Algemene gegevens	
PPS-nummer	AF EU 13007
Titel	FUEL4ME – FUture European League 4 Microalgal Energy
BAPS nummer	BO-21.04-001-007
Topsector en innovatiethema	BO-21.04 BBE – AF 1 Biobased – Topsector PPSen (001 Valorisatie grondstoffen AF Biobased)
Projectleider (onderzoek)	Dorinde Kleinegris
PPS-coördinator (namens private partij)	-
Contactpersoon overheid	-
Status (lopend of afgerond)	Lopend
Type onderzoek (F, T of V)	T
Werkelijke startdatum	01/01/2013
Werkelijke einddatum	31/12/2016
Korte omschrijving bijdrage DLO aan project	One of the outdoor pilot plants for optimization of microalgal growth and lipid production is located at DLO-FBR. Furthermore, in the downstream processing DLO-FBR is involved in the fermentation of remaining biomass into hydrogen, which is used for the production of biofuels. Next to that overall coordination of the project is in the hands of DLO-FBR.

Highlights:

FUEL4ME: Future European league for microalgal energy

Project context and objectives

The 4-year FUEL4ME project will develop a sustainable chain for continuous biofuel production using microalgae as a production platform, thereby making 2nd generation biofuels competitive alternatives to fossil fuels. This will be achieved by:
1) Transforming the current 2-step process for algal lipid production into a continuous 1-step process with high lipid content (production process);
2) Development of a continuous downstream process using all components of the algal biomass (conversion process);
3) Integration of production and conversion process.

After setting up and proof of concept within controlled indoor conditions, the continuous process will be tested outdoors under real production conditions in four different regions (NL, IL, IT ES). Simultaneous with research on biomass production, a continuous downstream process will be developed. Finally the whole process (both biomass production and conversion into biofuel) will be integrated and subjected to an economic analysis and life cycle analysis.

FUEL4ME aims to exploit one the unique strengths of algae: the ability to produce lipids using energy from photosynthesis. These lipids form excellent starting material for the production of bulk products; the largest fraction of the lipids will be used for the production of biofuel (NExBTL) and a smaller fraction will be used for food and feed components (ω3 fatty acids). This way optimal use of biomass results in simultaneous production of food and fuel.

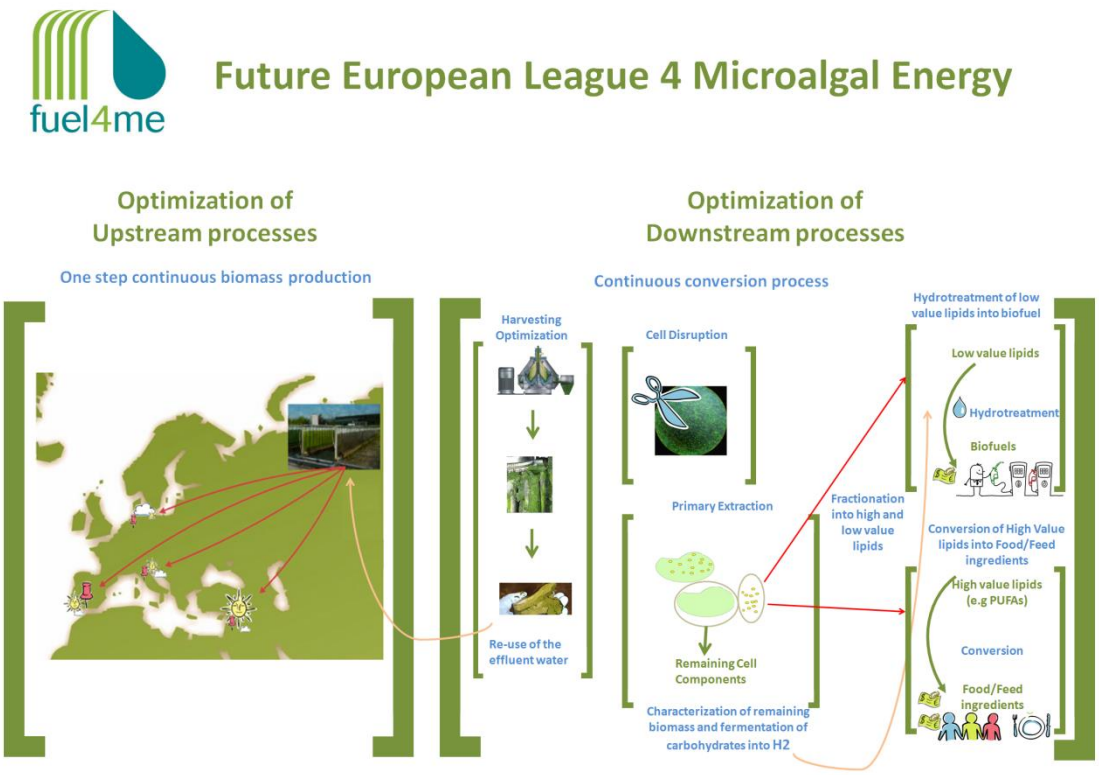

Figure 1. Schematic project overview

Work performed since the beginning of the project and the main results achieved so far
The kick-off meeting was organised 5 – 6 March 2013 where total project overview, scientific dependencies, project obligations, reporting, meetings, legal and financial aspects and also the importance to act as a team were intensively discussed and agreed upon..
In the first reporting period (January 2013 – June 2014) work has started on fundamental research and enabling technologies: understanding the genes, metabolism, biochemical aspects of the chosen strains (Nannochloropsis oceanica and Phaeodactylum tricornutum). Furthermore, the proof of principle concept for a one-step lipid production process was developed. In work package 2, where the translation from outdoors to production will be made, detailed engineering of the pilot plants was performed. Flat panel photobioreactors were installed in Israel and Italy and building is being finalized in the Netherlands. Furthermore, the first biomass has been produced for downstream processing experiments (WP 3) both in Italy and in Spain. Harvesting with the Evodos Type 10 of Nannochloropsis and Phaeodactylum was successfully demonstrated. The first experiments on extraction with supercritical carbon dioxide and subsequent characterization of fatty acids have been performed. Also the further fractionation of high value and low value lipids by using supercritical carbon dioxide technology has been evaluated in WP3. Objective of WP 5 is to perform a sustainability assessment, including environmental, economic and social elements based on the whole value chain in a life cycle perspective. The results will be used to guide the technical development and future implementation in the desired direction and to be able to determine economic feasibility and environmental sustainability. For the sustainability assessment the methodologies were described and specifically adapted to the considered algae concepts. In WP 6, concerning communication and exploitation, a communication and dissemination plan, website, newsletter, roll-up, project brochure have been established. Moreover, a stakeholder list has been issued and an industrial board and an online advisory service have been set up.

Expected final results and their potential impact and use

These key outcomes from this 4-year initiative will foster the production of sustainable biofuels in an economically, socially, and environmentally manner and to alleviate possible problems regarding competition with food in the bioenergy field:

- A sustainable process for biofuel production from microalgae demonstrated at pilot scale.
- Optimisation of lipid productivity in an integrated microalgae cultivation process based on photobioreactors
- Improvement in the extraction of oil from microalgae and conversion into biofuel.
- Commercial viability of the process by valorisation of the residual biomass
- Enabling a sustainable approach that can be replicated elsewhere across Europe.

Partnership

The consortium consists of a powerful mix of established research organisations and universities, small and medium enterprises (55% of total partners) and large scale industry. These are: Wageningen UR – Food & Biobased Research, Wageningen University, Ben Gurion University of the Negev, Fotosintetica & Microbiologica S.r.l., Biotopic, Evodos B.V., Cellulac, Feyecon Development and Implementation B.V., Neste Oil Corporation, JOANNEUM RESEARCH Forschungsgesellschaft mbH and IDconsortium SL. (see also http://www.fuel4me.eu)

Opgeleverde producten in 2014			
Wetenschappelijke artikelen	Rapporten	Artikelen in vakbladen	Inleidingen/ workshops/ invited lectures
Hingsamer et al. (submitted for publication) Life Cycle Sustainability Assessment of Energy Systems with Algae – Towards an European Approach with an Austrian Example – Applied Energy	-	-	* 31/03/14 Lipid production in *Phaeodactylum tricornutum* under simulated outdoor conditions @ Young Algaeneer Symposium * 02/04/14 FUEL4ME at F&M @ Montpellier Alg 'n Chem * 24/04/14 – Towards a standard methodology for the sustainability assessment of energy systems with algae – an European approach in FUEL4ME @ European biomass conference * 24/06/14 – Towards a standard methodology for the sustainability assessment of energy systems with algae – an European approach in FUEL4ME @ European biomass conference *02/12/14 FUEL4ME @EABA meeting