

Project description 'Imagine ... Biodiesel from algae'

I. Background

At the end of 2003, the Dutch Kluyver Centre for Genomics of Industrial Fermentations launched the secondary school students' competition 'Imagine...', which was supported by the Dutch Institute for Biology (NIBI), the Dutch Biotechnological Society (NBV), The Dutch Genomics Initiative (NGI), the Centre for Biosystems Genomics (CBSG), and the Netherlands Biotechnology Foundation (SBN). The most promising proposals were presented and judged by the audience during the Dutch Biotechnology Conference (NBC) which was held in Ede on 11th of March 2004. Students elaborated the preselected proposals and presented their final results to a professional jury at the Genomics Momentum 2004 Conference in Rotterdam on 31th August 2004. The prize was realization of the winning proposal. The proposed project 'Production of biodiesel from algae' won both the audience's vote in Ede and the professional jury's vote in Rotterdam. The scientists who had submitted this proposal are dr.ir. Wouter van Winden and ir. Bram van Beek. They have supervised the students Sonja Boas and Chang Liu in detailing the proposal.

At present, a project team is preparing the realization of the project. The goal of the project is to study the feasibility of producing biofuel which (a) creates a new market for agricultural products and new employment in Mozambique, (b) is fully renewable and carbondioxide-neutral, (c) leads to reduction of the emission of noxious exhaust gases and (d) reduces the dependence of the economy of Mozambique on increasingly expensive oil imports. Besides, (e) it will be investigated how side-products of the production of the biofuel can be utilized to improve the feasibility of the project and close the material cycles.

II. Project description

Biodiesel is a biofuel that is obtained from the reaction of vegetable oil with an alcohol, which can be combusted in conventional motors and which is past the experimental stage in both Europe and North America. Besides a multitude of advantages, this biofuel has some disadvantages as well: the used alcohol is usually methanol, which stems from fossil resources. For this reason, biodiesel cannot be claimed to be fully 'green'. Moreover, in most cases rapeseed oil is used, the agricultural production of which requires large land area, and significant amounts of fresh water and pesticides. These aspects also go at the cost of the sustainability of large-scale production of biodiesel.

The mentioned disadvantages can be countered by producing biodiesel from ethanol and algal oil. Ethanol can be produced by fermenting plants accumulating starch, such as sugarcane. Algae can grow in salt water, on saline soil that is unsuitable for regular agriculture. Moreover, the potential yield of algae is considerably higher than that of oil accumulating crops, such as the above mentioned rapeseed. Algae need warmth, light and carbondioxide to grow. The first two requirements make (sub)tropical regions suitable for culturing algae. The requirement of carbondioxide to make the algae grow well asks for the localization of the algal oil-based biodeisel production facility in the vicinity of an ethanol fermentation plant. During alcoholic fermentation, ethanol and carbondioxide are simultaneously produced.

Mozambique has a subtropical climate, ample availability of (semi-)salt water in the Zambezia delta, ethanol plants, a stable political climate and research institutes in the field of agriculture and biology. Taken together, this makes Mozambique an excellent choice for producing algal oil-based biodiesel. The main challenge is to develop a robust and productive method for culturing and harvesting algae. This has been investigated in more temperate climates of Europe and North America, but this has so far not yielded any established solutions, by our knowledge. The present proposal aims at realizing a pilotplant near Quelimane, in the Zambezia delta of Mozambique, where the technical feasibility of the production of biodiesel from algal oil can be investigated under the local conditions.



The red arrow indicates the envisaged localization of the pilot plant.

The pilot plant is to consist of an algae culturing pond with a surface area of approx. 1,000 m², equipment for harvesting and drying of algal biomass, equipment for extraction of oil from dried algal biomass and for conversion of algal oil

with ethanol to biodiesel. Besides insight in the feasibility of the envisaged project, this project will yield a small-scale production facility. At the end of the project this pilotplant will be transferred to a locally participating research insitute (university), which will follow-up the initial research.

The most important wate products of the production of biodiesel from algae and ethanol are glycerol and algal biomass. The recycling of these streams to add value to the process will be included in the feasibility study.

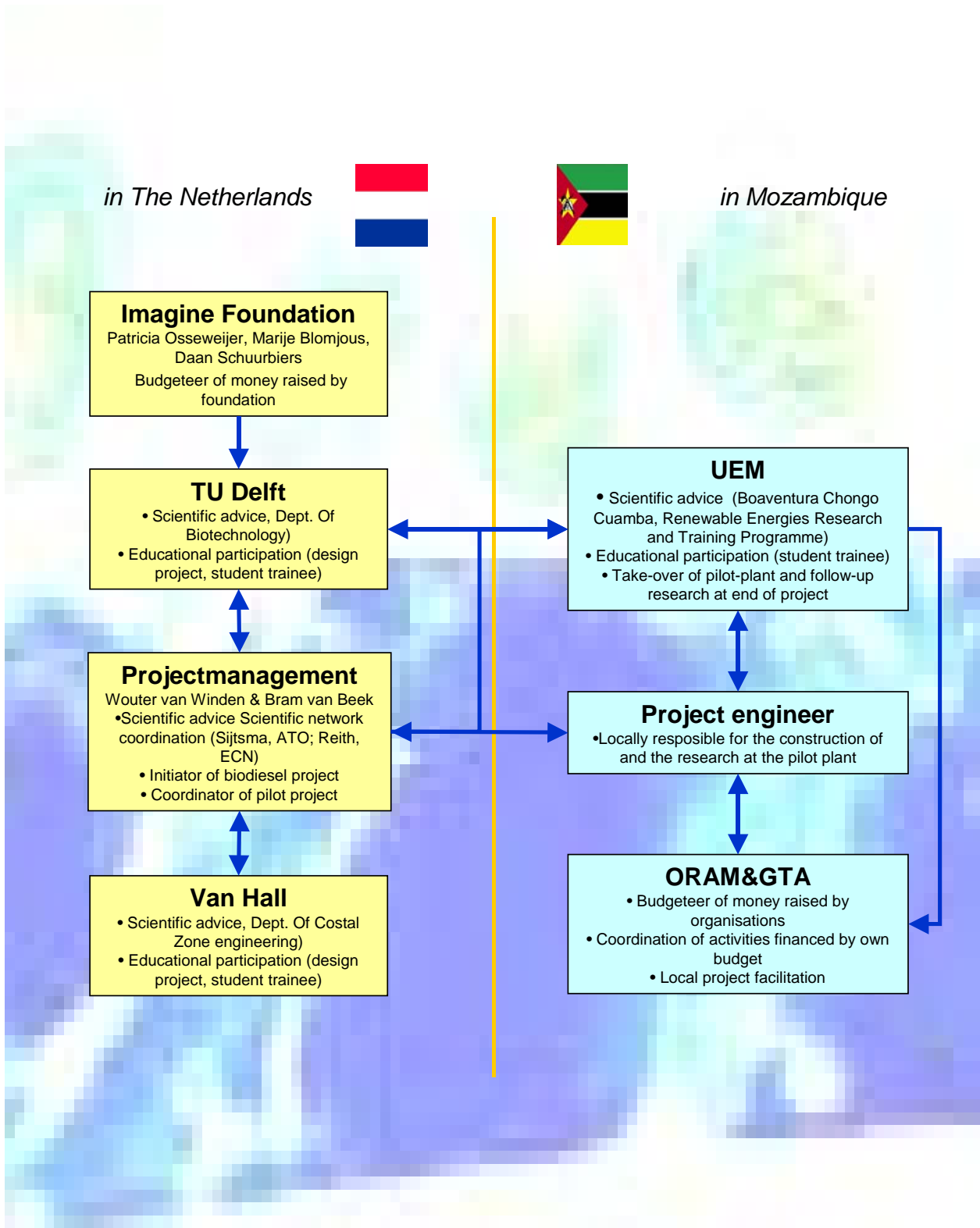
III. Projectteam

Name + address	Organisation	Role
Bram van Beek +31-6-43049325 bramvan@beekadvies.nl	Beekadvies, Amsterdam	Submission of project, scientific advisor
Wouter van Winden +31-15-2785307 w.a.vanwinden@tnw.tudelft.nl	Bioprosesstechnology Group, Delft University of Technology	Submission of project, scientific advisor
Patricia Osseweijer +31-15-2785140 p.osseweijer@tnw.tudelft.nl	Kluyver Centre for Genomics of Industrial Fermentations, Delft University of Technology	Organisation Imagine, project supervision
Marije Blomjous +31-15-2786654 m.blomjous@tnw.tudelft.nl	Kluyver Centre for Genomics of Industrial Fermentations, Delft University of Technology	Organisation Imagine, project supervision
Daan Schuurbiens +31-15-2127800 daan.schuurbiens@efbpublic.org	European Federation of Biotechnology, Delft	Organisation Imagine, project supervision
Jan de Moor +0025882402849 jandemoor@teledata.mz	Oram-Zambezia, Quelimane, Mozambique	Project preparation and facilitation in Mozambique

The project team is supported by cooperations with several Dutch research institutes such as ECN, ATO-DLO en Van Hall/Larenstein (see V. Organisationchart).

IV. Organisation chart

Below chart shows which parties are involved in the proposed project:



V. Time schedule – Milestones and plans

Datum	Activiteit
01-10-'04 → 11-03-'04	Submission of proposal for secondary school students' competition 'Imagine... 2003-2004' by scientists. Preselection of 5 proposals by a jury
12-03-'04	Presentation of 5 selected proposals during Dutch Biotechnology Conference in Ede. Audience's vote for 'Biodiesel from algae' project
13-03-'04 → 30-08-'04	Elaboration of project proposal by students
31-08-'04	Presentation of Imagine proposals by students at Genomics Momentum 2004 Conference in Rotterdam. 'Biodiesel from algae' project is chosen as winner of Imagine...2003-2004.
01-09-'04 → present	Further detailing of technical plans, building collaboration network, fundraising for realization of project
01-12-'04 → 12-02-'05	Detailed design study of algal production facility by graduate students of Life Science and Technology education at Delft University of Technology
08-'05 → 08-'05	Visit by projectteam plus laureate students Sonja en Chang to Mozambique, planned start of realization of project
07-'05 → 01-'06	Realization pilotplant
02-'06	Transfer of pilot plant to Eduard Montlane University (UEM) in Mozambique

VII. Further information

Interested parties can request on national press publications on the project, and further information on the scientific background, technical details and envisaged localization of the project from the members of the projectteam. The information can be partially found at the following websites: <http://www.kluyvercentre.nl/Imagine> and www.beekadvies.nl.