



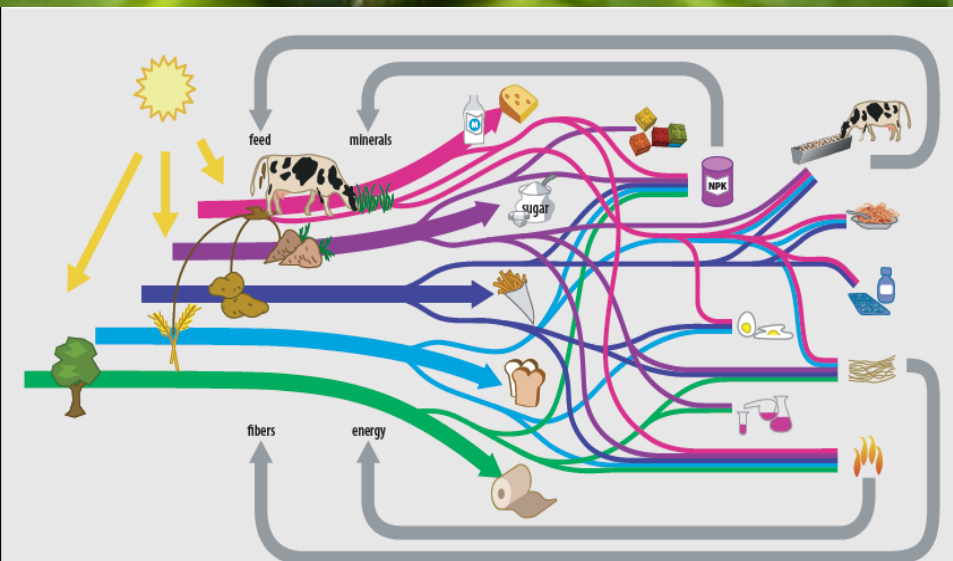
Netherlands Enterprise Agency



The Bioeconomy in the Netherlands

opportunities for collaboration

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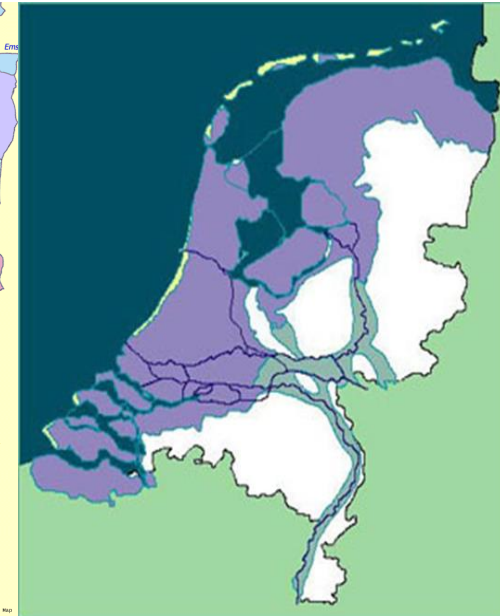


The Netherlands

17 million inhabitants
on 40.000 sq. km
46.073 US\$ GDP/Cap



Consumption fuels 11 Mton
Consumption biofuels: 0,4 Mton
Production biofuels: 1,9 Mton

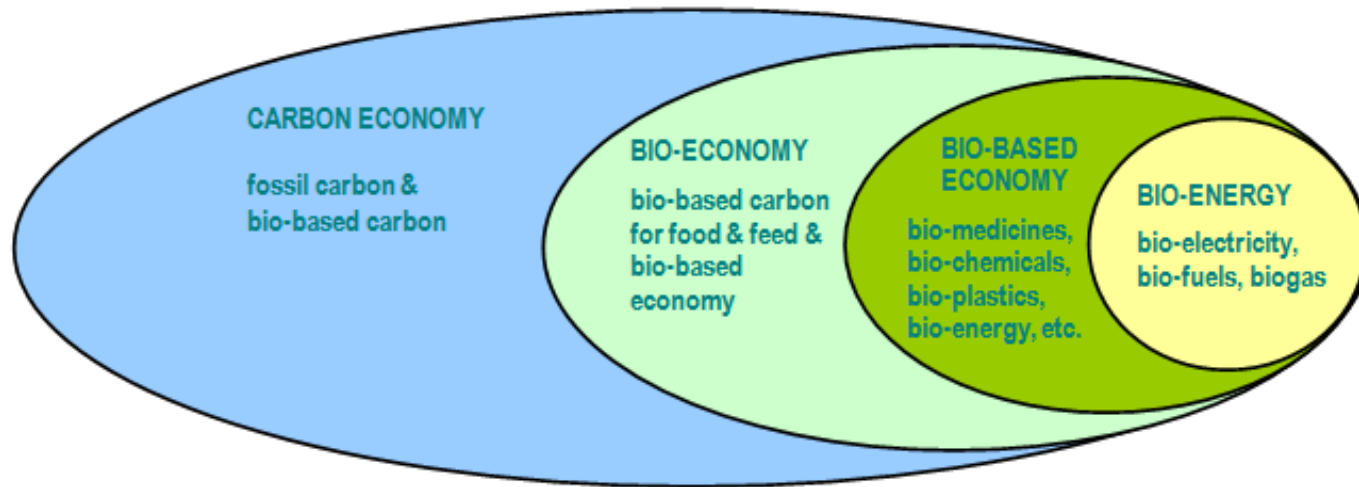


- Delta downstream large European rivers, 2/3 of the country below sea level
- Surrounded by industrialized area's of Belgium, Germany





Integrated Approach for Bioeconomy – Biobased Economy - Bioenergy



- The bio-energy arena is a subset of the bio-based arena (non-food use of biological resources), itself a subset of the bio economy, and ultimately of the 'carbon economy'.
- Our society is to a significant extent based on the 'carbon economy', fed both by fossil and renewable (or biological) carbon.



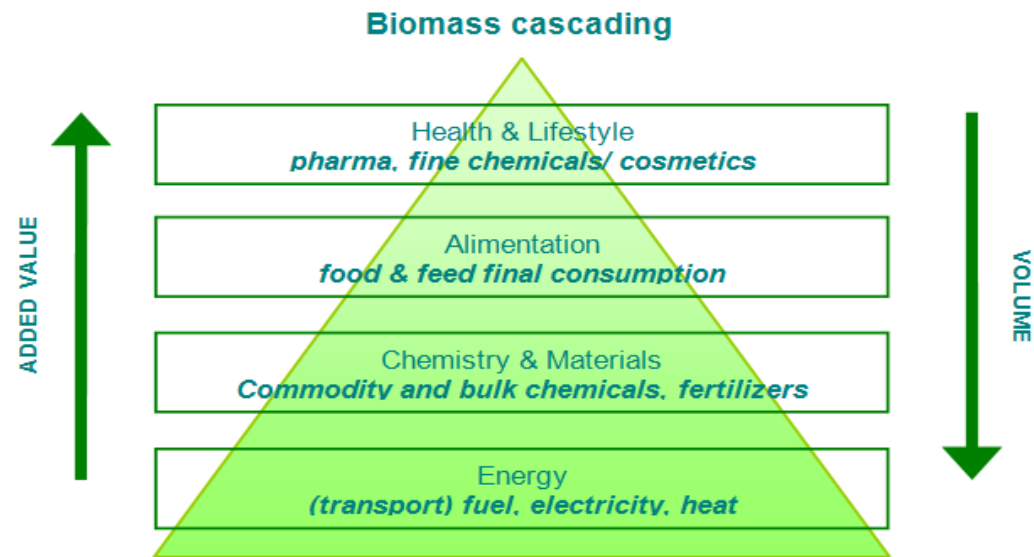
Policy Netherlands: Biobased Economy Create Sustainable Value from biomass

*Biomass for chemicals,
products and energy*

- *Sustainable Production*
- *Innovation*
- *Integrated use in Biorefineries*

Till now: Main Driver:

- *Renewable Energy Directive*
- *Netherlands: 14% in 2020*



*Optimum use of bio-resources implies
'cascading'*



Policy: 2016; Biomass 2030 – Strategic vision for implementation of biomass

Main message:

- In principal there is enough sustainable biomass available to fulfil the Dutch demand for food, feed, transport, chemicals and materials
- However, this requires:
 - supply of sustainable biomass
 - efficient and circular use of biomass in biorefineries
 - use an integral sustainability assessment framework
 - innovation

<https://www.rijksoverheid.nl/documenten/rapporten/2015/12/01/biomassa-2030>





Circular & Biobased Economy

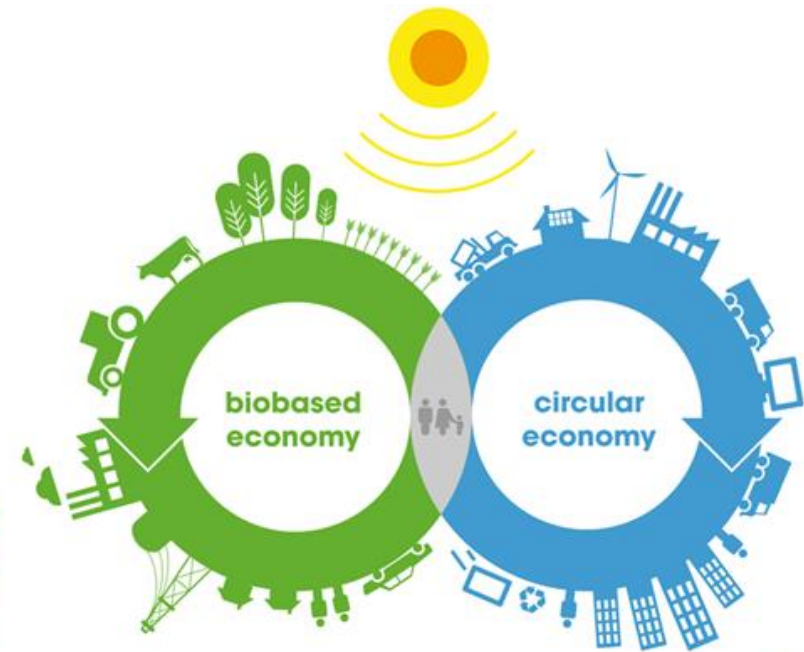
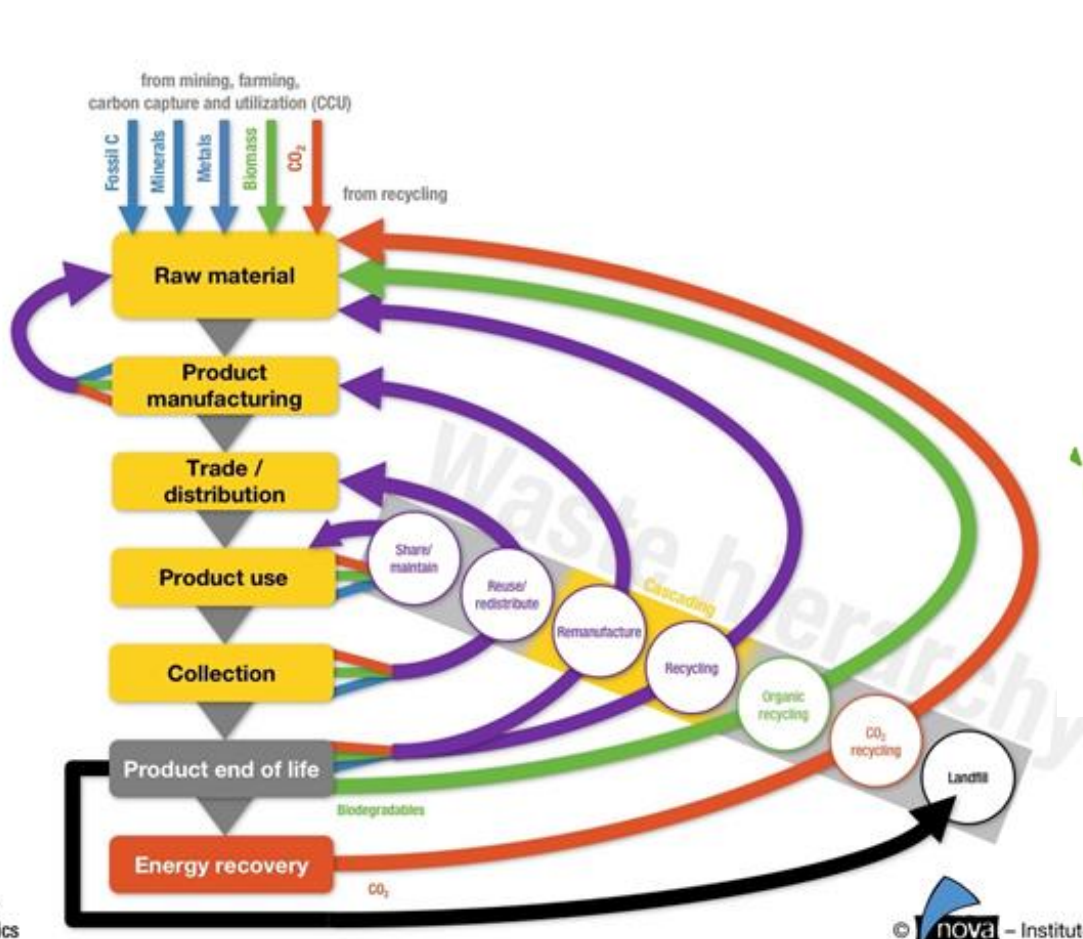
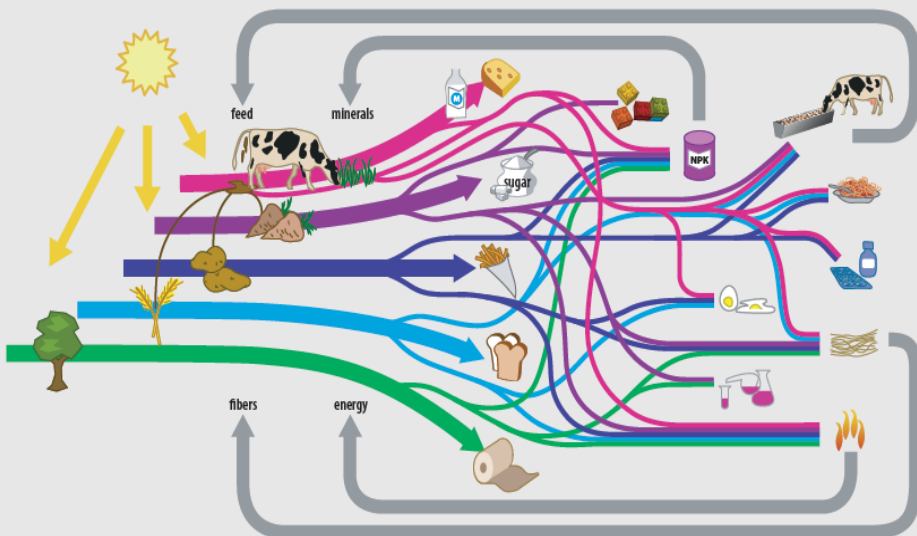


table at /graphics



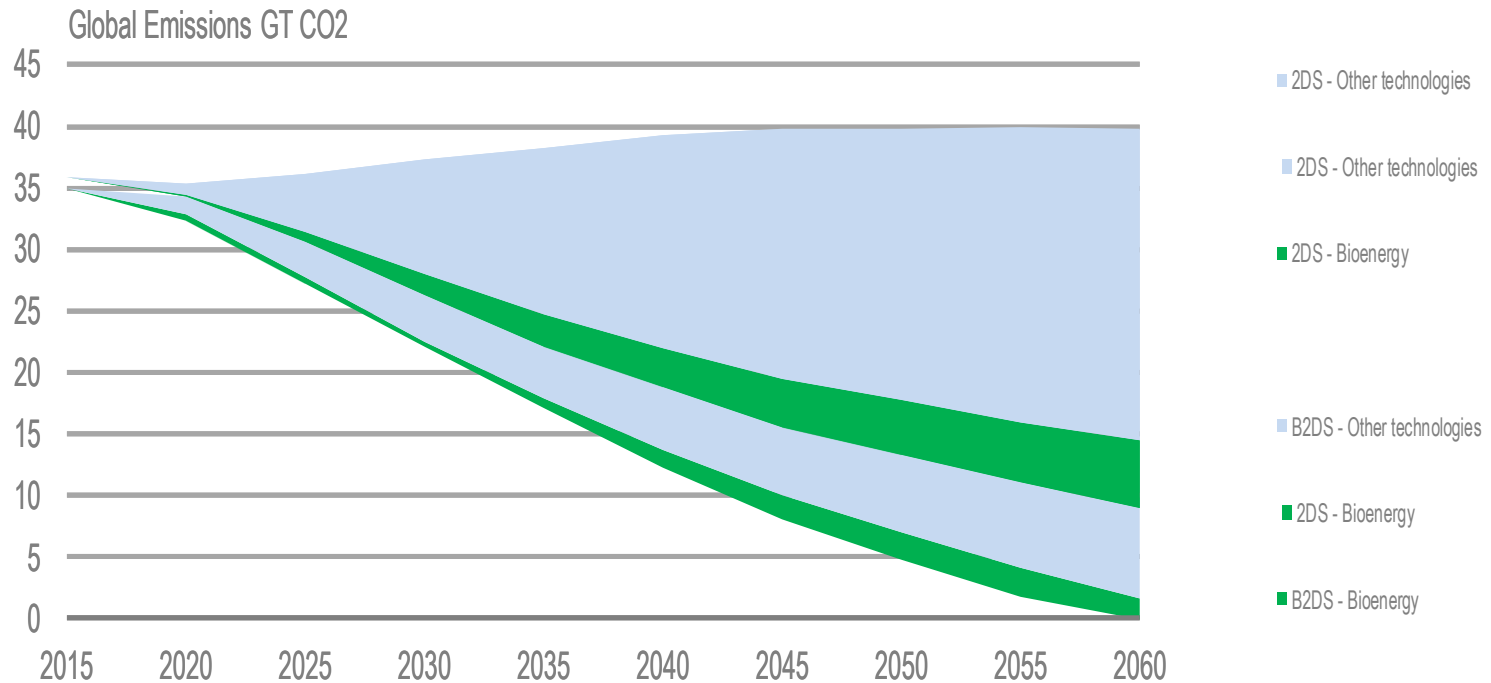
Bioenergy in a low carbon energy supply





Bioenergy an essential component of IEA Low Carbon Scenarios

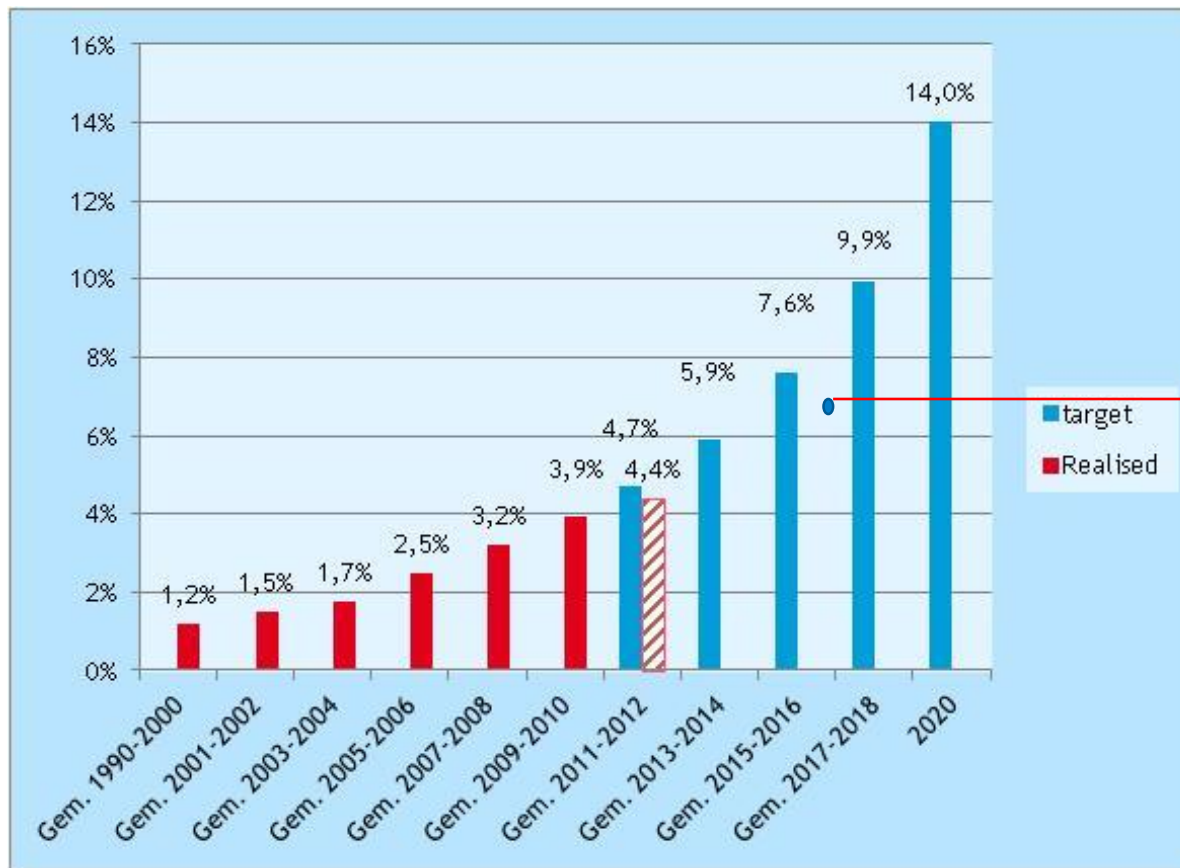
Role of Bioenergy – RTS to B2DS



Bioenergy to provide some 17% of cumulative carbon savings to 2060 in the 2DS and around 22% of additional cumulative reductions in the B2DS, including an important contribution from BECCS



Renewable Energy targets: RED: 2020: 14% in NL

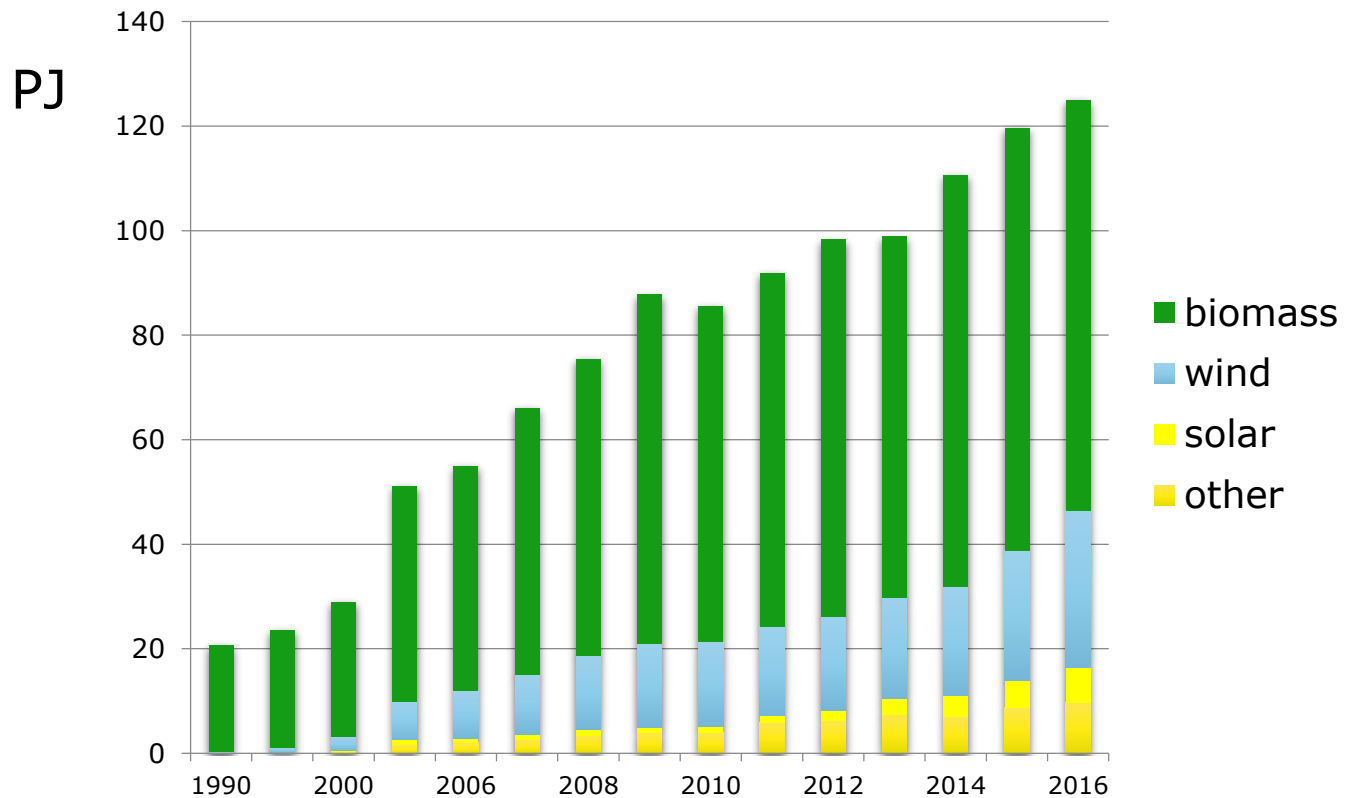


2017:
6,6 %



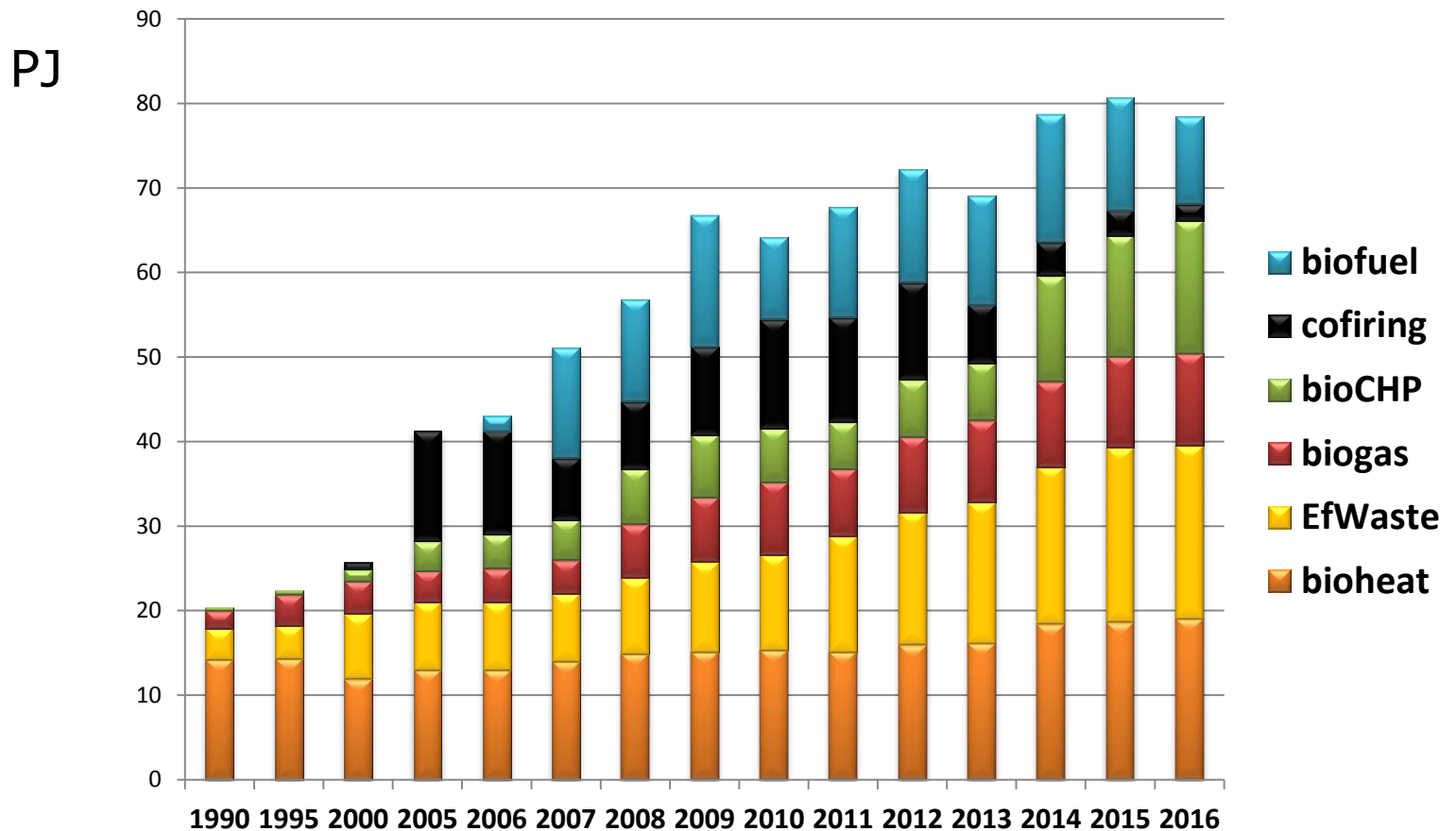
Renewable Energy: 2017: 6,6 %

About 70% realised with Bioenergy





Biomass for Bioenergy use in Netherlands





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Realisation of the Renewable Energy Directive obligation by the Energy Agreement (2013)





Indicative Contribution of R.E. opti



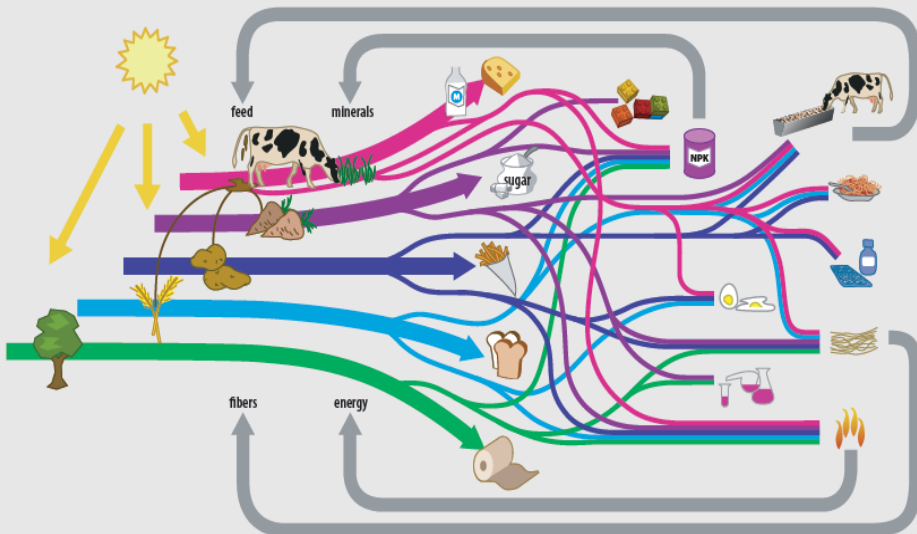
Source	2013	2020
Wind on sea	3,1	27,0
Wind on land	20,6	54,0
Solar PV	0,9	11,6
Biomass Cofiring	6,1	25,0
Waste Incineration	13,3	11,7
Biomass CHP	3,5	13,6
Biomass Heat	19,0	31,6
Biofuels	18,0	35,6
Renewable Heat	6,1	36,3
TOTAL	105,5	261,6
Percentage R.E.	4,4%	14%

For Biomass:
2013: 59,9
2020: 117,5

Doubling the amount of biomass



Research and Realisation of Biorefineries in the Circular Economy





National Research Approach

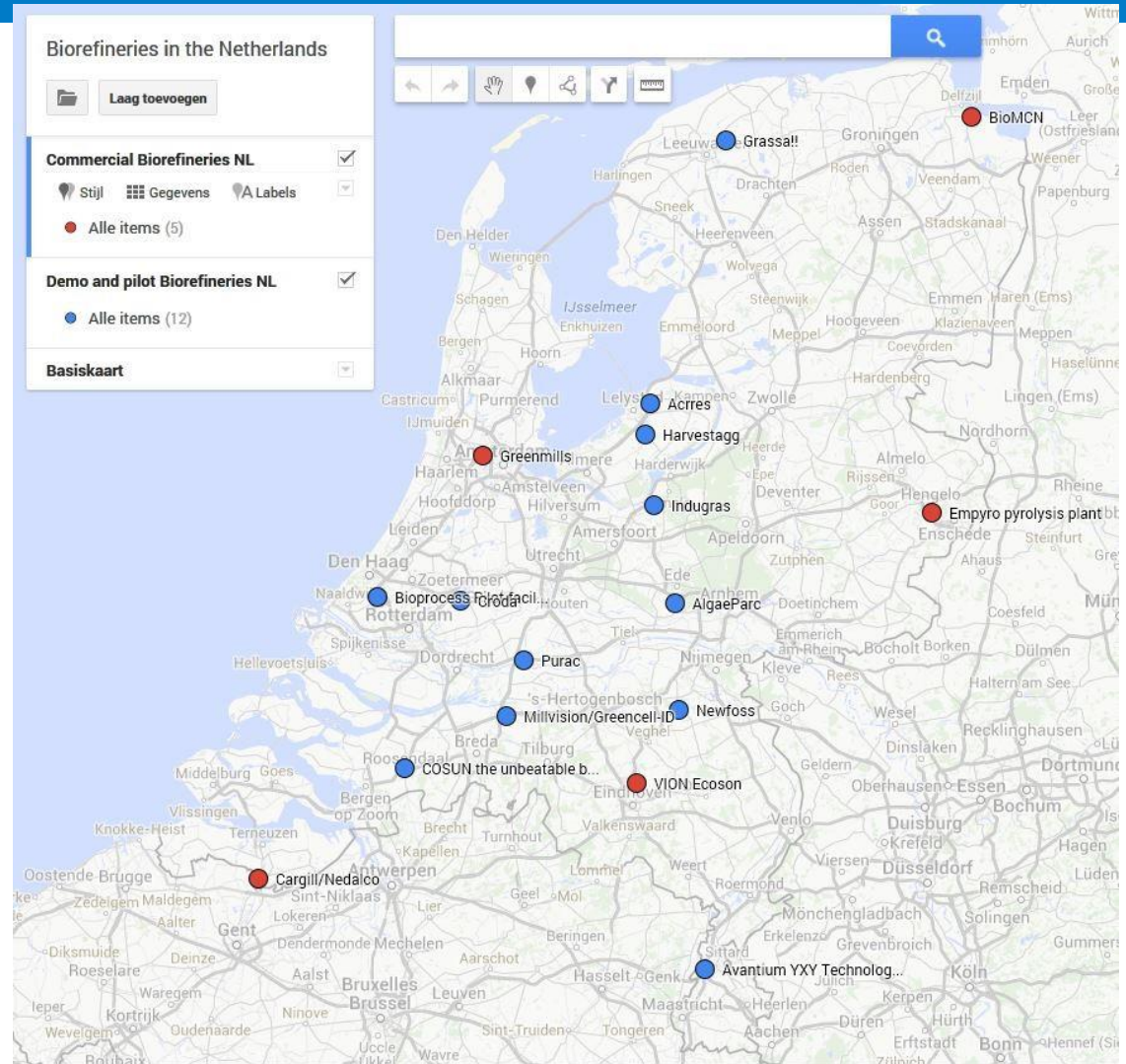
- Netherlands:
 - Topsector Approach
 - Biobased as a solution for Chemical Industry
 - > Strong Agricultural knowledge (Wageningen)
 - > Good Infrastructure (Rotterdam harbour)
 - > Collaboration Chemical/Energy/Agriculture/Waste sectors
 - Research agenda 2015 – 2027 published





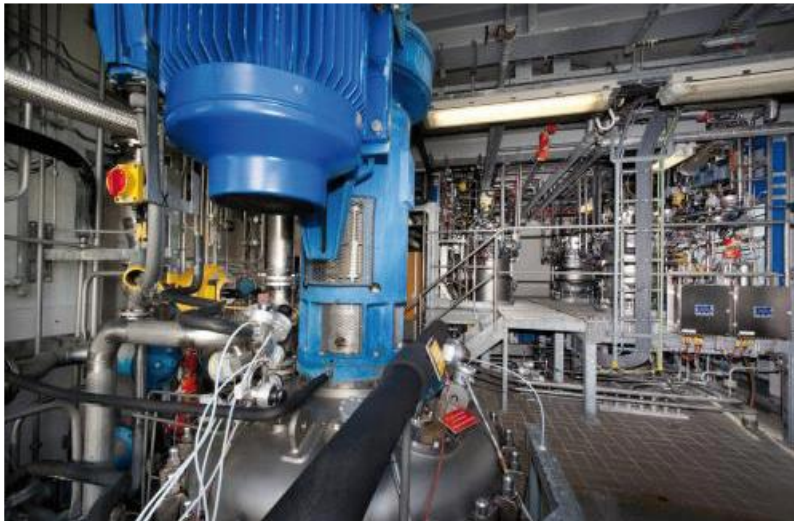
Bioefineries in NL

- commercial (red)
- demo & pilot (blue)



Bioprocess Pilot Facility (BPF)

- Open-access multipurpose facility
- State-of-the-art 5000 m² facility consisting of complex piloting equipment and supporting labs to investigate scale-up issues
- Modules/technologies: pre-treatment and hydrolysis, fermentation, downstream processing and food grade



<http://www.bpf.eu>

- Microalgae production & refinery platform for the production of proteins, lipids, carbohydrates and pigments
- Located in Wageningen
- Develop technology and processes to fractionate microalgae biomass
- Systems analysis
- Sustainability assessment





Green chemicals from solar (www.photanol.com)

- CO₂+light -> chemicals
 - Blue algae -> lactic acid
- Spinn-off Univ. AMS
- Collaboration AKZO
- Labscale -> pilot -> demo in greenhouse

Lessons:

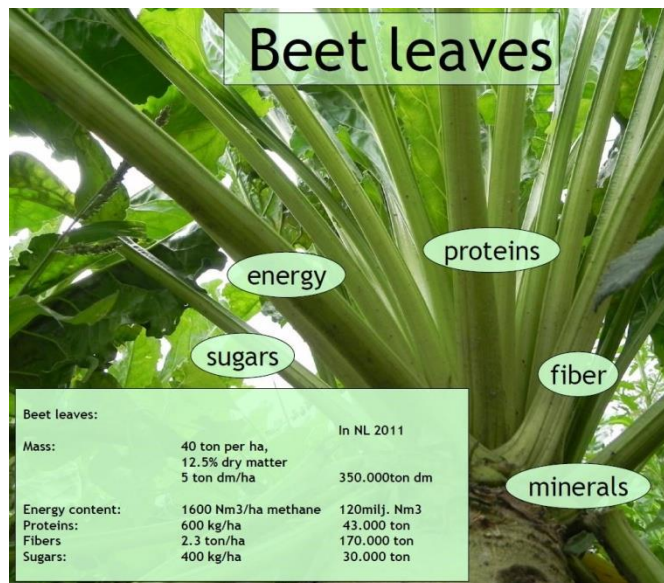
- Partnering for market entry
- Use existing infrastructure





COSUN the unbeatable beet

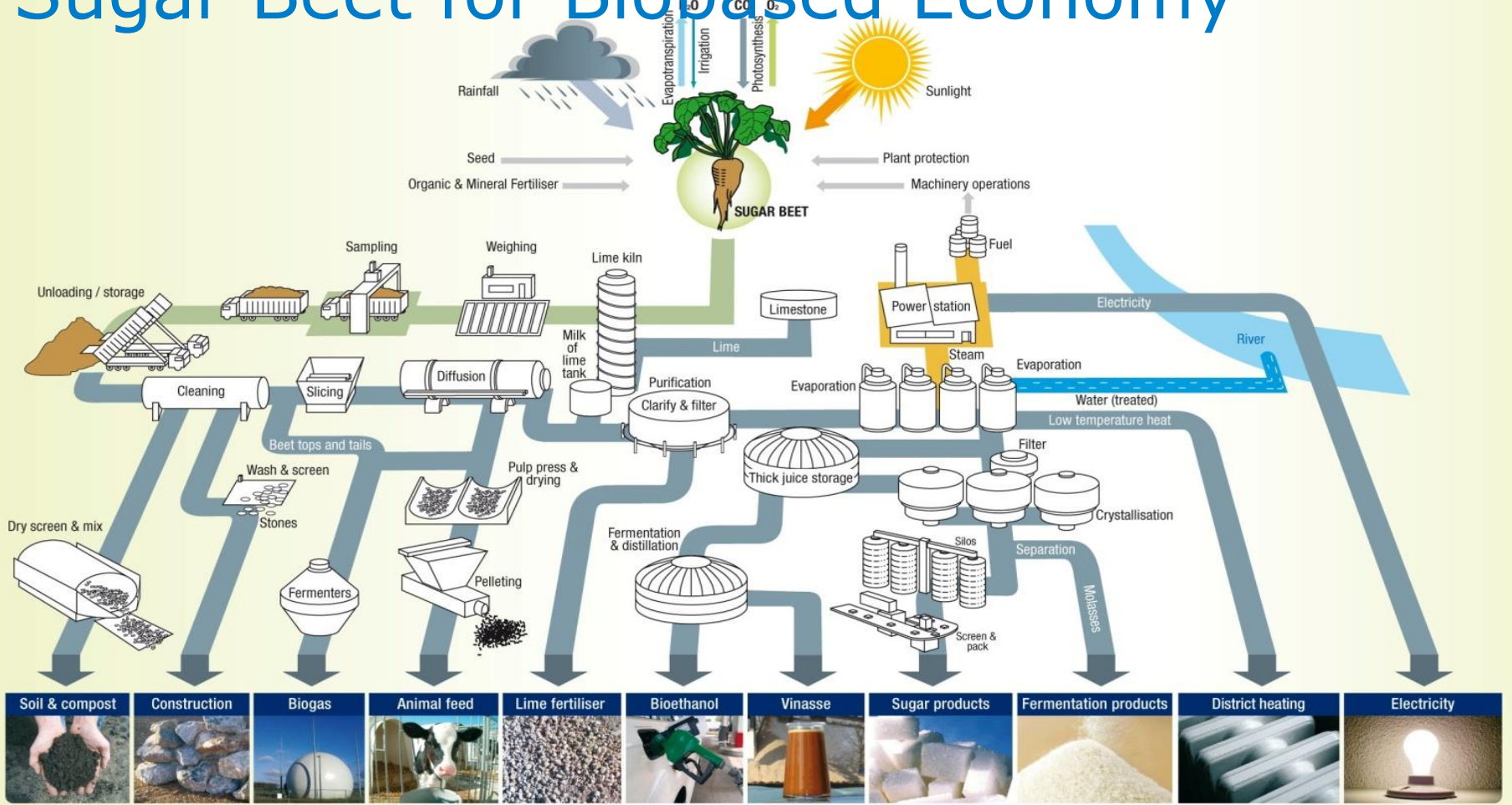
- Beet to food, feed, chemicals, materials and energy
- Cosun processes about 75,000 ha beet (22-25 tonnes d.m. per ha/year) into sugars and animal feed
- Within this pilot project they valorise the whole beet plant, i.e.: the beet, the leaves and the carrots



<http://www.cosun.com>



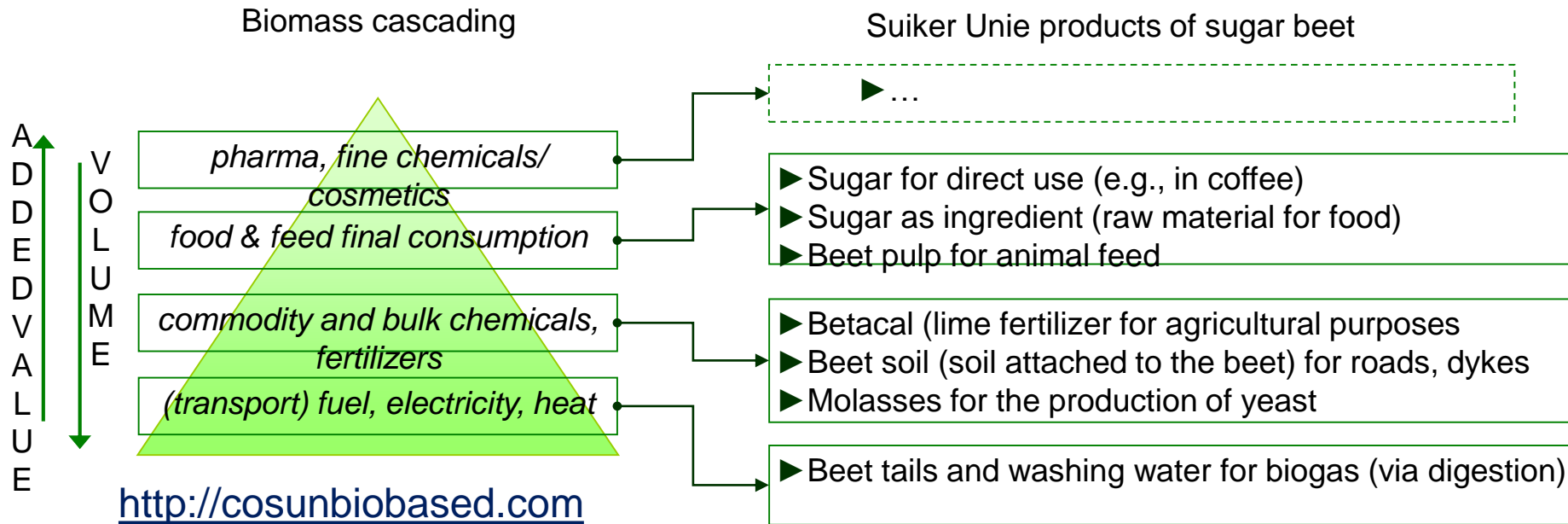
Sugar Beet for Biobased Economy



Source: CIBE and CEFS (after British Sugar)



Biomass Cascading and Valorisation



- Total concept, including a 50% increase in sugar beet yield per hectare, a 50% reduction in fertilizer use, and a 50% efficiency improvement in the sugar plant (all in about 20 years).
- Further optimization includes export of waste heat, and site utilization for renewable energy production (solar and wind).



Pyrolysis Empyro (www.btg-btl.com)

- **First Operational Plant in NL**

- Built in modules in Hengelo,
- operational since 2015

- **Phasing of applications**

- 1: burning ->
- 2: transportfuels ->
- 3: chemicals

- **Take off client:**

- 20 mln. liter/jaar, used by Friesland Campina Borculo for steam (supported by SDE+)





23 Dutch water authorities put wastewater to good use :

- **Increased Output:**
 - energy, biogas to power cars or electricity
 - raw materials ; phosphate, which is used to produce fertilizers.
- **Collaboration**
 - the water boards have set up a collaborative network organization called Energy & Raw Materials Factory (EFGF). <http://www.efgf.nl/english>
 - Joint Research programme with Universities



Products from waste water sludge

- Energy
- Fosphate
- Cellulose
- Bioplastics & Acids
- Alginate
- CO₂

• Movie:

- <https://www.youtube.com/watch?v=CT9lVE6wfIc>



Zambezi Process in a Nutshell



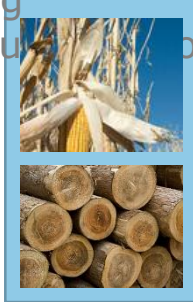
Improved Bergius-Rheinau process:

Two-stage, concentrated HCl hydrolysis

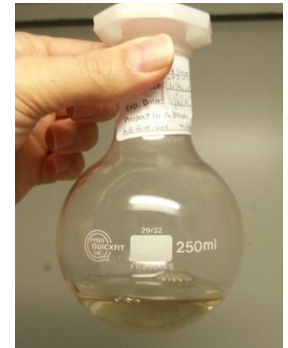
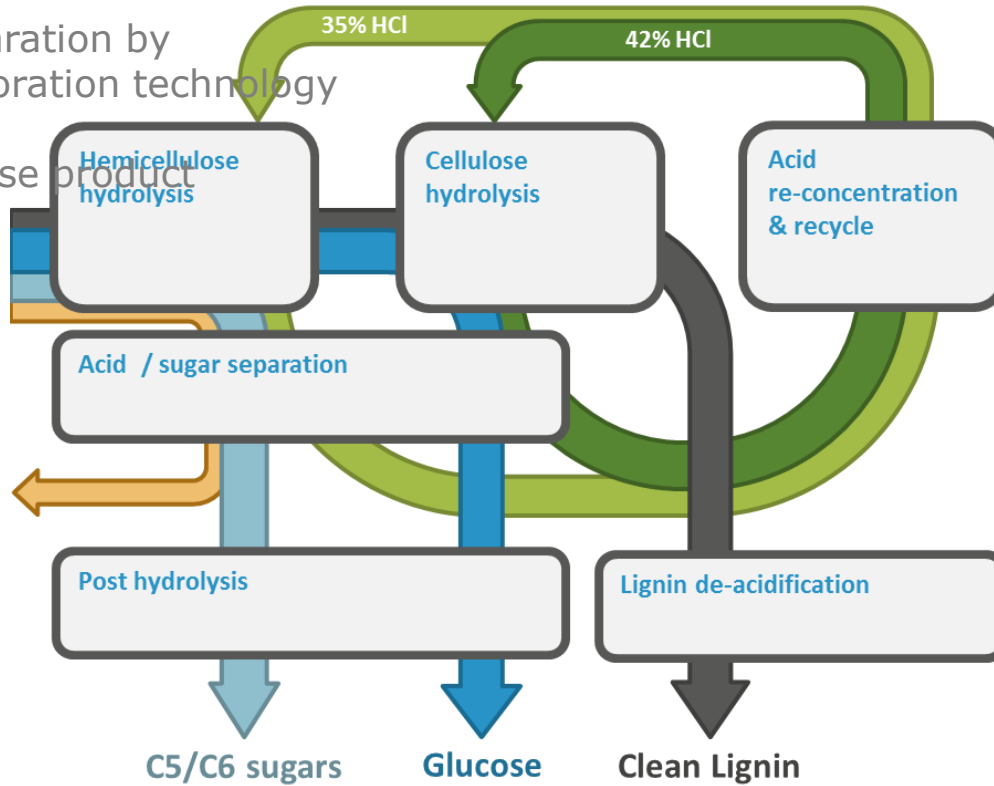
Acid / sugar separation by proprietary evaporation technology yielding

High purity glucose product

Feedstock Flexible



Tall oils & terpenes



■ Technical Breakthroughs

- Acid sugar separation
- Material construction
- Lignin deacidification



Intellectual Property captured through patent filings

Zambezi Project in Delfzijl



AkzoNobel



staatsbosbeheer



avantium



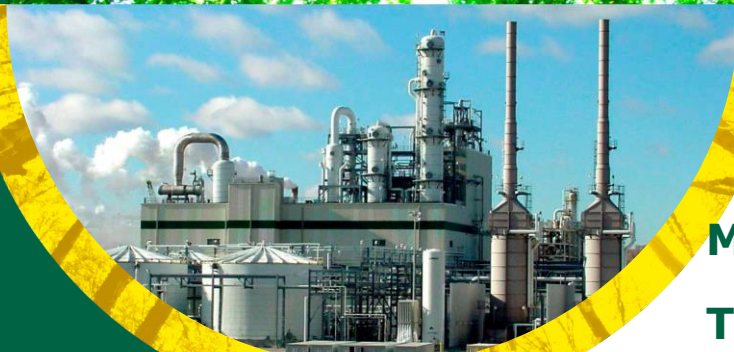
CHEMPORT
EUROPE



International Collaboration

IEA Bioenergy:

platform for international collaboration and information exchange in bioenergy research, technology development, demonstration, and policy analysis.



Mission:

To increase knowledge and understanding of bioenergy systems in order to facilitate the commercialisation and market deployment of environmentally sound, socially acceptable, and cost competitive bioenergy systems



Netherlands Enterprise Agency



*Thank you for
your attention*

Questions?

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