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Task42 Biorefining in a Future BioEconomy

Country Update The Netherlands

May 2019

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iea Energy Technology Network

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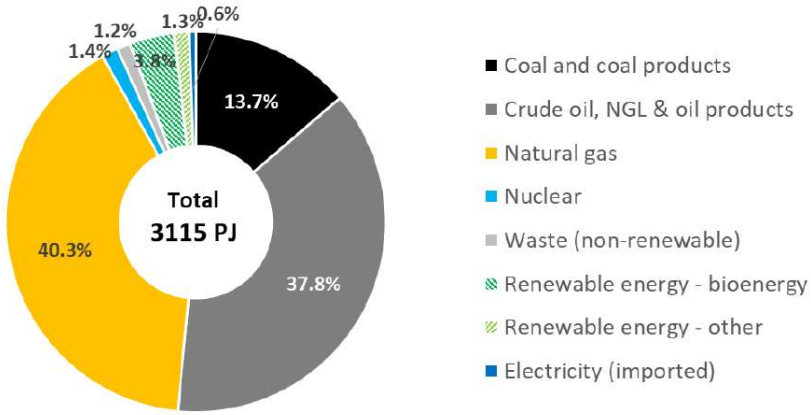
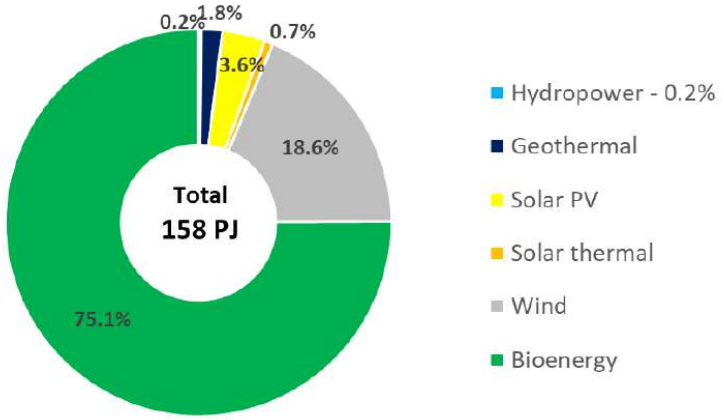
1. Total primary energy supply (TPES)

TPES in the Netherlands was 3,115 PJ in 2016 of which 5.1% (158 PJ) was renewable energy. The largest share of renewable energy is from bioenergy, accounting for 75.1% (119 PJ) of renewable energy. Wind power contributes 18.6%, solar 3.6% and others 2.7% of renewable energy

TPES in The Netherlands in 2016



TPES of renewable energy sources in The Netherlands in 2016



Source: World Energy Balances, OECD/IEA 2018

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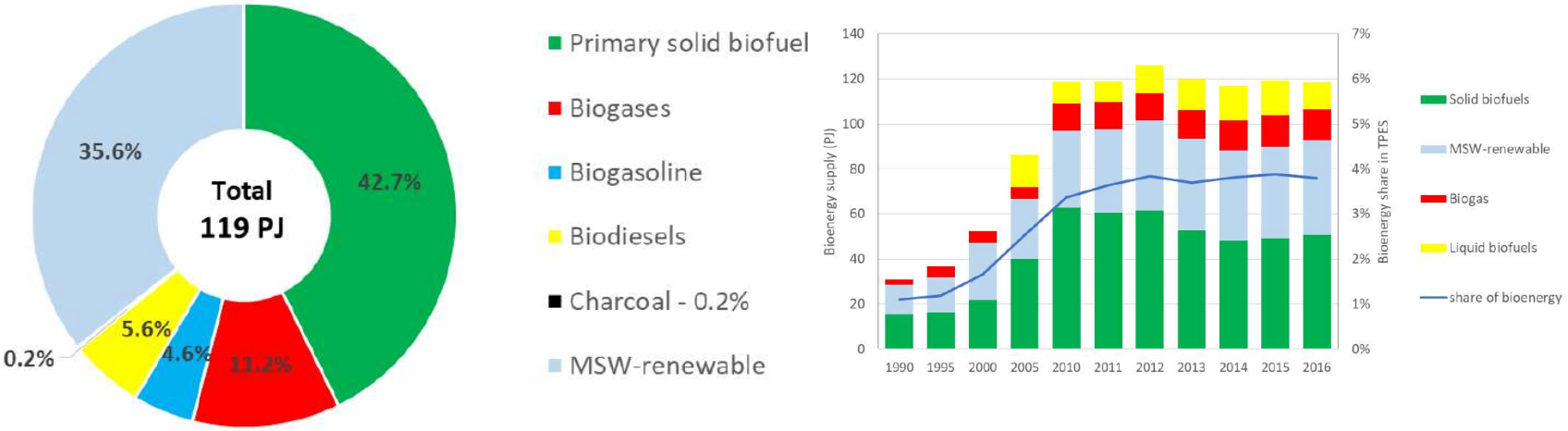
2. TPES from bioenergy and trend in evolution

Bioenergy supply in The Netherlands more than doubled between 2000 and 2010 with a high increase of solid biomass and biogas and the establishment of liquid biofuels on the market. Since 2010 the share of bioenergy has stabilized around 3.8% (119 PJ)



Source: World Energy Balances, OECD/IEA 2018

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2. Contribution of bioenergy in different sectors (2016)

The share of bioenergy is:

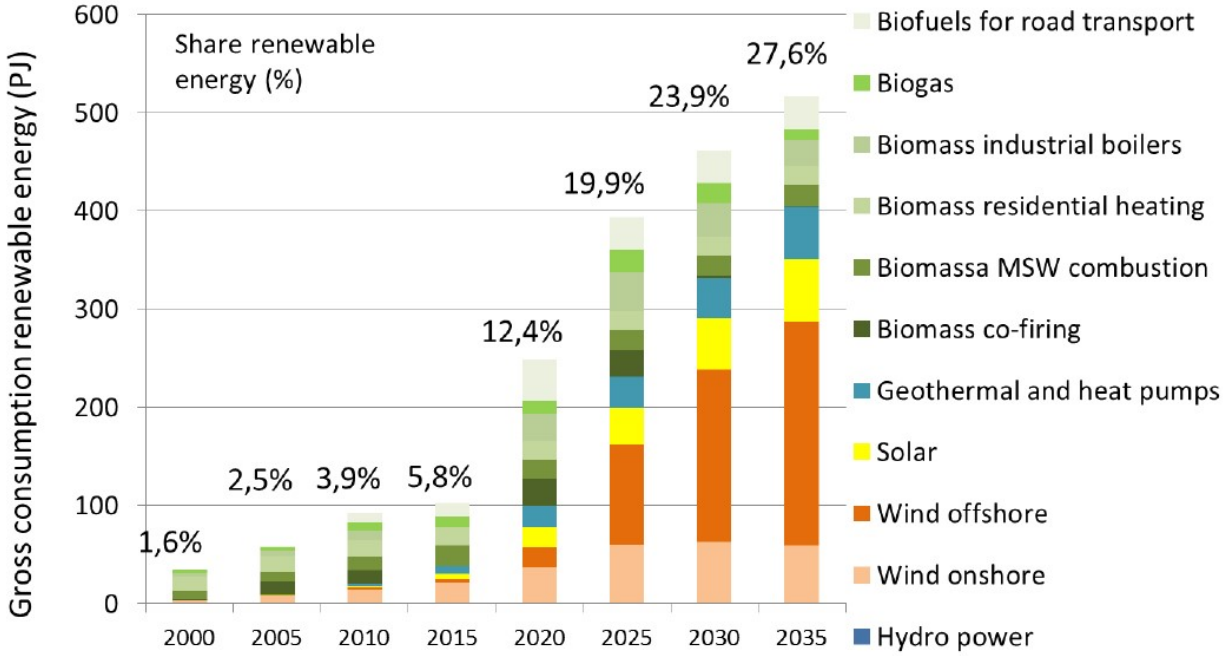
- 4.3% in electricity production (4.95 TWh or 17.8 PJ)
- 2.3% in transport energy (10 PJ)
- 4.7% in fuel and heat production (45 PJ)

Sector	Share of bioenergy	Share of renewable energy	Overall production/ consumption
Electricity production	4.3%	12.8% (7.1% wind)	115 TWh (415 PJ)
Transport energy (final consumption)	2.3%	2.5%	436 PJ
Overall fuel and heat consumption[11]	Direct biomass: 3.3% Biobased heat: 1.0%	4.7%	1,048 PJ

Source: World Energy Balances, OECD/IEA 2018

2. Future development renewable energy (incl. bioenergy)

The main increase expected in renewable energy consumption 2015-2035 is expected for offshore wind, onshore wind and solar. Bioenergy is expected to double till 2025 and to further increase to 2035



Source: Nationale Energieverkenningen, PBL, 2017

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3. Biomass use for non-energetic purposes

In 2015 use of biomass for materials was 6.8 million tonnes dry matter for wood & paper and 0.2 for oils & fats. The total use including bioenergy and biofuels 13.3.

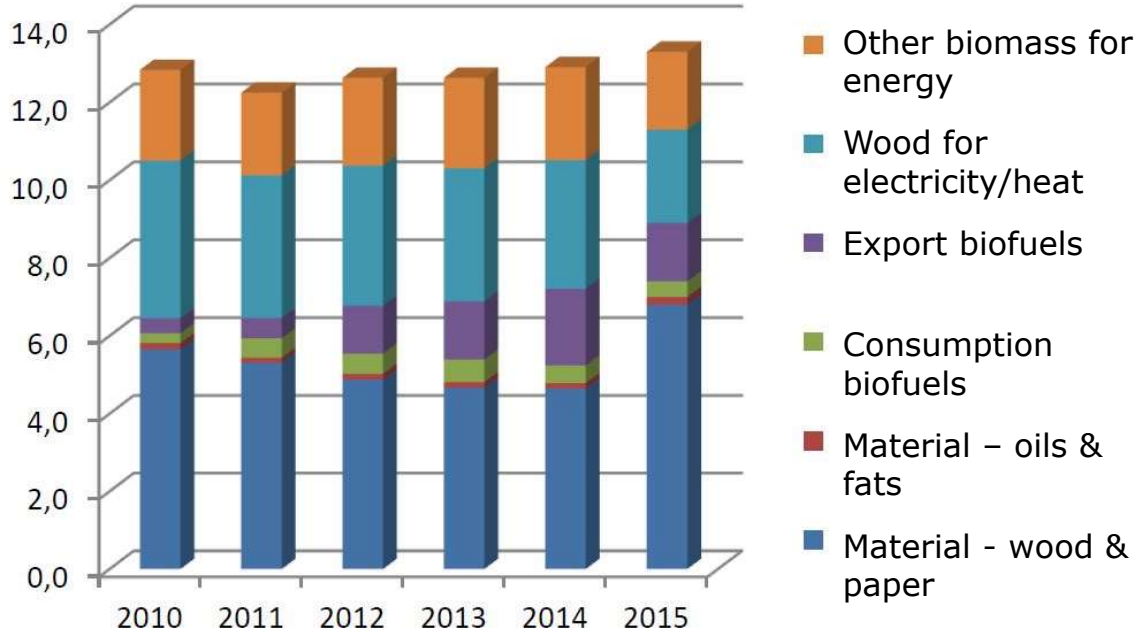

Figure: Biomass used in the biobased economy in NL in millions of tonnes dry matter.

Source: Kwant et al., 2018 & 2017

4. Bioenergy targets & policies (1)

- The Dutch energy policy aims to secure energy supply for the future and reduce emissions from the energy sector
- Future targets for renewable energy are governed by the Renewable Energy Directive (EU-RED, 2009/28/EC) which sets an obligatory target for renewable energy sources for the Netherlands at 14% share of final energy consumption by 2020

Sector	Expected share	Targets set in the RED and the NREAP
Overall target	14.5%	14.0%
Heating and cooling	8.7%	
Electricity	37%	
Transport[2]	16%	10%

Source: National Renewable Energy Action Plan (NREAP) of the Netherlands (2010)[3]

Source: Kwant et al., 2018

4. Bioenergy targets & policies (2)

- The European objective of 14% renewable energy in 2020 and the raised objective for 2023 of 16% in the Dutch Energy Agreement are the official targets
- In 2013 this Energy Agreement was established by different stakeholders (NGOs, government, industry) to agree on a pathway to realise the 14% Renewable Energy target in 2020 and 16% in 2023
- Important pillars of this agreement are doubling the energy efficiency, increased solar and wind energy (10 times more) and also doubling the share of bioenergy
- In 2017 the Dutch government has set a target of 49% GHG emission reduction in 2030
- In 2018 the Climate Agreement was concluded as a follow-up of the Energy Agreement

Source: Kwant et al., 2018

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4. Biomass 2030 – Strategic vision for implementation of biomass

The main message is that 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
- use an integral sustainability assessment framework
- innovation

www.rijksoverheid.nl/documenten/rapporten/2015/12/01/biomassa-2030

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4. The position of the bioeconomy in the Netherlands

Eight pillars are vital in the development of bioeconomy policy:

- using resources within the planetary boundaries
- reducing climate change
- production for people
- sustainable resource management
- a stable and predictable legal framework
- collaboratoin in the value chain
- long-term research and innovation agenda
- regional strategy and rural development

Ministry of Economic Affairs and Climate Policy

The position of the bioeconomy in the Netherlands

Source: Ministry of Economic Affairs and Climate Policy, 2018

5. Legislation

- In order to achieve these targets the Netherlands established a comprehensive legal and administrative framework nurturing deployment of renewables with a number of complementary financial, fiscal and promotional measures, like feed-in premium (SDE and SDE+), biofuels obligation, research support and green deals
- The Renewable Energy Directive (RED) has been implemented by the Dutch Decree on Energy in Transport
- In 2018, a limit to conventional biofuels and an obligation for advanced biofuels were introduced
- The law also prescribes that biofuels are only allowed to count towards the target in case these meet the sustainability criteria of Article 17 of the RED and provides the possibility of double-counting biofuels from waste and residues

Source: Kwant et al., 2018

5. Funding: SDE+

Netherlands Enterprise Agency

- The 'Stimuleringsregeling Duurzame Energieproductie' – SDE+ [Incentive Scheme for Sustainable Energy Production] initiates a new system of feed-in premium allocation subsidising renewable energy in the electricity, heat and gas sectors. It supports all different kinds of renewable energy
- Biomass suppliers and bioenergy producers who wish to receive a SDE+ subsidy, need to demonstrate that the biomass meets the legal sustainability requirements
- The SDE+ provides a feed-in premium (FIP) subsidy that covers the difference between wholesale market prices of electricity and the cost of electricity from renewable sources. The budget is made available in auctions where the lowest bidder is awarded an 8–15 year contract first

Source: Kwant et al., 2018

5. Funding: Topsector Energy (TSE)

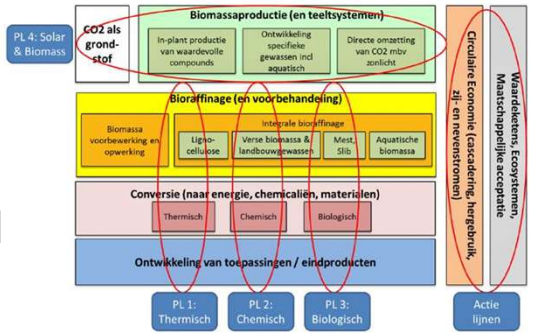
The Topsector Energy (TSE) is the driving force behind innovations that are necessary for the transition to an affordable, reliable and sustainable energy system

The transition paths from the energy agenda determine the priorities of the TSE

https://topsectorenergie.nl/en

5. Funding: TKI Biobased Economy

- In 2015 a new Research Agenda for the Biobased Economy was produced by the Top Consortium for Knowledge and Innovation BioBased Economy: TKI-BBE. The TKI-BBE operates within the Top sector Chemistry and Top sector Energy
- Besides energy, biomass streams can also be used for materials. By separating biomass into fractions, and by valorisation of the molecular capital, financial gains are enhanced, and at the same time the use of fossil fuels in the chemical sector is reduced
- The TKI BBE stimulates the development of this bio-cascading
- The Research Agenda is being developed via existing programme lines of the TKI BBE.
  These programme lines are:
  i) thermal conversion from biomass;
  ii) chemical catalytic conversion technologies;
  iii) biotechnological conversion technologies and
  iv) solar capturing (and biomass production)



https://topsectorenergie.nl/tki-biobased-economy

5. Funding: MIT Innovation Credit for SMEs

MIT Innovation Credit for SMEs stimulates innovation at small and medium sized enterprises. Furthermore, MIT stimulates that SME projects connect to the innovation agendas of the Topsectors

Netherlands Enterprise Agency

Subsidies given for:

- advisory projects
- feasibility projects
- R&D-cooperation projects
- knowledge vouchers

Source: Netherlands Enterprise Agency, 2019

6. Commercial biorefinery facilities

6. Commercial biorefineries

- Alco Energy Rotterdam Biorefinery: conventional ethanol + ...
- BioMCN: glycerine to methanol + ...
- Cargil Biorefinery Sas van Gent: residues to ethanol + ...
- Empyro pyrolysis plant: pyrolysis oil to heat + ...
- Greenmills anaerobic composting plant: biogas-based BR
- Musim Mas Europe glycerine refinery Farmsum: glycerine ref.
- Neste Biorefinery Rotterdam: oleochemical BR (HVO etc.)
- VION Ecoson: animal waste to biogas, biediesel + ...

Descriptions see Dutch Country Report early 2019

Recent News

Published on *chemanager-online.com* (https://www.chemanager-online.com)

06.03.2019

Shell Joins Dutch Waste-to-Chemicals Project

Shell has joined a consortium that comprises Air Liquide, Nouryon (formerly AkzoNobel Specialty Chemicals), Enerkem and the Port of Rotterdam to construct Europe's first waste-to-chemicals (W2C) plant at Botlek in the Netherlands.

The Dutch energy and chemicals company will become an equal equity partner in the W2C project, which will convert up to 360,000 t/y of non-recyclable waste, including plastics, into 220,000 t/y of bio-methanol.

Inv Dec 2019

The companies have not yet revealed a start-up date for the plant, which will have two production lines and use Enerkem's proprietary technology. Air Liquide will supply the necessary oxygen with Nouryon providing hydrogen. Both Nouryon and Shell intend to purchase the bio-methanol output.

The project is expected to help the Netherlands realize its ambition to become virtually carbon neutral by 2050.

Recent News

Avantium has decided to locate the new MEG demonstration plant for its Mekong technology in Chemie Park Delfzijl, the Netherlands. The plant will be located near Avantium's Dawn Technology™ pilot biorefinery, which produces glucose and lignin from non-food biomass.

- The construction of the demonstration plant – with a capacity of around 10 tons of plant-based monoethylene glycol (bio-MEG) (-> plastics/textiles) – is on track, with the opening scheduled for the second half of 2019.
- €2 million grant from the European Regional Development Fund (ERDF).

Recent News

Green Fuel Nordic from Finland will invest € 100 million in Dutch pyrolysis technology that can be used to extract oil from sawdust from Scandinavian sawmills.

- One factory purchased for 25 MEuro, but three more expected in near future
- Technology from BTG-BTL (developed at UT)
- Prefab factories will be build in the NL; assembled in FIN
- Zeton: manufactoring core unit factory

7. Regional initiatives

- Biobased Delta: SW NL = Biorizon + Sugar Delta + Redefinery
- Dutch Biorefinery Cluster (DBC): NE NL = coop agrofood/paper companies for open innovation
- Port of Amsterdam: BM Hub & + residues for energy, fuels & products
- Rotterdam Bio Port: Gateway Biobased Economy for EU

Descriptions see Dutch Country Report early 2019

Recent News

The biobased economy in the north is about to benefit from a number of brand-new innovation facilities - the Innovation Hall of the Zernike Advanced Processing Facility (ZAP) and the Avebe Innovation Centre that includes Innolab Agrifood.

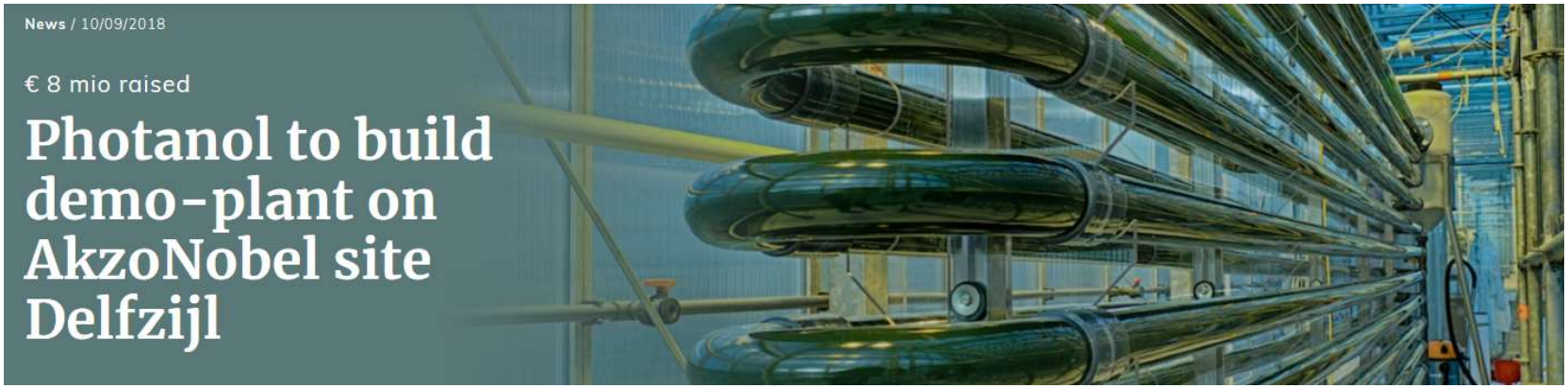
On the 10th of October 2018 the Innovation Hall was be opened officially. The facility provides businesses with around 100m3 of space for pilot-scale testing – scaling up from grams to kilos – of biomass processes that were developed in the lab.
BioBTX is one of those businesses, and it commissioned a new pilot plant for extracting chemical building blocks from liquid biomass and recycled plastics in the Innovation Hall.

8. Demo and pilot plants

- ACRRES National centre for applied research on renewable energy and green resources Lelystad
- Algae PARC Wageningen
- Biobased Products Innovation Plant Wageningen
- Bio-BTX pilot plant
- Bio-MEG plant
- Bioprocess Pilot Facility Delft
- Grassa!
- Indugras - TNO
- Millvision – Greencell-ID
- NewFoss
- Zambezi process reference plant
- Zernike Advanced Processing Facility

Descriptions see Dutch Country Report early 2019

Recent News



Photanol raised € 8 million from shareholders to build a demonstration plant in Delfzijl for the production of chemicals from CO2 and sunlight. The plant will be located on the site of Photanol partner AkzoNobel Specialty Chemicals and must be operational by 2020.

Photanol uses modified cyanobacteria to produce chemicals from CO2 via photosynthesis. The demo-plant is an essential step towards scaling up the production of organic acids that can be used in biodegradable plastics, personal care products and as intermediates for the chemical industry.

In addition to the existing shareholders, UvA Ventures Holding and Icos Capital, there are three new parties investing in the demo-plant: GROEIfonds, Innovatiefonds Noord-Nederland and Investeringsfonds Groningen.

9. Major innovation activities

- Bioasphalt made of lignine
- Biobased Performance Materials: HQ materials from BM
- Biorizon: Bioaromatics
- CatchBio R&D programme: catalysist for biomass val.
- Scaling up lignin crude to CLO for shipping
- Small-scale biorefining
- TKI BBE Biorefinery Projects
- EU biorefinery projects with Dutch input: MacroCascade, Pulp2Value, Drive4U, URBIOFIN, BRISK2, LignoCOST, BioForever, ...

Descriptions see Dutch Country Report early 2019

10. Major stakeholders

- Industry & SMEs
- Research Institutes
- Universities
- Governmental organizations
- Non-governmental organizations
- Financial organizations & others

Specification see Dutch Country Report early 2019

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