

# Bio-Energy

Biomass is an important source of energy globally and in Scotland and is a central component of EU energy policy. It provides 35% of the energy needs of 75% of the world's population and 20% of the energy needs of Finland and Sweden.



Biomass for Bioenergy can be sourced from co-products arising in the forestry, agriculture, seaweed industries, food processing, the restaurant trade, production of non food crops grown for energy and energy crops tailored for specific end uses. Similarly, there is a wide range of biological, chemical or thermo-chemical conversion technologies that can be used to produce heat, power or liquid transport fuels, including potentially aviation fuels.



A distinctive property of biomass for Bioenergy is that the material can be harvested and then stored for future use so it is possible to develop a sustainable and constant supply of fuel to the conversion plant without interfering with food or forest production.

Scotland has a significant forest cover and well developed forest processing industry. Bioenergy plants can be developed and sized to the appropriate level which can work along-side the forest industry to provide heat and power whilst providing secure employment and enhanced rural development.



Development of the Bioenergy industry in Scotland will contribute to energy security, reduce CO<sub>2</sub> emissions, add to the carbon sequestration potential, enhance the economies of rural areas and help meet renewable energy targets for the key sectors of heat, power and transport.

The strong research base in the ETP universities is well placed to help industry rise to the challenge of developing a sustainable industry.

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## Summary of Bio-Energy expertise in ETP

### Biomass production systems

Sustainable production of biomass for bioenergy is essential to meet the low carbon agenda. ETP scientists are working on agronomy of short rotation coppice, and a range of oil seed crops suitable to grow in Scotland. Micro and macro algal crops are also being investigated. A key barrier to the biological processing of lignocellulosic crops for liquid fuels is being studied and biochemical and genetic solutions are being sought. Land use, life cycle analysis and carbon modelling are all being investigated to ensure the development and deployment of sustainable systems.

### Supply Chain

Harvesting, transport, storage and pre-processing of biomass are key elements in the supply chain which are being studied by ETP engineers.

### Thermochemical Conversion

There is a range of thermochemical process that can use biomass as a source of fuel. Biomass can be combusted, gasified or pyrolysed to produce heat, electricity, transport fuels and even hydrogen. Key issues being addressed by ETP scientists are fuel characterization, characterization of emissions, catalytic processes to convert syngas from gasification into Fischer-Tropsch hydrocarbons.

### Physical-Chemical Conversion

Bio diesel can be produced from crops rich in lipids such as oil seed rape or algae, or animal fats via physical extraction of the oil and then transesterification. Key issues being addressed are fuel characterization, processing the co-products and engine testing.

### Biological Conversion

Anaerobic digestion can be utilised to breakdown organic materials such as vegetable processing co-products, seaweeds or domestic wastes in a controlled process to produce methane. The methane can be burnt directly to give heat, upgraded and injected into the gas grid or converted to hydrogen via steam reforming. All aspects are being investigated.

Fermentation of sugar or starch rich biomass, either from crops or co-products from the biomass processing

industries can be used to produce ethanol or butanol, depending on the type of microorganisms used.

### Microbial fuel cells

These are devices which utilize the catalytic reaction of microbes to convert chemical energy to electrical energy, i.e. the direct conversion of organic matter to electricity using bacteria. These have a range of potential applications including clean-up of contaminated water.

### Expertise

The scientists and engineers within ETP embrace many different disciplines to further their research and development of Bioenergy technologies:

- Terrestrial and marine biomass production systems
- Plant breeding
- Chemical and materials characterisation
- Resource economics and land use studies
- Carbon and lifecycle analysis
- Technoeconomic analysis
- Biochemical processing
- Bioengineering
- Thermochemical processing
- Catalysis
- System design
- Process engineering

### The Scottish Energy Laboratory (SEL)

Energy sector test facilities have been brought together under the Scottish Energy Laboratory (SEL) umbrella. Facilities of particular relevance to bio-energy are:

- ETC mechanical test facility
- Integrated energy materials facility
- Thermal engineering test facility
- Urban-micro renewables test facility

For more details visit [www.scottishenergylaboratory.com](http://www.scottishenergylaboratory.com)