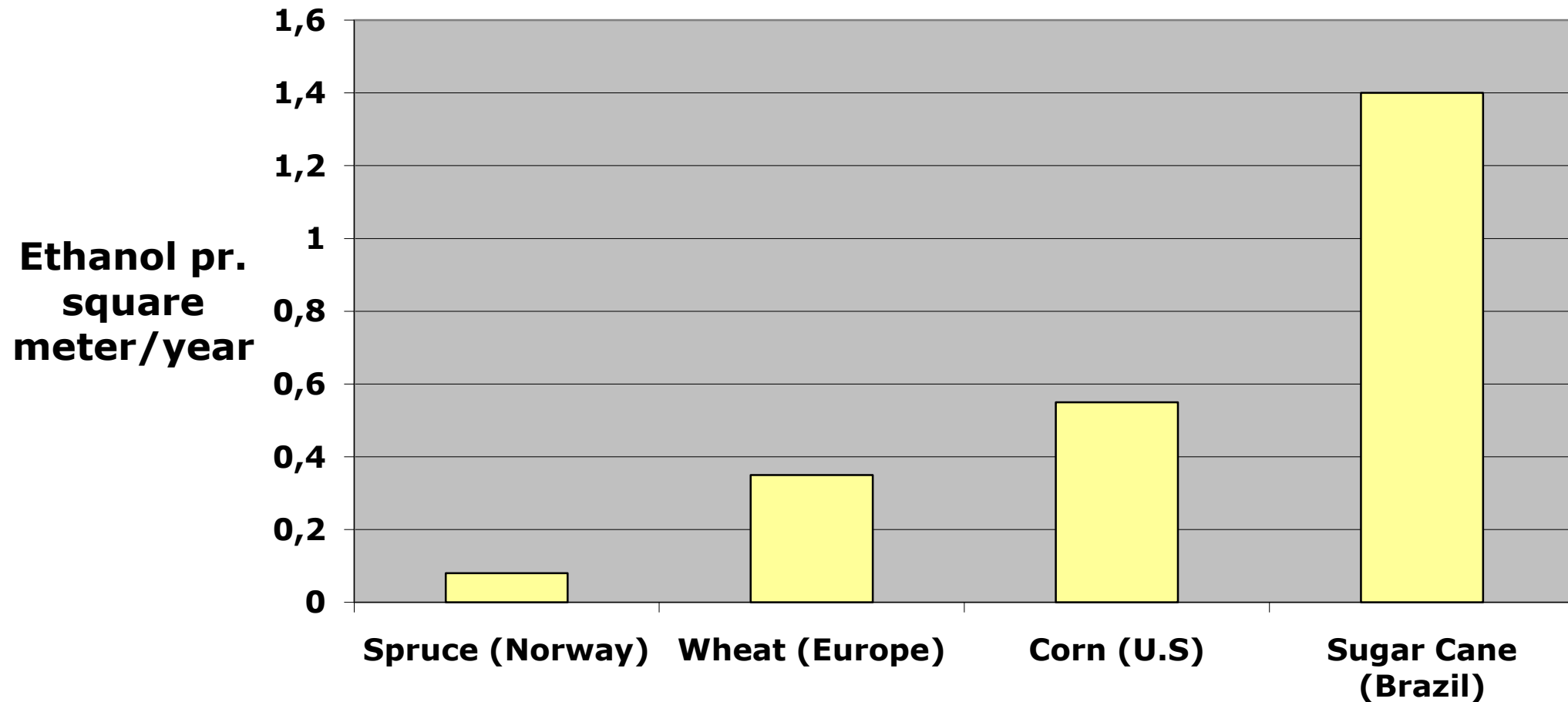
Cost efficiency – biomass growth is a big challenge in Scandinavia

1.generation

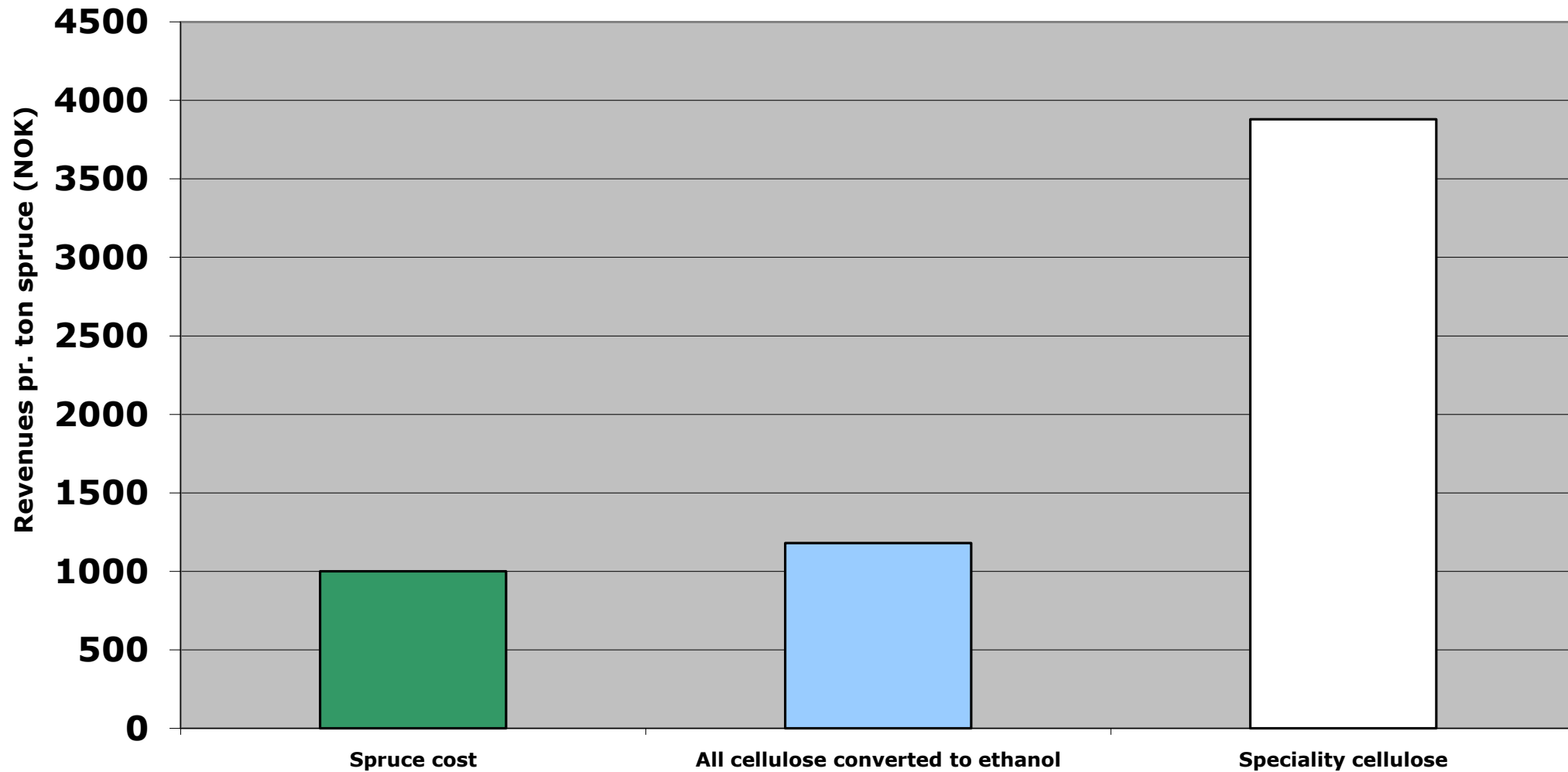


Cost efficiency – biomass growth is a big challenge in Scandinavia

2.generation with C5 fermentation

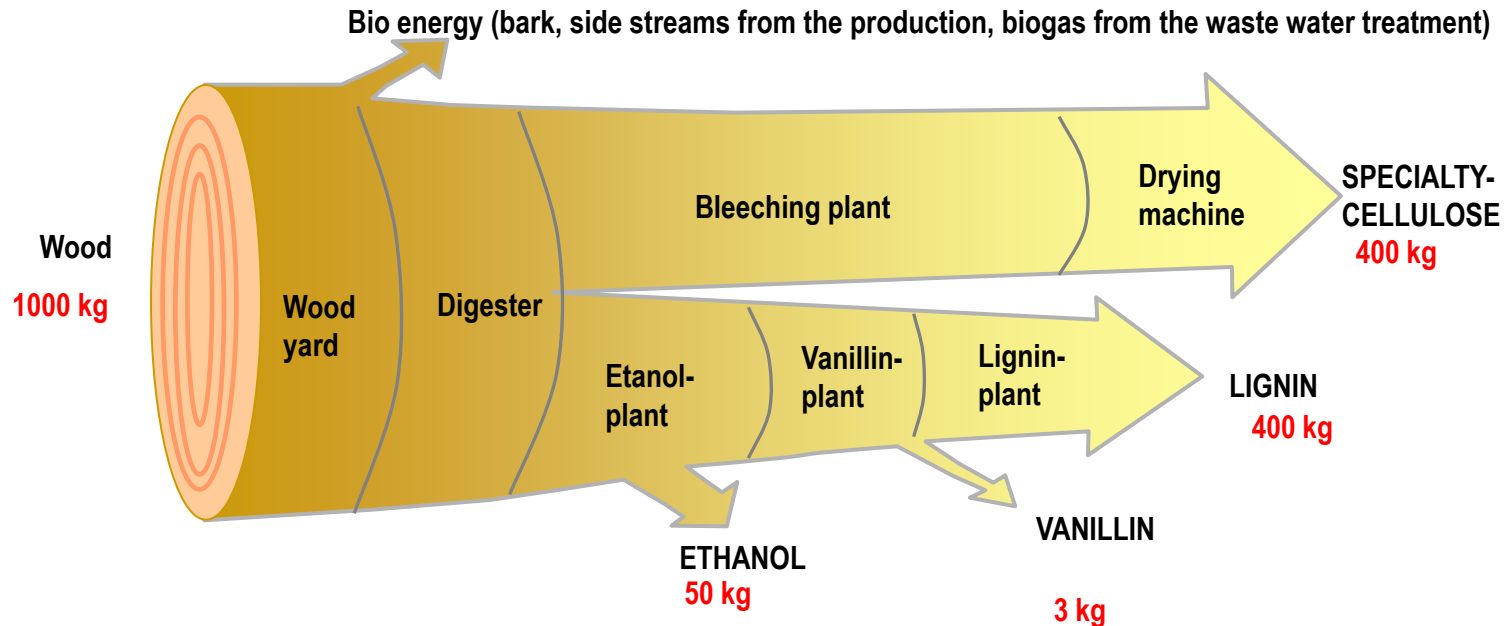


Biorefining – ethanol and cellulose option



- Mass balance
- Value added products and customers vs production costs
- Energy balance

Wood based chemicals in an integrated concept



Applications (end products)

Cellulose

Construction materials
Cosmetics
Food
Tablets
Textiles
Filters
Paint / varnish

Lignin

Concrete additives
Animal feed
Dyestuff
Batteries
Briquetting
Mining

Vanillin

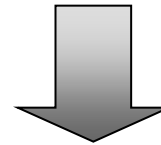
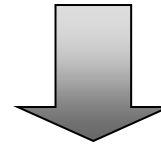
Food
Perfumes
Pharmaceuticals

Ethanol

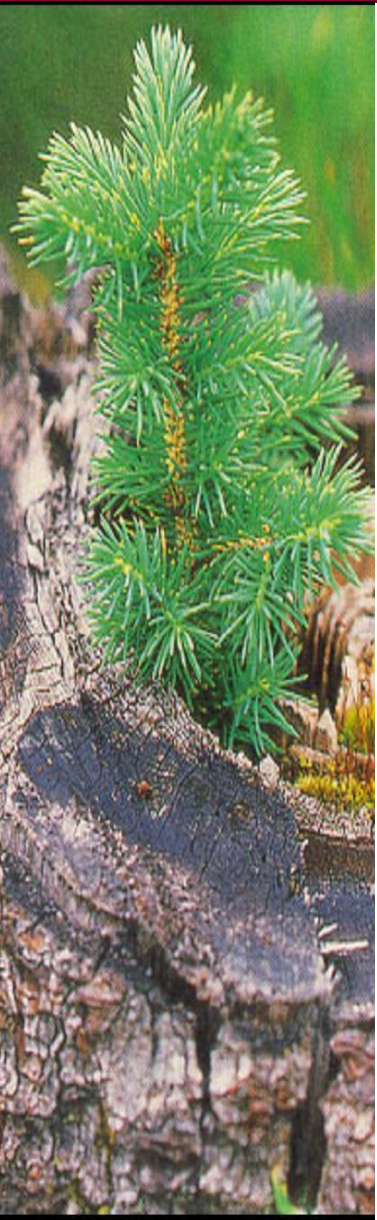
Car care
Paint/ varnish
Pharmaceutical industry
Bio Fuel

Biorefining: Definition

- The fractionation of biomass into components that may be further refined, giving an optimum and a balanced production of:
 - 1. Bio Materials
 - 2. Bio Chemicals
 - 3. Bio Fuel
 - 4. Bio Energy
- The pursuit of the unique properties of our raw materials – not the destruction of them



Utilization of biomass– *only renewable source to replace fossil carbon in fuels/materials!*



How we spend fossil carbon today

***FLEXIBLE -
CONVENTIONAL
TRANSPORT
30%***

***STATIONARY -
INDUSTRY H/P
PROCESS & GOODS
40%***

***STATIONARY-
RESIDENTIAL
SERVICES H/P
30%***

How we need to spend **green** carbon in the future to achieve sustainability

We **do** need carbon



*Use for materials
and chemicals*

We **do not** need carbon



*Use other renewable
alternatives for heat/power*

Green and sustainable business?

- The value chain will tell the story

Raw material



Natural
Renewable
Non toxic

Processes



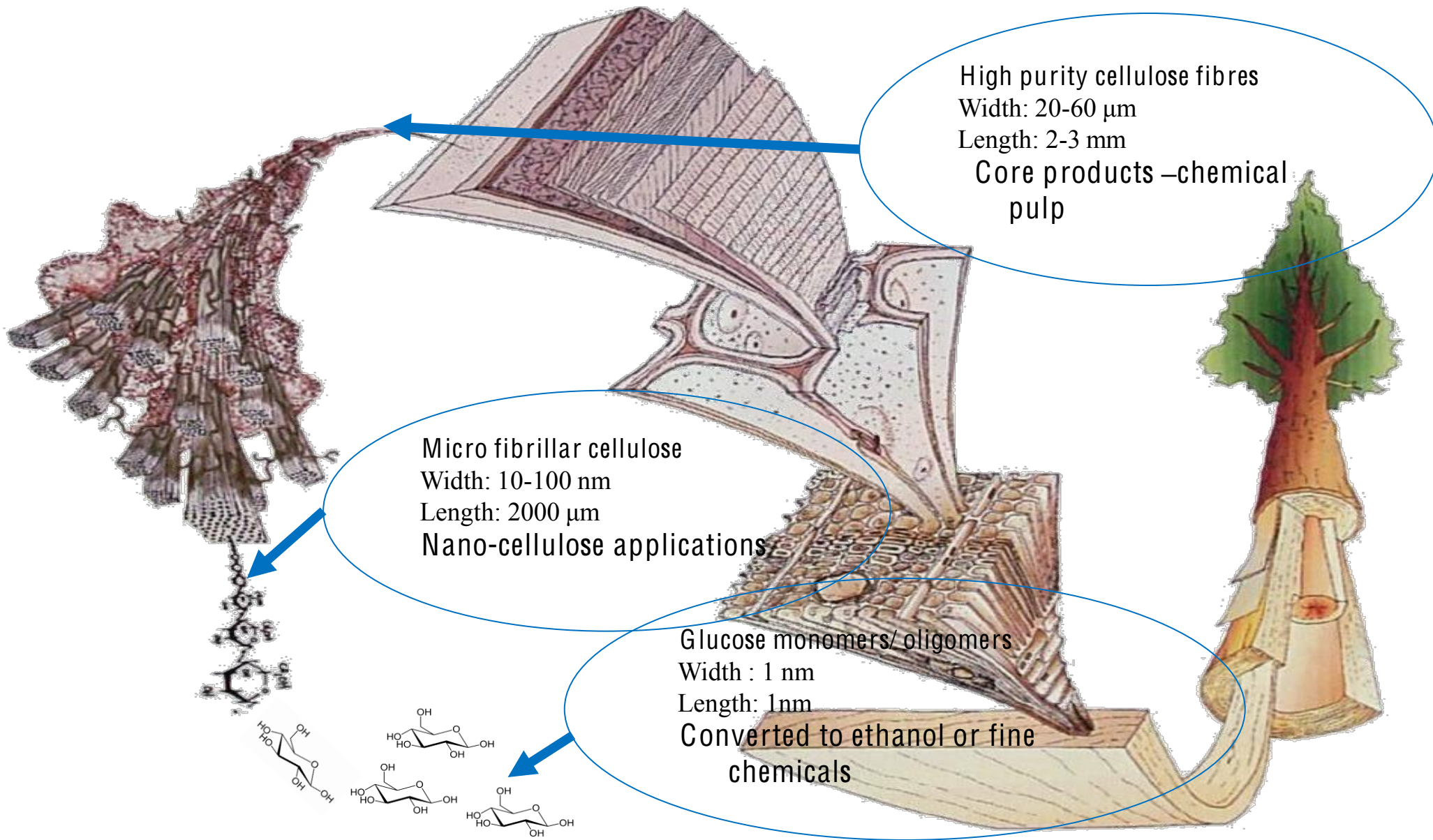
Reduced emissions
Energy conservation/renewable energy
High raw material utilisation
Risk management

Products



High performance
Substitutes oil based products

Unique properties of all fractions, cellulose, hemicellulose and lignin



Borregaard ChemCell

Specialty cellulose - applications



Construction



**Pharmaceutical
industry**



Textiles



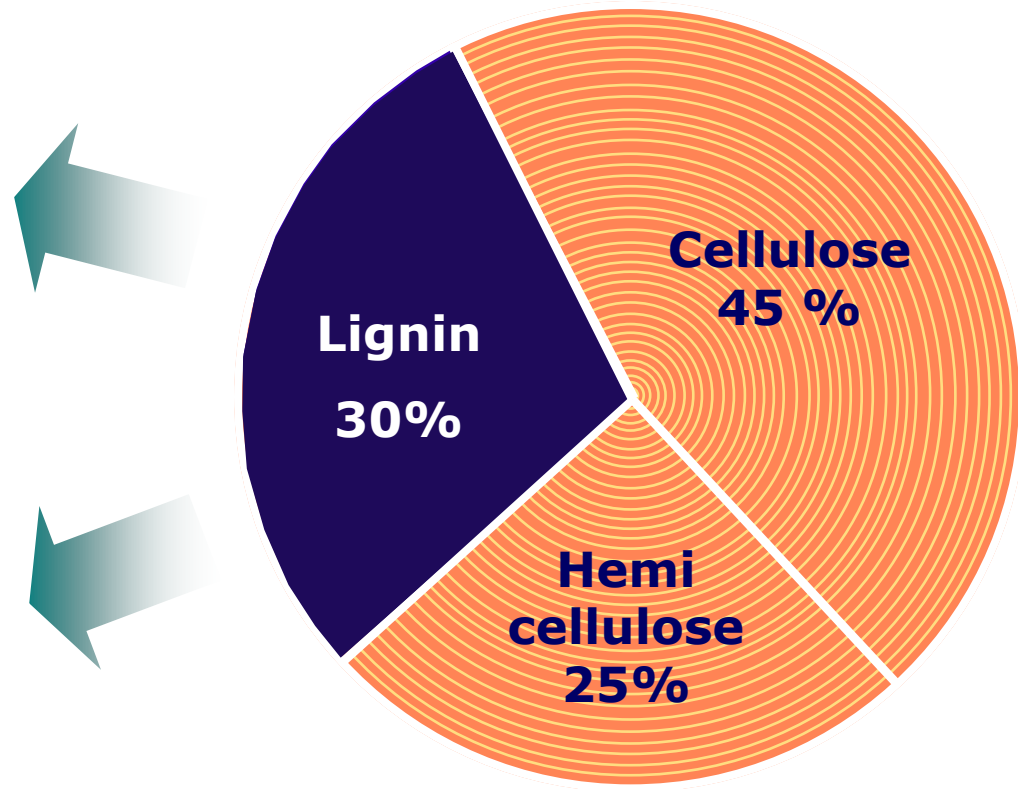
Food



**Cosmetics
Health products**

**Lignin based
specialty chemicals**

**Burning
(Energy and chemicals
recovery)**



Borregaard LignoTech

Lignin based products – applications



Agriculture



Oil
field chemicals



Dyes



Pelleting performance
enhancers



Additives for
tiles and bricks



Additives for
concrete admixtures



Additives for
tiles and bricks



CO2 savings pr. year:
4 Million tons !

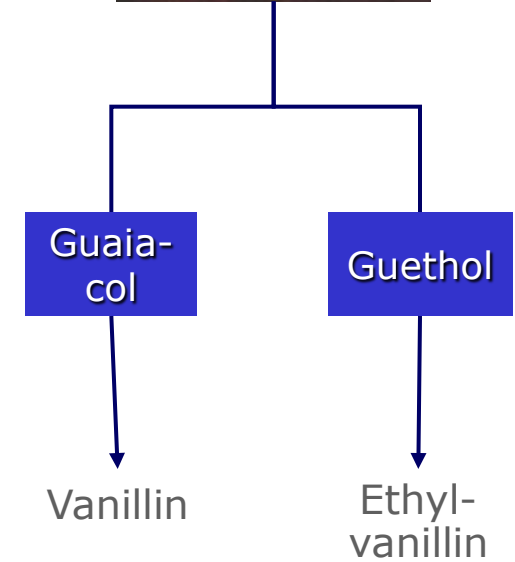
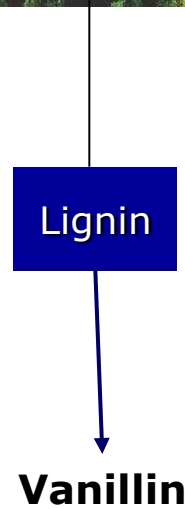
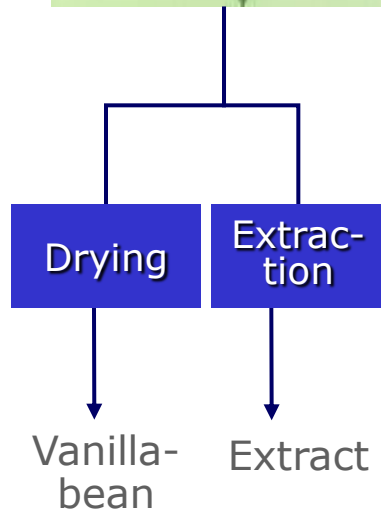


Pelletizing performance
enhancers



Additives for
concrete admixtures

Wood to food: Vanilla



Steam
Production
2010
950 GWh



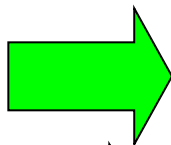
Liquid biomass from process and waste oil



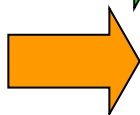
45 GWh



S02 production plant



165 GWh



135 GWh



Bark from debarking and sludge from bio treatment plant



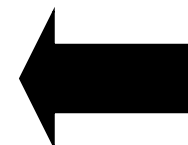
30 GWh

Bio Gas



40 GWh

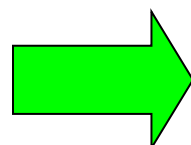
160 GWh



Heavy Fuel oil and electricity

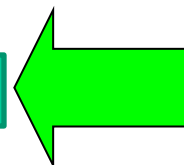


Sorted municipal waste (1)



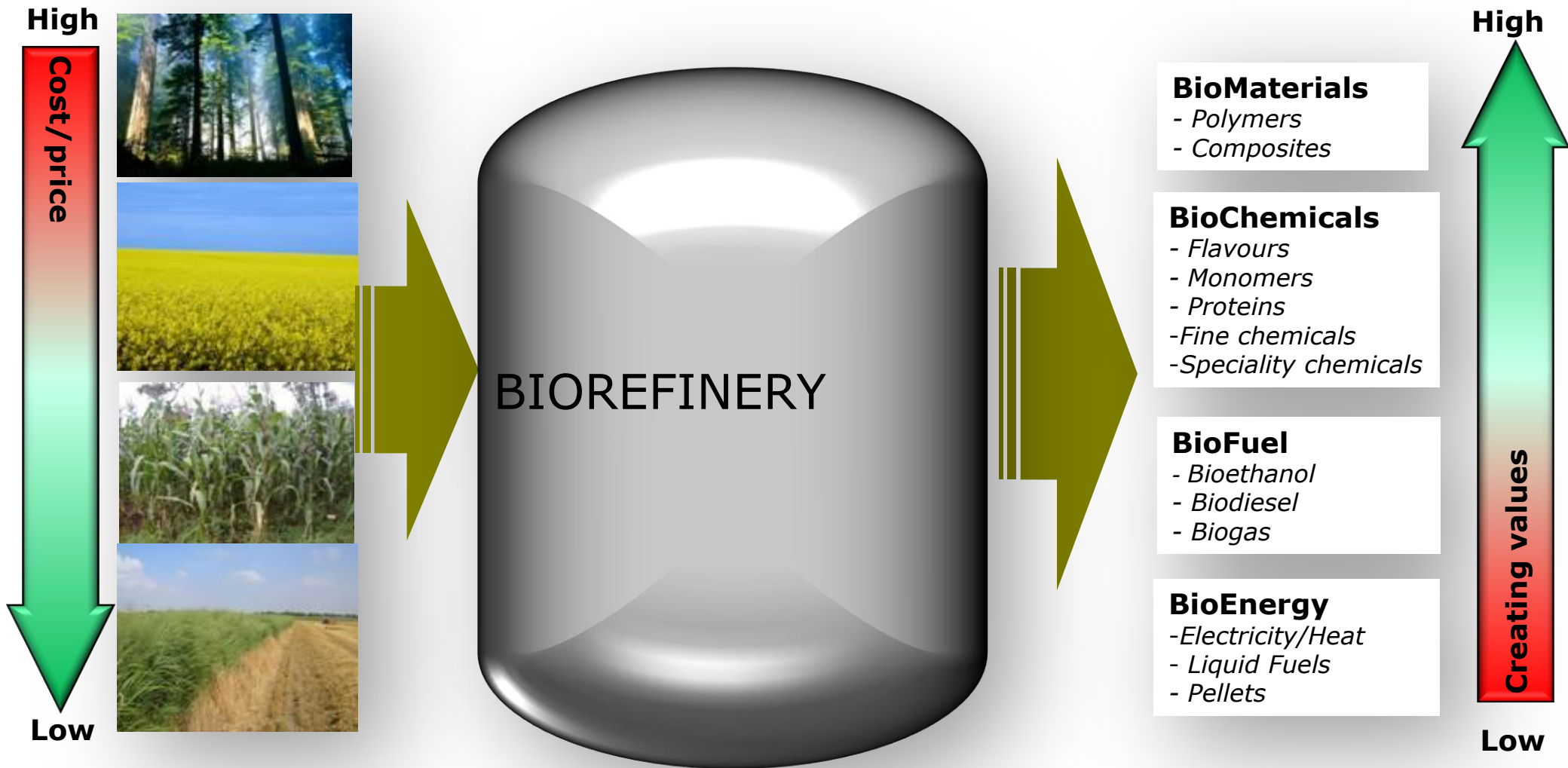
175 GWh

200 GWh



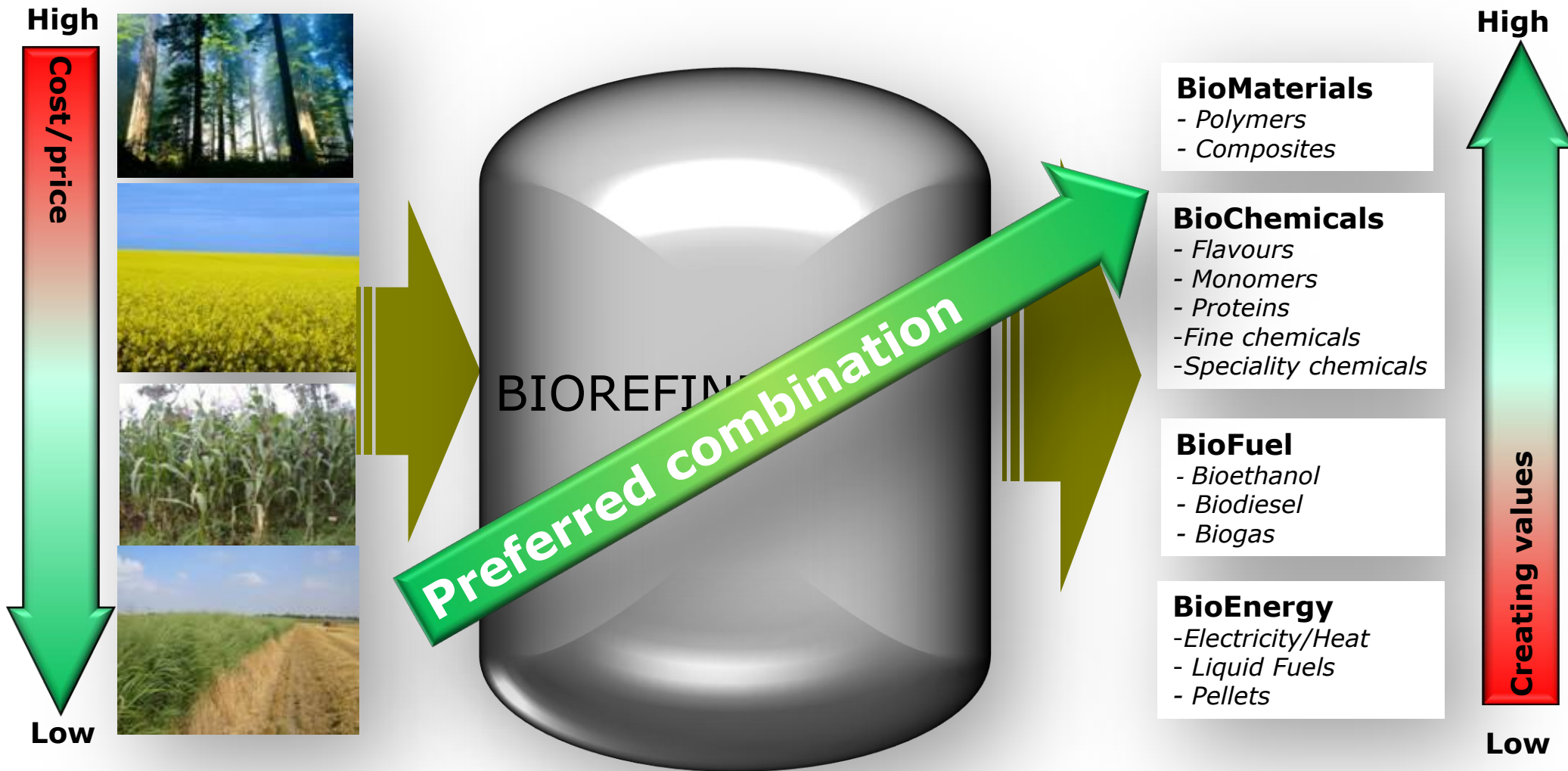
Sorted municipal waste (2)

Biorefinery options - profit considerations

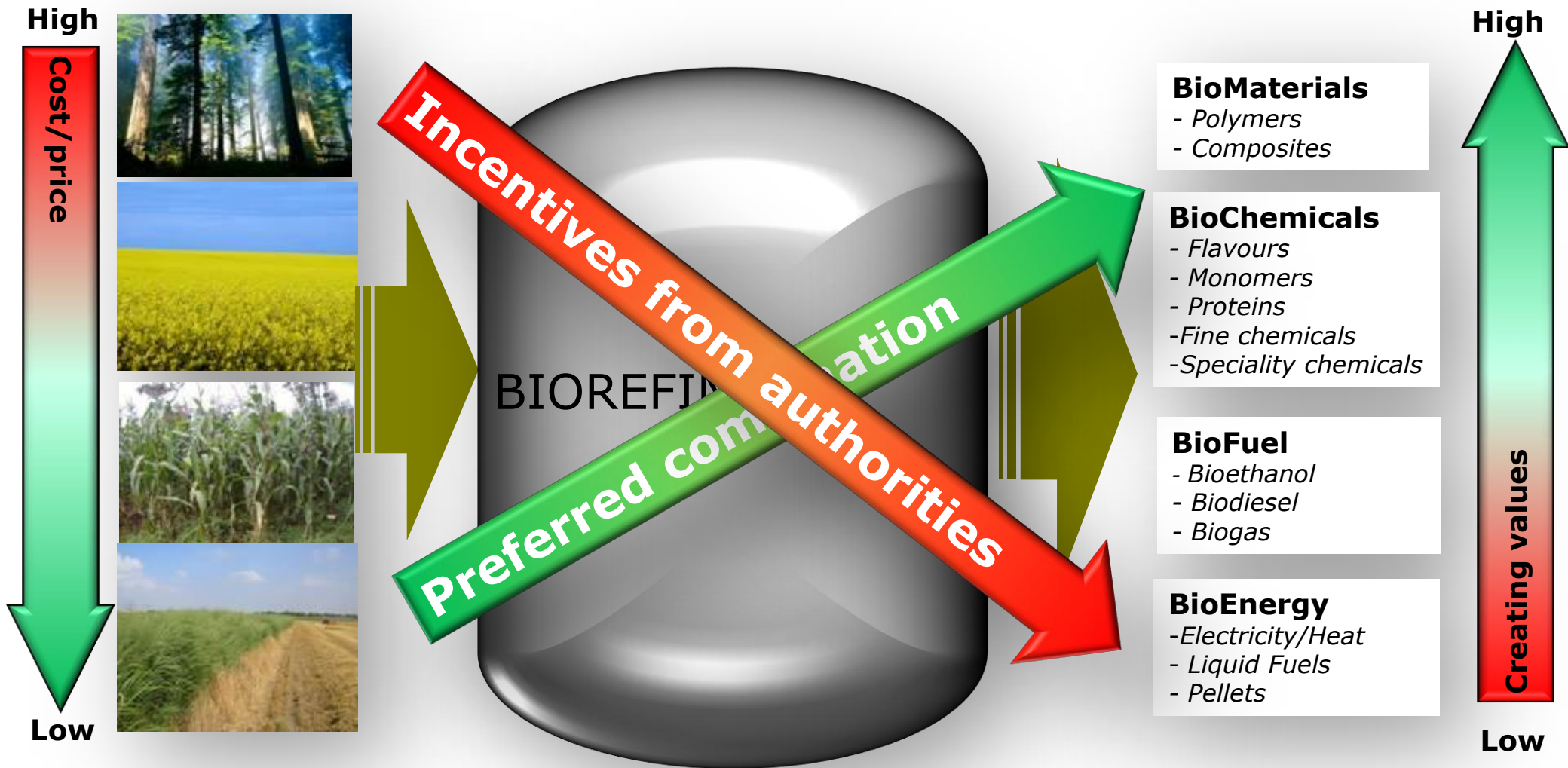


Biorefinery options - profit considerations

Reduce feedstock price & increase product price



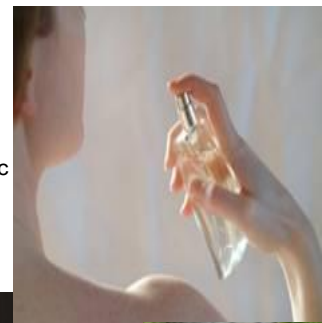
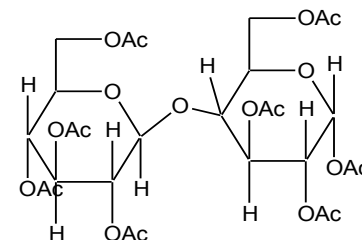
Biorefinery options - the incentive paradox



Project portfolio

-New technologies and applications

Cost-efficient raw materials
Chemical and enzymatical pre-treatment and fractionation
Hemicellulose (polymeric and monomer applications)
Chemicals from sugars (C-5/C-6)
Nanofibers and applications
Fine-/specialty chemicals based on pyrolysis
Fine-/specialty chemicals based on lignins
“Bioplastic” (lignin in plastic materials)
Applications for hydrolysis lignins
New applications based on existing raw materials/process technology



70+ persons in R&D and business development
20% innovation turnover target



Are we ready for "War Chemistry" ?

