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Opportunities and barriers of algae based biogas

The world's energy consumption is expected to double from 2010 to 2050 with a 1,6% annual growth rate, for comparison, the total consumption was 4 661 Mtoe in 1973 and 13 647 Mtoe in 2015. This increasing demand, together with the urgent need to slow down climate change and support sustainable development, has led to a growing demand for alternative renewable energy sources. Algae have great potential as an alternative to other energy biomass such as wood, bio waste and energy crops. To enable the use of algae as a source of biogas we still need to solve both socio-economic and technological challenges. This infosheet provides an overview over some of the main barriers affecting the full-scale production and marketization.

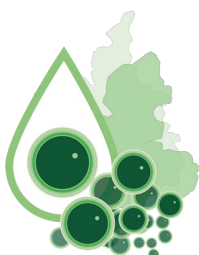
OPPORTUNITIES OF ALGAE BASED BIOGAS

Theoretically, algae are a very promising source of biomass for the production of biogas. Here we present different types of opportunities divided into functional, environmental, economic and social aspects. As an example of functional opportunities, algae have high growth rates, actually being the most rapidly growing biomass, and great capability to accumulate lipids.

One great feature of algae is that they can clean wastewater by taking up nutrients during cultivation, and this makes nutrient recycling possible when algae biomass is utilized.

Another by-product from the gasification process (e.g. the anaerobic digestion of algae) can be high value, nutrient rich algae biomass residue usable as fertilizer. Positive social effects are new algae based product and service innovations that might spark the starting of new companies and thus create new jobs. In addition, cleaner, healthier living environments are top priorities for cities and municipalities globally; algae based closed loop systems (e.g. water purification, biogas and fertilizer) have a lot of potential to help solving these issues. Altogether, algae hold a lot of potential as an alternative and renewable raw material for biogas.

Type of opportunity	Opportunities of algae based biogas
Functional	The most rapidly growing biomass
Functional + Environmental	Cleaning wastewater
Functional	Can grow in water, does not need agricultural land
Environmental	More environmentally friendly than fossil fuels
Environmental	Part of circular economy
Environmental	Can enhance nutrient recycling
Environmental	Battle eutrophication
Economic	Biogas as end product
Economic	Wastewater purification & fertilizer
Social	Creating new companies and jobs
Social	Healthier living environment



BARRIERS OF ALGAE BASED BIOGAS

Full-scale algae based biogas production is still at an early stage because there are challenges that need solving. So-called barriers to entering the market divide into: technological, functional, knowledge based, economic, climate, cultural and legal. First, the Nordic climate is not ideal for algae cultivation. There are only four months of a year when the algae can be cultivated outside.

There are still many barriers to full-scale algae based biogas production and its commercialisation. The greatest challenge now is that algae cultivation and harvesting consumes more energy than the algae based biogas contains. Another significant barrier is economic as the establishment and production costs are high in comparison to the market price for biogas.

Type of barrier	Barrier of algae based biogas
Technological	Cultivation & harvesting of algae biomass demand much energy
Technological	Harvesting problems
Functional	Low concentration of algae biomass in cultures
Functional	Cultivation needs a lot of space
Knowledge	Algae change naturally their composition with season
Knowledge	Need for systemic, 'circular' innovations
Economic	Production costs higher than energy price
Economic	High establishing costs
Climate	The Nordic climate is not ideal for cultivation
Cultural	Attitudes towards renewable energy
Legal	Development lacks governmental support



CONCLUSION

Algae based biogas production holds a lot of potential and it is important to continue research on algae as biomass source. Algae is turned into biogas already, e.g. SolRod Biogas. Uncovering and removing barriers hindering full-scale market entrance is of high importance at this stage. Solving such challenges as presented in this paper, calls for further research, technological development, changing attitudes towards renewable energy especially towards biogas as well as governmental support.

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Full report:

Janni Lohiraja (2018). Understanding the marketing system for algae based biogas. Master thesis, School of Marketing and Communication. University of Vaasa

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