

Fact sheet on Biofuels

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What are biofuels?

Biofuels are liquid fuels derived from non-fossil biomass (recently living organisms and their metabolic by-products). While biofuels are generally thought of as vehicle fuels, they can be used in any application that currently uses liquid fuels, e.g. in generators or cooking stoves. Biogas is also sometimes included as a biofuel when it is used in engines instead of liquid petroleum gas (LPG) or compressed natural gas (CNG). Currently, the two main biofuels are ethanol and biodiesel.

Ethanol is currently produced from sugar crops such as sugar beet and sugarcane, or starch crops such as corn and wheat. Biodiesel is made from plant oils such as soybean oil, palm oil and rapeseed oil.

What is the difference between first and second-generation biofuels?

“First-generation” biofuels employ relatively simple and well-established technologies and use edible food crops as feedstocks. “Second-generation” biofuels use more advanced technologies to capture and convert the energy contained in cellulose from a wide range of feedstocks including poplar trees, grasses such as switchgrass and miscanthus as well as waste. They can reduce the land footprint of biofuel production and improve the GHG and energy balances of biofuels. The technology is considered to be 5–10 years from commercial viability.



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How are biofuels different from bioenergy?

Biofuels are a sub-category of bioenergy, which refers to any energy sourced from non-fossil biomass used for heat, electrical power, or transport. Bioenergy currently

accounts for roughly 10% of total primary energy supply globally but most of this energy is consumed as wood for cooking in developing countries. Biofuels make up only a small fraction of current bioenergy use.



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What is driving the current interest in biofuels?

Concerns about high energy prices, climate change, and the pressing need to foster agricultural and rural development are all strengthening the case for biofuels, both in developing and industrialised countries. Biofuels occupy a unique position at the nexus of energy, environmental and rural development agendas and offer an available technology for (purportedly) reducing greenhouse gas (GHG) emissions from transport without major infrastructural changes. Consequently, biofuels are receiving unprecedented support in the form of subsidies, investments and mandates as governments attempt to maximise the perceived synergies of biofuels.



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What are the main opportunities of biofuel production and use?

Rural development:

2 billion people worldwide lack access to modern energy sources and rely on traditional bioenergy such as charcoal and wood for heating and cooking. This situation places unsustainable burdens on people's health, livelihoods and the environment, and disproportionately affects women and children. Electrification is expensive and may not be cost effective in remote areas. Bioenergy and biofuels offer rural communities in developing countries the double promise of access to efficient, local energy, and the opportunity to grow feedstocks for market to supplement their incomes.

Ecosystem restoration: In some settings biofuel feedstocks can be produced while actively promoting ecosystem restoration by improving soil fertility and water retention. Where native species are used, they may also provide valuable biodiversity habitat and provide an economic incentive for propagation.

Can biofuels reduce greenhouse gases and provide rural development opportunities at the same time?

In industrialised countries, biofuels are viewed as a short to medium term opportunity for reducing the GHG emissions of road transport. However, due to the necessary scales of production and strict product quality requirements, which favour large-scale monocultures and industrial scale production, there are increasing concerns about their

sustainability, in particular the GHG implications of the landuse changes and deforestation resulting from large scale production. Consequently, biofuels produced at smaller scales for local use in developing countries offer more immediate opportunities for delivering environmental and development benefits.

What are the main risks of biofuel production and use?

The impacts of biofuels are linked to risks associated with agriculture in general. Increased demand for some feedstocks has resulted in increased pressure on ecosystems from deforestation and habitat fragmentation, agrochemical pollution and water abstraction. Other, indirect effects, include:

Food security: Aside from small-scale re-used cooking oil initiatives, most biofuels are currently made from edible crops, which threatens food security, mainly by reducing stockpiles of basic food and feed and also by inflating the price of agricultural commodities.

Leakage: It is increasingly apparent that competition for land for biofuel feedstock production has led to a number of indirect effects as other agricultural land uses are displaced or required to intensify to occupy a smaller land footprint. These indirect impacts may adversely affect the net GHG and energy balances of biofuels but they are currently very hard to quantify.

Social risks: Weak tenure and access regimes, and gender inequality in many regions may result in biofuel production marginalizing certain groups such as women and the landless poor.

Many of the risks of biofuel production and use are compounded by unrealistic expectations about the scale of future biofuel production and its contribution to total energy demand.

What tools exist for improving the sustainability of biofuel production?

While large-scale first-generation biofuels have highlighted a number of shortcomings, there are a number of existing tools and approaches as well as potential future technologies that offer ways of significantly improving the ecological, economic and social sustainability of biofuels.

- ☑ Develop more efficient second-generation biofuels to improve energy and GHG balances.
- ☑ Appropriate use of Life Cycle Assessments (LCAs), which enable comparisons between different biofuels; and resource management tools to quantify and minimise or avoid adverse effects on ecosystems.
- ☑ Social equity and gender tools to mainstream the needs of disadvantaged groups and facilitate equitable participation in projects.
- ☑ Certification, standards and product labelling to support markets for sustainable biofuels.
- ☑ Economic tools such as green investments and payments for ecosystem services (PES) that provide economic incentives for producers to follow best practices.



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How is biofuel production linked to ecosystems?

The links between biofuels and ecosystems are many and complex. Production of biofuels relies upon ecosystems to provide the goods (biomass feedstocks, and in some cases biochemical process agents) and services (e.g. pollinators, climate regulation, soil formation and water regulation and provision).

However, biofuel production may have significant negative impacts on ecosystems in much the same way as conventional agriculture and forestry through habitat destruction, agrochemical pollution, the introduction of invasive species and the use of genetically-modified feedstocks.

Biofuel producers can adopt a range of practices that minimize adverse effects on ecosystems, reduce soil erosion, water and fertiliser use, and support biodiversity. Such practices are essential to ensuring the future viability of biofuels but need to be conducted at appropriate scales that maintain ecosystem functions across landscapes.

How much oil can biofuels realistically replace?

Biofuels can realistically only represent 4–7% of world road fuel use by 2030 (International Energy Agency, 2007). However, the implications for ecosystems and livelihoods are generally not factored into energy scenarios.

Biofuels only make sense if combined with major efforts to reduce fossil fuel consumption through dramatically improved efficiency and conservation measures, i.e. driving fewer miles, using more public transport, driving smaller vehicles and introducing radically more efficient vehicles.

Biofuels should not divert attention from other potentially more significant options for sustainable energy and GHG emissions reductions. Examples include: wind and solar energy, liquefaction of stranded natural gas, using smart grids in conjunction with widespread micro-generation and curbing deforestation.

What is the IUCN Secretariat doing on biofuels and bioenergy?

The aim of IUCN's work on energy is to accelerate society's transition to energy systems that are ecologically sustainable, socially equitable and economically viable. To this end, IUCN is:

- Working to fill knowledge gaps and support governments and industry in making well-informed decisions and policies.
- Strongly engaged with biofuel standards and criteria setting processes and provides significant expertise and knowledge on ecosystem restoration and management, establishing robust governance frameworks, managing invasive species risks, ensuring right to land tenure and access. IUCN is a member on the Steering Board of the Roundtable on Sustainable Biofuels (RSB) and heads the environmental working group.
- Providing a balanced platform for informed discussion about biofuels at national, regional and global levels. Stakeholder dialogue and engagement is a crucial part of creating sustainable energy futures.



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