



INDUSTRIAL BIOTECHNOLOGY IN THE NETHERLANDS

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¹ Please send your contributions and modifications to [a.peeters\[at\]europabio.org](mailto:a.peeters@europabio.org)

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INTRODUCTION

For more than 100 years the Netherlands have had a strong position in fermentation technology (food, cheese, beer, yeast). The chemical and agricultural sectors, two important pillars of the Dutch economy, have growth potential. The Dutch agricultural sector has a good reputation in the field of processing and producing starch, sugar and lactic acid. Furthermore, a small number of Dutch chemical companies are manufacturing biopolymers and biobased chemicals for niche markets. Initiatives for the large-scale manufacture of biofuels and bio-refining are still either in the preparatory or research stage. Nevertheless, the Netherlands does hold a prominent position in terms of knowledge in the field of cultivation technologies and industrial biotechnology.²³

² www.kluyvercentre.nl/content/documents/BIOForumEuropejuli2005.pdf

³ www.twanetwerk.nl/upl_documents/TWABio_Based_eng.pdf

I. RESEARCH AND INNOVATION

A. Public research funding

The Netherlands Organisation for Scientific Research (NWO⁴) is member as partner of the European Network Area on Industrial biotechnology (**ERA-net IB**)⁵.

IBOS - Integration of Biosynthesis and Organic Synthesis⁶. This programme from NWO-ACTS runs from 2003 to 2010 with a budget of € 13,6 million (€ 2,27 million from NWO General Board € and 2,27 million from NWO Chemical Sciences), Ministry of Economic Affairs (€ 4,54 million), chemical and life sciences industry (€ 4,54 million).

It aims at a change of strategy in synthetic chemistry by integrating state of the art organic chemistry and modern biochemistry and biotechnology. This will enable a new and sustainable future for more efficient industrial synthesis of ever more complex products, hand in hand with a drastic reduction of waste products.

B-Basic - Bio-based Sustainable Industrial Chemistry⁷. The B-Basic programme from NWO-ACTS runs from 2004 to 2010 with a total budget of € 50 million (basic subsidy of the Ministry of Economic Affairs (€ 25 million), industrial B-Basic partners (€ 12 million) and participating universities and research institutes (€ 13 million). Research focuses on 4 multidisciplinary themes: bulk chemicals, fine chemicals, performance materials and novel feedstocks. In addition B-Basic contains a Life Science & Technology Training Centre and a clear focus on innovation via workshops and an annual Innovation Trophy. B-Basic aims to provide the chemical industry with an advanced set of tools and concepts by approaching bioBio-based sustainable industrial chemistry Sustainable Industrial Chemistry in a fully integrated manner, combining functional genomics, intensified bioprocess technology and feedstock scenarios.

B-Basic is a consortium of Delft University of Technology, the University of Groningen, Leiden University, Wageningen University and Research Centre, TNO, Agrotechnology & Food Sciences Group, DSM, AkzoNobel, Shell Global Solutions, Paques and Schering-Plough.

STW Open Technology Programme⁸ is open to proposals from any field of applied research and aims to enhance the utilisation of research results. Research proposals can be submitted on an on-going basis.

Kluyver Centre for Genomics of Industrial Fermentation⁹. This Programme initiated by the Netherlands Genomics Initiative¹⁰ has started in 2002. Since 2008 a second 5 years subsidy round has began. The annual turnover of the Kluyver Centre is €10 million with up to one third from industry and two third from governmental sources and knowledge institutes. The research covers five programmes: yeast for chemicals, fuels and beverages, Filamentous fungi for protein and peptides; lactic acid bacteria for fermented foods and food ingredients; systems biology of industrial micro-organisms and industrial genomics for society. The Kluyver Centre aims to enable breakthrough innovations in industrial biotechnology that are required for addressing sustainability, quality of life and the economy. To this end, it applies existing and novel genomics technology for high-quality, precompetitive and focused research on three key groups of industrial micro-organisms: yeast, fungi, and lactic acid bacteria.

The Kluyver Centre is a consortium comprised of Delft University of Technology, the universities of Groningen, Leiden and Utrecht, Wageningen University, VU University Amsterdam, NIZO food

⁴ <http://www.nwo.nl/>

⁵ <http://www.era-ib.net>

⁶ http://www.nwo.nl/nwohome.nsf/pages/NWOA_6NSGQQ_Eng

⁷ <http://www.b-basic.nl/>

⁸ <http://www.stw.nl>

⁹ <http://www.kluyvercentre.nl/>

¹⁰ <http://www.genomics.nl>

research and TI Food and Nutrition. Current industrial partners are: Applikon Biotechnology, CSK Food Enrichment, Danone, DSM, Friesland Foods, Heineken, Nestlé, Purac, and Tate & Lyle.

Innovational Research Incentives Scheme¹¹. The aim of the Innovational Research Incentives is to promote innovation in the academic research field. Industrial Biotechnology research ideas can flourish within this funding.

CatchBio - Catalysis for Sustainable Chemicals from Biomass¹² initiates a research programme of 8 years (it started in 2007) in the field of catalytic biomass conversion. It aims to process the various components present in biomass (cellulose, hemi-cellulose, lignin, proteins and oils) in useful fuels, chemicals and pharmaceuticals. Also the socio-economical and ethical aspects will be investigated.

CatchBio is a collaborative programme of Universities and Industry with a total budget of € 29 million of which € 15 million is a subsidy provided by the Ministry of Economic Affairs.

Horizon - The Horizon programme¹³ is set up as a breeding ground for talented researchers active in genomics and/or bioinformatics. It aims to promote and coordinate outstanding and visionary fundamental research by offering researchers the freedom to realize their ideas and concepts beyond existing disciplines. The research supported by the Horizon programme is future-oriented. Researchers are given the opportunity to respond rapidly to new hypotheses or technologies. In addition, the Horizon programme seeks to achieve valorisation of the results obtained in the research projects. Project leaders are therefore expected to adopt an active attitude towards valorisation.

B. Pilot and demonstration plants

i. pilot plants

Most laboratories, bench and pilot-scale facilities available in the universities and institutes are more or less open-to-all facilities; those available in private enterprises are mostly closed facilities.

Regarding funding, the open-to-all pilot facilities are mostly financed by both national and European grants, together with financial contributions from participating stakeholders (private enterprises, institutes, universities). The closed facilities are often financed by private enterprises alone, though some receive national and European subsidies.

a) Open to all

Delft

Technical University Delft (TUD)	
General, products, feedstocks	
Services	White biotechnology facilities, product separation facilities
Financing	
Contact	http://www.bt.tudelft.nl/live/pagina.jsp?id=57b749a1-b9e1-4f0a-ac27-514b9a07d13a&lang=en

Delft

¹¹ http://www.nwo.nl/subsidiewijzer.nsf/pages/NWOA_4YJDQ3_Eng

¹² <http://www.catchbio.com>

¹³ <http://www.genomics.nl/Talent/Horizon.aspx>

TNO, Delft	
General, products, feedstocks	
Services	Hydro-Thermal-Upgrading (HTU) of relatively wet biomass to “biocrude”
Financing	
Contact	http://www.tno.nl/content.cfm?&context=markten&content=product&laag1=190&laag2=224&item_id=351&Taal=2

Eindhoven

Technical University Eindhoven (TUE)	
General, products, feedstocks	
Services	Vegetable oil production and upgrading, thermo-chemical biomass conversion
Financing	
Contact	http://w3.wtb.tue.nl

Groningen

Groningen University (RUG)	
General, products, feedstocks	
Services	Catalytic synthesis processes...
Financing	
Contact	http://www.rug.nl/gbb/index

Petten

Energy research Centre of the Netherlands (ECN), Petten	
General, products, feedstocks	
Services	A variety of pilot-facilities within the following areas: biomass pre-treatment, combustion, pyrolysis, (staged) gasification, gas clean-up, gas conditioning, product separation; torrefaction pilot facility, Milena indirect gasification facility for conversion of biomass into syngas.
Financing	
Contact	http://www.ecn.nl/en/bkm/

Twente

University Twente (TU)	
General, products, feedstocks	
Services	Thermo-chemical biomass conversion (pyrolysis, gasification) facilities
Financing	
Contact	http://tccb.tnw.utwente.nl/

Wageningen

Wageningen University (WU)	
General, products, feedstocks	Plant Research International: upstream biomass cultivation and pre-treatment pilot-facilities Agrotechnology and Food Innovations B.V.: a variety of pilot facilities in the following areas: aquatic biomass cultivation, biomass pre-treatment, decomposition and hydrolysis, enzymatic fermentation, product separation, (catalytic) product synthesis.
Services	Biorefinery concepts and subtechnology development: a.o. aquatic biomass cultivation, biomass pre-treatment, hydrolysis, (advanced) fermentation, separation processes, (catalytic) upgrading processes
Financing	
Contact	http://www.wageningenuniversiteit.nl/UK/research/research/

b) Partly restricted

c) Restricted

Bergen op Zoom

Royal Nedalco, Bergen op Zoom	
General, products, feedstocks	Lignocellulosic ethanol: integration of a lignocellulosic bioethanol pilot-plant into an existing first generation bioethanol plant, using byproducts from a neighbouring industry Cargill in Sas-van-Gent.
Services	
Financing	
Contact	http://www.nedalco.nl

Breda

Agrologistiek BV, WUR, Breda	
General, products, feedstocks	
Services	Bioethanol: small-scale (5-50 Ml/a) bioethanol production from multiple arable crops.
Financing	
Contact	http://www.agrologistiekbv.nl/

Delfzijl

Harbour Delfzijl	
General, products, feedstocks	Bioport: co-production of a portfolio of value-added products from imported biomass making use of existing logistical and industrial infrastructure.
Services	
Financing	
Contact	http://www.groningen-seaports.com

Enschede

Biomass Technology Group	
General, products, feedstocks	
Services	Pyrolysis technology, supercritical gasification technology

Financing	
Contact	http://www.btgworld.com/

Rotterdam

Harbour Rotterdam	
General, products, feedstocks	Bioport: co-production of a portfolio of value-added products from imported biomass making use of existing logistical and industrial infrastructure.
Services	
Financing	
Contact	http://www.portofrotterdam.com/en/home/

Terneuzen

Harbour Terneuzen	
General, products, feedstocks	Bioport: co-production of a portfolio of value-added products from imported biomass making use of existing logistical and industrial infrastructure.
Services	
Financing	
Contact	

Veendam

Prograss Consortium, Veendam	
General, products, feedstocks	Dutch Green Biorefinery: grass to juice concentrate, proteins and fibres. Lead by Avebe
Services	
Financing	
Contact	www.avebe.com

ii. demonstration plants

Demonstration plants have been funded only with private investments.

Delfzijl

Bio Methanol Chemie Nederland (Bio MCN), Delfzijl	
General, products, feedstocks	Glycerin to biomethanol (maximally 900 kt/a 100% green methanol). Biofuels
Services	
Financing	Private
Contact	http://www.biomcn.eu

???

NUON	
General, products, feedstocks	1200 MWe multi-fuel IGCC-based power plant Eemshaven
Services	

Financing	Private
Contact	

Bergen op Zoom

Royal Nedalco, Bergen op Zoom	
General, products, feedstocks	Lignocellulosic ethanol: integration of a lignocellulosic bioethanol pilot-plant into an existing first generation bioethanol plant, using byproducts from a neighbouring industry Cargill in Sas-van-Gent.
Services	
Financing	Private
Contact	http://www.nedalco.nl

II. POLICY

Public authorities can promote the quick take-up of industrial biotechnology innovations by implementing a number of “instruments” or policy initiatives. This can be the improvement of the regulatory framework; the integration of specification for bio-based products in public procurement; the establishment of standardisation, labelling and certification schemes to overcome perceived uncertainty about product properties and weak market transparency; the development of financial instruments and supports to increase investments into research, technology development and innovation as well as the elaboration of communication and information campaign to communicate the benefits of bio-based products to users.

A. Policies and regulations

The vision of the government on the biobased economy focuses on the optimal valuation and use of biobased raw materials. In other words: “how can we simultaneously use various non-food products from the same biomass and/or residues from the agricultural sector”.

To accompany the government’s vision that high-grade biomass applications in particular offers Dutch industry considerable opportunities and requires biomass to be produced sustainably, the government has set out a Policy Agenda¹⁴ that consists of four sections:

- More efficient use of biomass
- Sustainable biomass production
- Encouraging the production of green gas and sustainable electricity
- Market developments

The Dutch Government feels that it should be active in the development of sustainable biomass production, technology development (such as 2nd generation technologies), market development and logistics. The government’s Clean and Efficient (new energy for climate policy) Programme¹⁵ forms an important financial framework for the implementation of the Policy Agenda for the biobased economy (financial instruments and measures are explained in the programme).

In October 2007, the Dutch Government published its vision on the bio-based economy. in the energy transition¹⁶¹⁷. For the Government the development of the bio-based economy is driven by the desire to strengthen the economic competitive position of the business sector, to address the problem of climate change, to reduce waste and the distribution of environmentally hazardous substances, and to be less dependent on oil. This vision paper identifies challenges and opportunities for the Netherlands and Dutch companies.

B. Public procurement

A programme for sustainable procurement is being developed. It should be operational in 2010.

C. Standardisation, labelling and certification

No information.

D. Access to finance

¹⁴ <http://appz.ez.nl/publicaties/pdfs/04EP06.pdf>

¹⁵ <http://www.sharedspaces.nl/docs/internationaal/New%20Energy%20for%20Climate%20Policy.pdf>

¹⁶ http://www.minlnv.nl/cdlpub/servlet/CDLServlet?p_file_id=21862

¹⁷ http://www.minlnv.nl/cdlpub/servlet/CDLServlet?p_file_id=14937

IBB (Innovatieve BioBrandstoffen) regulation¹⁸ is a subsidy programme for the development of innovative biofuels. The programme supports investments in demonstration plants.

UKR (Unieke Kansen Regeling) regulation¹⁹ supports demonstration programs in the field of energy transition, including biofuels, biobased materials etc.

Small Business Innovation Research Program²⁰ (SBIR) is a program for entrepreneurs developing products or services for societal issues. Contracts are awarded in a three-phase competition: feasibility, research phase and commercialisation. The unique feature of the SBIR programme is that the contracting authority fully funds the first two phases, whilst the resulting intellectual property remains with the company. In 2006, one of the themes was biobased product.

E. Communication

Biotechnology enterprises are represented at the national level by Niaba²¹, the National Biotechnology Association.

Centre for Society and Genomics (CSG)²² is one of the Genomics Centres of Excellence of the Netherlands Genomics Initiative (NGI) that aims at understanding and improving the interaction between society and genomics. Next to the academic research involving social sciences, law, ethics, philosophy and economy a broad array of public communication and education activities is developed and organised. These activities range from genomics practicals in high schools and participation in science festivals to online discussions with specific target groups (parents, patients, farmers, etc.) and public debates organised around current topics.

The Biobased Raw Materials Platform²³, one of the platforms of the Energy Transition²⁴ has formulated its vision the The Biobased Book (April 2007)²⁵. It describes how the ambition of 30% of energy and material in The Netherlands is to be based on raw materials before 2030 can be realized. Other communication means of this platform include a movie about Biobased Raw Materials in the Netherlands and the book Biomass Hot issue²⁶.

¹⁸ <http://www.senternovem.nl/Biobrandstoffen/>

¹⁹ http://overheidsloket.overheid.nl/index.php?p=product&product_id=900166

²⁰ http://www.senternovem.nl/english/products_services/encouraging_innovation/small_business_innovation_research_sbir_programme.asp

²¹ <http://niaba.nl/html/index.php>

²² <http://www.csg.nl>

²³ http://www.senternovem.nl/energytransition/themes/biobased_raw_material_platform/index.asp

²⁴ <http://www.senternovem.nl/energytransition/>

²⁵ <http://www.senternovem.nl/energytransition/downloads/index.asp>

²⁶ www.senternovem.nl/mmfiles/Biomass_Hot_Issue_Smart_choices_in_difficult_times_tcm24-277868.pdf