



INDUSTRIAL BIOTECHNOLOGY IN FINLAND

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INTRODUCTION

Since the mid 1990s, support for research and development and commercialisation of biotechnology has been a key policy area in Finland. This strong public investment in biotechnology and the entrepreneurial spirit of its industry has resulted in a fast growth in biotech. Tekes technology programmes and the Academy of Finland research programmes are central tools in the promotion of Finnish scientific and R&D work. The combination of knowledge, research, know-how, and a solid infrastructure has been encouraging to entrepreneurs. Most new companies in the field have emerged from research and innovation that originated in universities or institutes of technology. More than half of Finland's biotech companies operate in the health sector but industrial biotechnology is also recognised as an important sector by the Government which has recently launched two large R&D programme for this field.

RESEARCH AND INNOVATION

Modern industrial biotechnology is a relatively new discipline, with major areas of knowledge still to be explored. Public support to research as well as the establishment of pilot and demonstration facilities to scale-up individual processes will therefore help in the development of a European bio-based economy.

A. Public research funding

The Finnish Funding Agency for Technology and Innovation, Tekes², is member as a partner of the European Research Area for Industrial biotechnology (ERA-net IB³).

Tekes is supporting two programmes in the field of research in industrial biotechnology.

SymBio - Industrial Biotechnology⁴: this programme has a budget of €80 million for a five years period (2006-2011) and is funded by the Government (49%), private companies (48%) and research institutes (3%). The aims of the programme are:

- to create competitive industrial processes, new products and services using biotechnology;
- to enhance the environmental friendliness of industrial processes;
- to create new business opportunities in the fields of industrial production and environmental biotechnologies and
- to boost the transfer of research results into technology and new products

Both companies and research organisations can take part in the programme.

The programme

BioRefine⁵: €137 million has been allocated to this programme from 2007-2012. It aims to develop innovative technologies, products and services based on national strengths as well as generate necessary new expertise. The programme also looks to develop biorefineries is examining the processing of biomass in general for the international market and is trying to promote the development and use of second-generation production technology in biofuels for transport.

B. Pilot and demonstration plants

i. pilot plants

Pilot plants are listed by alphabetical order of location.

Remark: Process development unit (pdu) are facilities larger than scale up facilities (pilot plants but smaller than industrial pilots (demonstration plants).

a) **Open to all**

Espoo

KCL, Espoo
General, products, feedstocks

² www.tekes.fi/eng

³ www.era-ib.net/

⁴ <http://akseli.tekes.fi/opencms/opencms/OhjelmaPortaali/ohjelmat/SymBio/en/etusivu.html>

⁵ <http://akseli.tekes.fi/opencms/opencms/OhjelmaPortaali/ohjelmat/BioRefine/en/etusivu.html>

Services	<u>Mechanical size-reduction</u> - Grinding units <u>Separation (solids from liquid or specific components)</u> - Filtration/screening units (pdu) <u>Transformation/fractionation/modification</u> - Steam explosion unit (pdu) - Chemi-mechanical grinder/refiner (pdu) - Fibre pulping (mechanical and chemical) and subsequent fractionation unit (pdu) <u>Thermo-chemical conversion</u> - Chemical conversion pilots (based around stirred-tank reactors that can handle alkaline or acidic conditions as well as pressure) (pdu)
Financing	Private. KCL is a research organisation owned by four companies from the forest-refining sector.
Contact	http://www.kcl.fi/page.php?page_id=46 http://www.kcl.fi/

Espoo

Helsinki University of Technology, Espoo	
General, products, feedstocks	
Services	<u>Separation (solids from liquid or specific components)</u> - Filtration/screening units (pdu) <u>Biochemical conversion</u> - Stirred tank bioreactors (pdu)
Financing	Mainly public
Contact	www.tkk.fi/en/

Jokioinen

Aromtech Oy and BioTrim/Agropolis Oy, Jokioinen	
General, products, feedstocks	
Services	<u>Separation (solids from liquid or specific components)</u> - Supercritical extraction (pdu)
Financing	
Contact	www.biotrim.fi/

Lappeenranta

Lappeenranta University of Technology, Lappeenranta	
General, products, feedstocks	
Services	<u>Separation (solids from liquid or specific components)</u> - Filtration/screening units (pdu)
Financing	Mainly public
Contact	http://www.lut.fi/en/lut/Pages/Default.aspx

Oulun Yliopisto

University of Oulu, Oulun Yliopisto	
General, products, feedstocks	
Services	<u>Biochemical conversion</u> - Stirred tank bioreactors (pdu)
Financing	Mainly public
Contact	http://www.biocenter.oulu.fi/ http://www.oulu.fi/english/

Turku

Åbo Akademi University, Turku	
General, products, feedstocks	
Services	<u>Transformation/fractionation/modification</u> - Circulating cooking apparatus (pdu at Åbo Akademi)
Financing	Mainly public
Contact	http://www.abo.fi/public/

VTT

VTT Technical research centre, VTT	
General, products, feedstocks	
Services	<u>Mechanical size-reduction</u> - Grinding units <u>Separation (solids from liquid or specific components)</u> - Continuous centrifuges (pdu) - Filtration/screening units (pdu) - Film evaporator (pdu) - Crystallisation tanks (pdu) - Supercritical extraction (pdu) <u>Transformation/fractionation/modification</u> - Extruder (pdu) - Steam explosion unit (pdu) - Driers incl. spray drying (pdu) - High-pressure liquefaction (pdu) - Organosolv (pdu) - Chemi-mechanical grinder/refiner (pdu) - Fibre pulping (mechanical and chemical) and subsequent fractionation unit (pdu) - Compounders and casting units to produce (bio-)composites (pdu) <u>Thermo-chemical conversion</u> - Gasification & syngas cleaning unit (pdu) - Fast pyrolysis (pdu) - Chemical conversion pilots (based around stirred-tank reactors that can handle alkaline or acidic conditions as well as pressure) (pdu) ▪ <u>Biochemical conversion</u>

	<ul style="list-style-type: none"> - Stirred tank bioreactors (pdu) - Batch reactors for enzymatic conversion (pdu) - Mashing tanks and brewing bioreactors (pdu) ▪ <u>Miscellaneous</u> <ul style="list-style-type: none"> - Fuel cell unit (pdu) - Biomass combustion technology (various pilot-scale equipment)
Financing	Mainly public
Contact	http://www.vtt.fi/services/cluster4/index.jsp http://www.vtt.fi/

b) Partly restricted

c) Restricted

ii. demonstration plants

Demonstration plants are listed by alphabetical order of location.

Remark: Industrial pilots (ip) are large pilot, usually not open to outsiders, funded by industry or jointly by industry and public resources.

a) Open to all

b) Partly restricted

c) Restricted

Espoo

Preseco Oy, Espoo	
General, products, feedstocks	
Services	<u>Thermo-chemical conversion</u> <ul style="list-style-type: none"> - Biodiesel production (small-scale FAME-type process, Preseco Oy)
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.preseco.eu

Espoo

M-Real Oyj, Espoo	
General, products, feedstocks	
Services	<u>Miscellaneous</u> <ul style="list-style-type: none"> - Black liquor ultra filtration unit (ip)
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.m-real.com/wps/portal

Helsinki

StoraEnso, Helsinki	
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General, products, feedstocks	
Services	<u>Thermo-chemical conversion</u> - Gasification & syngas cleaning unit (ip)
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.storaenso.com

Helsinki

St1 Biofuels Oy, Helsinki	
General, products, feedstocks	St1 Biofuels Oy is a joint venture of St1 and VTT. The ethanol will be produced using waste from the food processing industry in the place of origin of the waste.
Services	<u>Thermo-chemical conversion</u> - Bioethanol from bakery waste material
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.st1.fi

Jyvaskyla

Metso Paper, Jyvaskyla	
General, products, feedstocks	
Services	<u>Separation (solids from liquid or specific components)</u> - Filtration/screening units (ip)
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.metsopaper.com/

Kantvik

Danisco, Kantvik	
General, products, feedstocks	
Services	<u>Separation (solids from liquid or specific components)</u> - Continuous centrifuges (ip) - Filtration/screening units (ip) - Chromatographic separation columns and ion exchange columns (ip) <u>Thermo-chemical conversion</u> - Chemical conversion pilots (based around stirred-tank reactors that can handle alkaline or acidic conditions as well as pressure) (ip)
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.danisco.com

Kiviranta/Tornio

Aromtech Oy, Kiviranta/Tornio	
General, products,	

feedstocks	
Services	<u>Supercritical fluid extraction</u> - Extraction of functional lipids from plants (Aromtech Oy)
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.aromtech.com

Kokemäki

Kokemäen Lämpö Oy, Kokemäki	
General, products, feedstocks	
Services	<u>Thermo-chemical conversion</u> - Catalytic cleaning of syngas (as a part of the Novel small-scale power plant producing heat and electricity)
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.kokemaenlampo.fi

Porvoo

Neste Oil Oy, Porvoo	
General, products, feedstocks	
Services	<u>Thermo-chemical conversion</u> - NExBTL process (hydro-cracking of fats and oils) resulting in a novel biodiesel product
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.nesteoil.com/

Rauma

Forchem Oy, Rauma	
General, products, feedstocks	The raw material is a by-product from the pulp industry thus derived from Northern trees.
Services	<u>Thermo-chemical conversion</u> - Tall oil distillation
Financing	Investments have been private but they have been complemented with R&D subsidies and repayable loans.
Contact	http://www.forchem.com/

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

No information

B. Public procurement

No information

C. Standardisation, labelling and certification

No information

D. Access to finance

VTT⁶ and universities, as well as research organisations active in industrial biotechnology and biorefinery research, receive their basic financing for pilot and demonstration plants from the state budget as they are governmental bodies.

Investments for pilot-scale equipment and other test beds are normally financed from two sources:

- from the research institutes' own budget (institutional money)
- from Finnish Funding Agency for technology and Innovation (Tekes), which grants money for such investment and related R&D work on the basis of competition. The R&D projects concerned are non-profit, pre-competitive projects – the so called shared-cost projects – that are supposed to benefit the society at large. The companies may also participate in such jointly funded projects (as financer and/or through R&D input).

E. Communication

Industrial biotechnology enterprises are represented at national level via the national association for biotechnology: Finnish Bioindustries⁷.

⁶ www.vtt.fi

⁷ www.finbio.net