Our Project Team

The MacroFuels consortium brings together specialists along the entire chain of biofuel production, from seaweed cultivation up to fuel testing via fuel production. Feedback loops between the experts ensure crosspollination of ideas, concepts and insights. The cultivation, pre-treatment and conversion experts are further complemented by experts in the field of sustainability assessments, risk analysis and mitigation, commercial deployment and IP monetisation, as well as communication.

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This flyer is part of the MacroFuels project.
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 654010.

Third-Generation Biofuels from Seaweed

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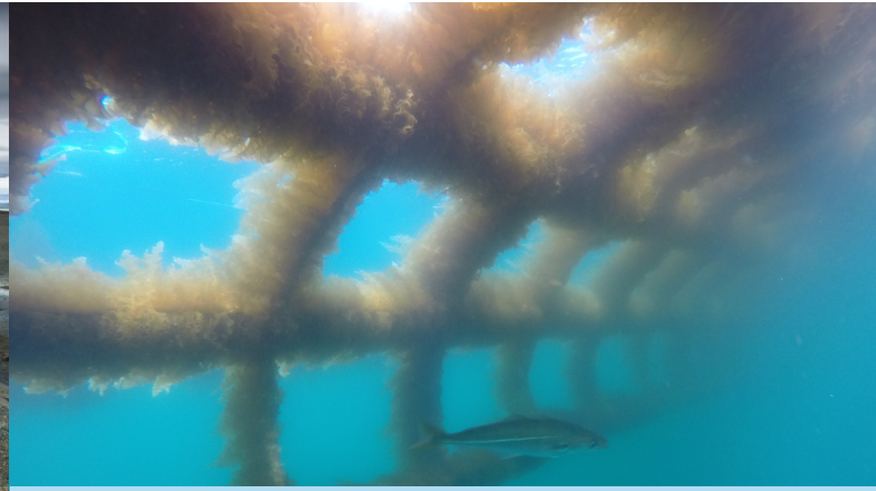


MacroFuels - Turning a Vision into a Solution

MacroFuels in a Nutshell

MacroFuels aims to produce advanced biofuels from macroalgae, commonly known as seaweed. The targeted biofuels are ethanol, butanol, furanics and biogas. The project will achieve a breakthrough in biofuel production from macroalgae by:

- Increasing biomass supply by developing a rotating crop scheme for cultivation of seaweed, using native, highly productive brown, red and green seaweeds, in combination with the use of advanced textile substrates resulting in a year round biomass yield.
- Improving the pre-treatment and storage of seaweed and to yield fermentable and convertible sugars at economically relevant concentrations (10-30%)
- Increasing bio-ethanol and bio-butanol production to economically viable concentrations by developing novel fermenting organisms which metabolize all sugars at 90% efficiency
- Increasing biogas yield to convert 90% of the available carbon in residues by adapting the organisms to seaweed
- Developing thermochemical conversion processes of sugars to furan-based fuels
- Performing an integral techno-economic, sustainability and risk assessment of the entire seaweed to biofuel chain

MacroFuels will develop technologies for the production of fuels which are suitable as liquid fuels of precursors thereof for the heavy transport sector as well as potentially for the aviation sector. MacroFuels will furthermore expand the biomass available for the production of biomass available for the production of advanced biofuels. Seaweed does not need fresh water, arable land or fertilizers to grow, which provides environmental benefits, and, in addition, has a high carbon dioxide reduction potential as well as reduces the demand for natural resources on land. The technology offers many novel opportunities for employment along the entire value chain.

Benefits and Impacts

The progress that will be achieved by MacroFuels will have significant impact on various economic fields, and - most importantly - paves the way towards a sustainable solution that is not competing with arable land or food, in contrast to 1st and 2nd generation biofuels derived from food-based crops and residuals. Thus, MacroFuels aims to make a substantial contribution towards renewable energy from photosynthesis and towards the goal set by the European Union of 10% of the transport fuel of every EU country to come from renewable sources such as biofuels by 2020.

Advanced technologies and decreased production costs for third-generation biofuels will offer many novel opportunities for employment along the entire value chain. MacroFuels estimates that about 15.000 jobs can be created based on the EU target of 2.5% biofuels, which corresponds to 5000 km² of cultivated seaweed area.

✓ MacroFuels converts seaweeds more efficiently to biofuels via breakthroughs in pre-treatment (water reduction of more than 50% and total elimination of process steps are among our ambitious goals), via wet, sugar preservative storage methods, and by improving the ethanol and butanol productivity up to economic levels.

✓ MacroFuels enables a favourable energy balance as well as significant potential for cost reduction, which will permit our targeted fuels to eventually compete favourably with fossil or 1st and 2nd generation biofuels.

✓ MacroFuels stimulates stakeholder dialogues and international collaboration by bringing together experts that are involved in international activities on seaweed-derived biofuels, and by entering dialogues with stakeholders to understand their interests and concerns. Although the objective is unique, MacroFuels will not be an isolated effort. Indeed, the links with other projects and networks ensure that MacroFuels will be up to date on the latest trends and support maximising the project's impacts.

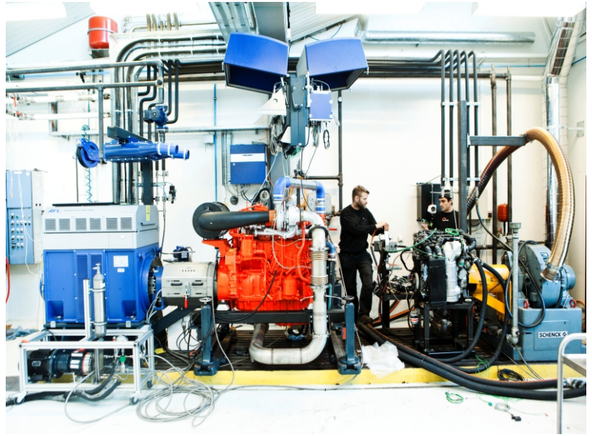
✓ MacroFuels improves innovation capacity by integrating prior state-of-the-art, know-how and experience along the entire seaweed to biofuels chain. Bringing together key players in the seaweed to biofuels area will accelerate innovation and market deployment and broaden the business-case for companies.

Economic viability and sustainability

MacroFuels will determine the economic viability of the seaweed to biofuel production chains by using accurate verified experimental data, obtained under relevant conditions. The data from the assessment will be used in a feedback loop to further inform the experiments, thus ensuring that the chances of commercial implementation are maximised.

Valorisation of the side- and waste-streams

Side- and waste-streams will be valorised by screening them for high value marketable components and identifying the most viable products. We will further assess the proteins liberated during the entire process for their use to augment feed supply in the EU, as well as the mineral streams for use as inorganic fertilizer in terms of primary, secondary and trace elements. This assessment will result in a potential value and market of these streams.



Fuel assessment under realistic conditions

Fuel assessment under operating conditions will be performed by utilising the DTI fuel assessment facilities. Fuel mixtures will be prepared and tested in the relevant engines to assess the suitability of these fuels under different realistic transport conditions.

Techno-economic and sustainability assessment

As part of MacroFuels, a multi-criteria assessment of the sustainability of substituting conventional, fossil-based transportation fuels and currently available biofuels with seaweed-derived fuels will be performed. The sustainability assessment will take into account economic, environmental, social, health and safety, and risk aspects and will consider the entire value chain of the transportation fuels using a life cycle comparison approach.