

The BREW Project

Medium and long-term opportunities and risks of the biotechnological production of bulk chemicals from renewable resources (<http://www.chem.uu.nl/brew/>)

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I.) Project abstract

To date, most attention related to biotechnology has been paid to GM food, pharmaceuticals and human genomics. Unperceived by most, **biotechnology is about to open new perspectives for the manufacture of chemical bulk materials and chemical intermediates.**

Potential benefits are the availability of new superior materials, the use of domestic renewable raw materials (stable and secure), ecological benefits (renewable feedstocks and energy efficient processes) and the evolution of a new technology area offering growth and employment opportunities in various sectors.

On the other hand there are **also important risks**, among them the reduction of biodiversity, health impacts for humans and the general public perception which can devalue earlier investments.

The BREW project deals with the major aspects of the biotechnological production of bulk chemicals and chemical intermediates from renewable raw materials in the medium and long term (until 2050). The ultimate goal is to provide an **overall evaluation of the opportunities and risks**. The results of the project are expected to be **highly relevant for strategy development both in companies and in policy**. Early communication of the results may also contribute to **a rational public discussion** and it may spur **private-public partnerships**.

II.) Objective

This study deals with the opportunities and risks of applying biotechnology (including genetic engineering) to produce **bulk chemicals and chemical intermediates from renewable raw materials**. The study provides an overview of the **technical options, their environmental effects, their economics, the risks related to the options, public perception and societal aspects**. The focus is on the production of chemicals by **fermentation** (with or without genetically modified organisms) and enzymatic conversions (White Biotechnology, also referred to as Industrial Biotechnology). The developments in the next 10-20 years and in the long term (until 2050) are addressed.

The study was prepared by a multidisciplinary team composed of **experts from the chemical industry and from research organisations**. It is a joint aim to compile as much quantitative information as possible, which is complemented by qualitative information. Analyses and internal review processes ultimately result in an **overall evaluation of the opportunities and risks**.

The results of the project are expected to be highly relevant for **strategy development both in companies and in policy**. Various **DGs within the European Commission** and **other stakeholders** are expected to benefit from this project.

III.) Table of contents of the BREW study

The BREW study (approximately 450 pages, see table of contents below) contains

- an extensive overview of chemicals which can be produced by White Biotechnology (Chapter 2)
- environmental and economic assessments for 21 White Biotechnology products (comparison based on one tonne of product; Chapter 3)
- scenario projections for Europe (EU-25) until the year 2050, thereby distinguishing between favourable, medium and unfavourable boundary conditions for bio-based chemicals (Chapter 4)
- an assessment of the risks related to White Biotechnology (both conventional risks and risks related to genetically modified organisms are covered; Chapter 5)
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The BREW consortium is composed of **universities, research organisations and industry.**

Universities and research organisations

1. Utrecht University (UU), Faculty of Chemistry, Department of Science, Technology and Society, Utrecht, Netherlands
2. Fraunhofer Institute for Systems and Innovation Research (FhG-ISI), Departments "Innovation in Biotechnology" and "Environmental Technology and Environmental Economy", Karlsruhe, Germany
3. CERISS (Centro per l'Educazione, la Ricerca, l'Informazione su Scienza e Società), Milan, Italy
4. Plant Research International (PRI), Wageningen, Netherlands
5. Universidade Complutense de Madrid (UCM), Madrid, Spain
6. A&F (Agrotechnology and Food Innovations), Wageningen, Netherlands

Industry

1. BP Chemicals, Hull, United Kingdom
2. NatureWorks, Naarden, The Netherlands
3. DSM Research BV, Geleen, Netherlands
4. DuPont, Bad Homburg, Germany
5. Shell International Chemicals BV, Amsterdam, Netherlands
6. Uniqema, Wilton/Redcar, United Kingdom
7. Novozymes A/S, Bagsvaerd, Denmark
8. Roquette Freres, Lestrem, France
9. Degussa AG, Hanau, Germany