

IEA BIOENERGY

Task 42 Biorefinery

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Biorefinery Status 2009 The Netherlands

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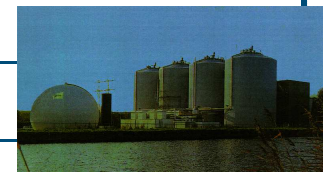
0. National Energy-related Policy Goals

Policy goals:

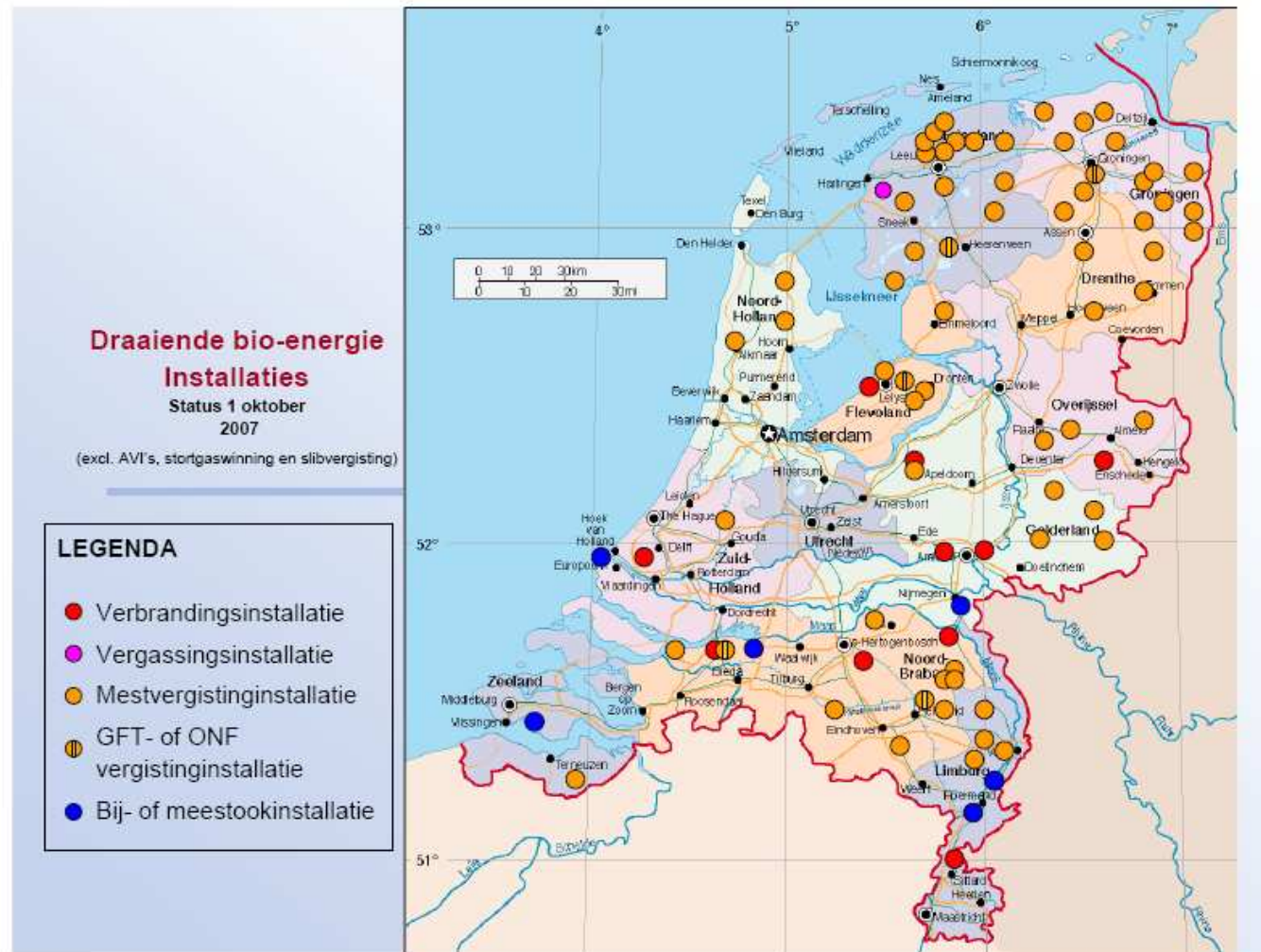
- 9% renewable power production in 2010**
- 20% renewable energy in 2020 (10% in 2010)**
- Biofuels for transport: EC goals**

1. Current Biomass Use for Energy in the NL (1)

	2007 [PJ_{affu}]	2010 Policy goals [PJ_{affu}]
Large scale		
Cofiring power plants	14.80 (33%)	34
Domestic waste combustion facilities	12.65 (28%)	20
Concrete furnaces	1.70 (4%)	-
Small scale		
Combustion (gasification) CHP	2.95 (7%)	8-18
Combustion heat	7.70 (17%)	7
Landfilling	1.44 (3%)	2
Digestion	3.72 (8%)	4-6
Total	44.96 (100%)	75-87



1. Current Biomass Use for Energy in the NL (2)



2. LT (2030) Vision Dutch Energy Transition (1)

30% fossil fuel use substitution by bio-based alternatives both for energetic (power, heat, CHP) and non-energetic (chemicals, materials) applications

Assumed overall energy use: 3000 PJ_{th} (comparable to 2000)

850 PJ_{th, affu} will require about 1200 PJ_{th} raw biomass or 80 Mt d.b. a year

Projection Dutch biomass availability in 2030:

6 Mt d.b. primary byproducts/residues (100 PJth)

12 Mt d.b. secondary byproducts (200 PJth)

0-9 Mt d.b. energy crops (0-150 PJth)

? Aquaric biomass

About half of the BM required has to be imported !

2. LT (2030) Vision Dutch Energy Transition (2)

Application	FF substitution [%]	[PJ _{th, affu}]	CO ₂ -em.red. [Mt/a]
Biofuels for transport	60 (very ambitious)	324	24
Chemicals, materials	25 (R&D ->)	140	11
Power	25 (full plant substitution necessary)	203	14
Heat	17 (mainly SNG)	185	10

Application in different market sectors required

Biorefinery ?

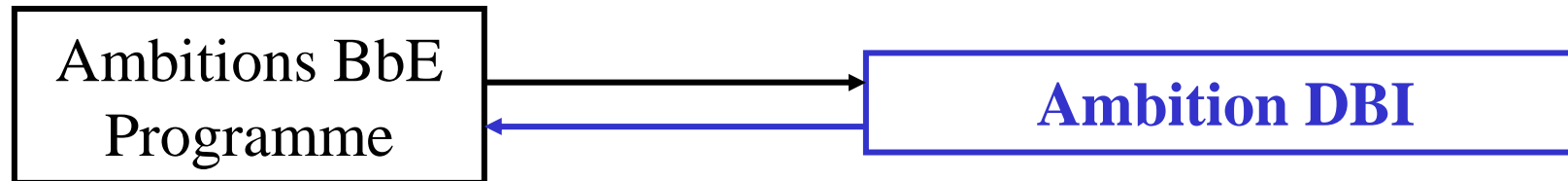
3. Dutch Biorefinery Initiative (DBI)

A coherent national Biorefinery Research, Development and Demonstration (RD&D) Programme within a European framework

Summary

- 7 year (2009-2015) market orientated RD&D Programme
- Framework: specific Dutch biorefinery strengths (“Moonshots”)
- Demonstration Support, Applied Research and Fundamental Research
- Stakeholders involved: industry, KIS (institutes and universities), GOs, NGOs, others; initiators: WUR and ECN

3.1 DBI Starting Points



- 25% value EU BbPs through NL in 2025
- 30% fossil resources substitution in NL for both sustainable non-energetic and energetic applications in 2030

To Develop and Demonstrate Sustainable Biorefinery Chains for Bio-based Products and Bio-energy to feed the Dutch and European BbE

3.2 Biorefinery Definition

Biorefining is the sustainable processing of biomass into a spectrum of marketable Bio-based Products (food, feed, materials, chemicals) and Energy (biofuels, power and/or heat)
[IEA Bioenergy Task 42]

**Very broad area -> focus for NL necessary ->
selection based on SWOT
-> Vision DBI**

3.3 Results SWOT Analysis – Biorefinery for the NL

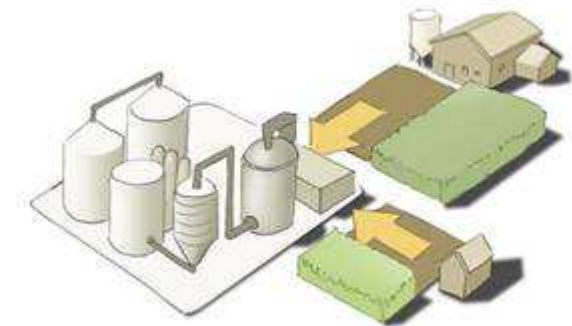
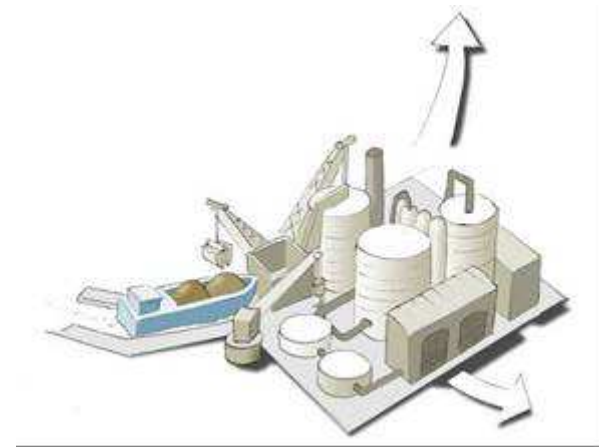
The SWOT-analysis was performed in 2007 together with a variety of (industrial) stakeholders within the Biorefinery.nl framework.

Specific strengths for the Netherlands

- Advantageous geographical position in the European market (NL as port of Europe)
- Available logistical infrastructure (harbours) already used to handle large raw material fluxes (incl. biomass)
- Strong economic agro-food/feed, chemical and energy sectors situated relatively close to each other
- Biorefinery is already relatively well developed in the food sector
- Strong Bio-based Knowledge Infrastructure (universities and institutes)
- Strong in White biotechnology, Catalysis, Machine building and Plant Breeding

3.4 Biorefinery Moonshots (1)

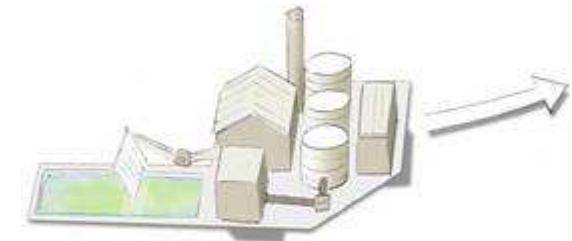
1. **Large-scale Biorefinery of imported biomass** and biomass-derived intermediates at Dutch harbour sites (making use of the existing logistical and chemical strengths). Examples: Bioports R'dam, Eems, Terneuzen,
2. **Small/Medium-scale Biorefinery of specific Dutch crops** (making use of the existing agro-, chemical and plant breeding strengths) Examples: beets, grass, maize,



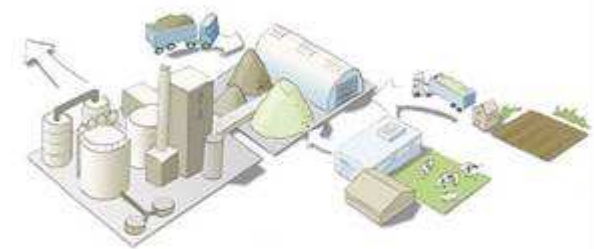
3.4 Biorefinery Moonshots (2)

3. Biorefinery of aquatic biomass

(making use of the specific Dutch expertise on algae production and process development) Examples: WUR-initiatives, Akzo Nobel initiative,



4. Biorefinery based on the valorisation of waste streams – multi-industrial and intersectoral approach (making use of the strong economic agro-food/feed, chemical and energy industries situated relatively close to each other) Examples: Biorefinery Cluster North NL,



White Biotechnology for non-food applications is part of all Moonshots shown.

3.5 DBI Vision 2015 and Beyond



**Development ,
Demonstration
and
Implementation
of
Sustainable
Biorefinery
Chains for
Bio-based
Products
and
Bio-energy
to feed the
Dutch
and
European
BbE**

3.6 DBI Pilots / Demos

Moonshots

Support of pilots/demos specified by stakeholder consortia within the Vision framework (potential examples)

- M1.1) Thermo-chemical Biorefinery (syngas platform)
- M1.2) Valorization of biofuel residues
- M2.1) Whole Crop (Sugar Beet) Biorefinery
- M2.2) Green (Grass) Biorefinery
- M3.1) Micro Algae Biorefinery
- M3.2) Macro Algae (Seaweeds) Biorefinery
- M4.1) Food Residues (undefined streams) Biorefinery
- M4.2) Crop Residues (defined streams) Biorefinery
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3.6 DBI RD&D Programme

Moonshots

Common thematic framework for both applied and fundamental research

- 1. Valorisation of residues, (new non-food) crops, and aquatic biomass**
- 2. Pre-treatment & primary refinery**
- 3. Secondary (bio)chemical & thermochemical refinery**
- 4. Full technical, logistical, socio-economic and ecological chain aspects**
- 5. Transition aspects**

3.7 Stakeholders (1)

Initiators: WUR & ECN

Participants:

- Industry: members consortia market initiatives “Moonshots” (pilots/demos) and a variety of other industrial stakeholders (see next slide)
- KIS: - institutes: WUR, ECN
- universities: WUR, TUD, RUG, UT
- GOs: ministries (LNV, EZ, VROM), SenterNovem, Staatsbosbeheer,
- NGOs: WWF, Natuur & Milieu,
- Others: Roland Berger, LTO, branche organisations,

3.7 Stakeholders (2)

Industrial stakeholders that have shown interest in a national RD&D initiative on Biorefinery - no official commitment yet

Port of Rotterdam	Arizona Chemical	Courage	“Corus”
DOW Benelux	Avebe	Argos Oil	KCPK/VNP/Bumaga
Akzo	Cosun	Ten Kate Vetten	Groningen Seaports
NOM	ADM	Van Ganzewinkel	Shell
Akzo	Agrologistiek	Ingrepo	Bayer
Aker Kvaerner	Beethanol	DSM	Biofuel B.V.
Eneco	CCL/Cehave	Sabic Europe	Grontmij
Meneba	BASF	Essent	Deltalinqs
Avantium	HVC Alkmaar	Unilever	Purac
Albermarle	Rosendaal Bioenergy	Cargill	BIOeCON

3.8 Knowledge Import and Dissemination

National knowledge dissemination platform:

- Dutch Knowledge Network on Biorefinery (WUR/ECN)

www.Biorefinery.nl

European knowledge import and dissemination platforms:

- EC Technology Platforms (a.o. Suschem TP, Biofuels TP, Forest-based TP), EC-projects (variety)

International knowledge import and dissemination platform:

- IEA Bioenergy Task 42 “Biorefinery” (WUR/Avantium)

3.9 DBI Timeframe

Dutch Biorefinery Initiative (DBI) and relation to Biorefinery Roadmap

