

Energise A Network of Knowledge

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Energise: Sustainable Fuels

Algae to Biofuels Roadmap Version 1.0

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Purposely cultivating algae unlocks a major opportunity to produce sustainable fuels for transport and power generation whilst avoiding many of the challenges of existing energy crops. Power generation plants and water treatment assets could even contribute their wastes and emissions to cultivate algae and harvest yields are expected to be more than thirty times that of conventional biomass crops.

The opportunity of successfully deploying algae-to-biofuels processes involves the knowledge and expertise from a broad range of sectors, including:

- ◆ Bioscience
- ◆ Chemical Processing
- ◆ Water and Waste Water Treatment
- ◆ Power Generation
- ◆ Automotive
- ◆ Aviation
- ◆ Offshore Engineering
- ◆ Oil and Gas

On 17th June 2008, Energise held the Sustainable Fuels 'Developing the Algae Opportunity' event to bring together these interests. It attracted over 100 delegates who shared their ideas and developed relationships to undertake research, development and demonstration projects.

The knowledge and strategic vision of delegates was drawn together and collated to produce a roadmap of actions, opportunities and 3-year aims towards capitalising the algae-biofuels opportunity. The roadmap provides a first, high-level direction with the intention that it be used, refined and updated as technologies and policies are developed and progress is made towards rolling 3-year aims.

The Energise Sustainable Fuels network now engages over 230 individuals from across the UK algae-biofuels supply chain and is available to assist in developing consortia and raising finance to accelerate the exploitation of this potentially vast opportunity.

I look forward to hearing from you,
Roy Williamson
EnviroBusiness

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Energise: Sustainable Fuels Algae to Biofuels Roadmap Version 1.0 July 2008

Comment on this roadmap, find collaborative project partners and identify research expertise from members of the Energise Sustainable Fuels Network by emailing energise@envirobusiness.co.uk

	Underpinning	Systems	Integration	
Short Term Actions	<p>KEY ACTION Generate a portfolio of algae strains most suitable for use in open and closed algae-cultivation systems in the UK. This would include native & global, freshwater & marine and micro & macro strains, evaluated for properties such as:</p> <ul style="list-style-type: none"> • yield/g/hectare for open and closed systems; • combustion properties of biomass and bio-oil; • resistance to contamination and species interaction • suitability for use with waste water treatment plants, CO2 sources such as power plants, and industrial process emissions <p>Develop/source specialist sensors and monitoring systems to control and optimise cultivation systems and process production systems</p> <p>Develop/source low cost solid/liquid separation techniques</p> <p>Develop/source low energy/ costs processes for oil extractions</p> <p>Explore the use of catalysts in the conversion of fuel from bio-oils</p> <p>Improve methods to distribute light and nutrients and manage heat in reactors</p> <p>Identify and manage by-products and understand how to optimise algae strain selection to mitigate any adverse outputs</p> <p>Develop methods to control genetic stability in algae reproduction and multi species interaction</p> <p>Increase production process efficiency</p>	<p>KEY ACTION Model, develop and demonstrate open-pond, closed and variable reactors with optimised designs at pre-commercial / proof of concept scale</p> <p>Develop methods to control biofuel combustion emissions and optimise algae strains and fuel production processes to meet existing specifications</p> <p>Reduce production and processing costs and explore more cost effective solutions/synergies with existing industry to accelerate deployment</p> <p>Understand the impact of algae strains and feedstocks on bioreactor designs</p> <p>Produce diesel oil directly from feedstocks</p> <p>Source existing technologies and expertise from other sectors, e.g. water and waste water management, offshore oil and gas engineering, ground source heating</p> <p>Catalogue properties of potential sources of feedstocks in the UK including power plants, waste water treatment plants, large industrial processes</p> <p>Develop methods to control near-shore and offshore marine cultivation systems</p>	<p>KEY ACTION Explore near-term opportunities to collaborate and integrate systems with existing power generation and water sector assets. These include use of reservoirs, anaerobic digestion plants, waste water treatment outputs, captured CO2 and biomass for co-firing.</p> <p>Create lifecycle, process and economic modelling tools to optimise algae to biofuels process. This should consider strain selection, growing conditions and market suitability of end product for power generation, transportation or bio-product use.</p> <p>Evaluate the potential to use the UK's coastal resources for marine cultivation</p> <p>Evaluate the potential of algae for non-fuel primary use and commercial products such as CO2 capture, water cleanup or cosmetics, with biomass as a secondary output</p> <p>Understand two-way environmental, economic and productivity benefits of integrating production facilities with systems, such as water reservoirs, water treatment and power generation plants</p>	
Cross Cutting Actions	<p>Identify and network research and industrial specialists in disciplines and sectors relevant to bio reactors</p> <p>Raise awareness of the algae opportunity and further engage the experience and expertise of relevant sectors such as water, chemical and offshore engineering</p> <p>Develop common protocols and standards at key stages of algae cultivation and processing into biofuels in order to enable trading as commodities and certification of production facilities</p> <p>KEY ACTION Share knowledge and catalyse collaboration between industry sectors, researchers, end-users and policy makers through networking and supported demonstrations</p>			
3-years aims	<p>Identified portfolio of algal strains for use in the UK, evaluated and understood for a variety of purposes</p> <p>Optimisation and modification of algal strains and mixes of strains under development</p> <p>UK algae-biofuel network and organisation established</p> <p>UK technology and expertise being exported</p> <p>Advanced chemical and catalytic processes under test</p> <p>Clear understanding of the opportunity of algae use as a global commodity for fuel, biomass and non-fuel products and as a service for water cleanup and CO2 capture</p> <p>Offshore farming using macro algae being piloted</p>	<p>Algae biomass at least as efficient as existing biomass feedstocks</p> <p>Combustion system and engine being tuned to bio-fuel properties</p> <p>Reliable technologies in operation exploiting existing UK strengths in water, bioscience, chemicals, oil and gas and power generation sectors</p> <p>Trading of working algae cultures emerging</p>	<p>Biofuels performing equal or better than existing fuels</p> <p>Common themes to reactor designs emerging</p> <p>Algae products being consistently produced to specification</p> <p>Open and closed reactor systems optimised for year-round UK resources being developed</p>	<p>Demonstration plants in integrated operation with waste water treatment and power generation plants</p> <p>Large scale demonstration plants operating</p> <p>Scale up to commercial production plants underway</p> <p>Algae in commercial use for CO2 capture and water treatment</p> <p>Public support for algae based biofuels for the UK</p> <p>Commercially viable plants designed and returns on investments emerging</p> <p>Algae based gas, oil and biomass being integrated into mainstream infrastructure</p> <p>Life cycle benefits and economics of integrated systems and bi-products established</p> <p>Public sector support aligned with opportunity for UK industry</p>



About EnviroBusiness

EnviroBusiness was formed in 2005 with the support of the South East England Development Agency in order to help UK enterprises increase their share of the growing global market for environmental services and technologies. We offer an expert and experienced resource dedicated to identifying and exploiting new business opportunities in environmental enterprise.

Our main activities are:

- Linking innovators to potential buyers, sources of public funding and investors
- Building collaborations to facilitate the commercialisation of new technologies
- Forming partnerships to secure funding for sector specific projects and initiatives
- Generating knowledge of global market opportunities for environmental enterprise

Contact us to see how we can give you a competitive advantage:

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