



# BIOENERGY AND BIOFUELS

## DID YOU KNOW?

### SOCIAL



Bioenergy accounted for roughly ten percent of the world total primary energy supply in 2009. Most of this is consumed in developing countries, where between two and three billion people rely on solid biomass (wood, charcoal, agricultural residues and animal waste) for cooking and heating, often in open fireplaces or traditional cook stoves. This causes nearly two million premature deaths per year due to indoor air pollution.

### ECONOMY



Global production of liquid biofuels for transport increased from 16 billion litres in 2000 to more than 100 billion litres in 2011. Today, biofuels provide around three percent of total road transport fuel globally (on an energy basis), with considerably higher shares in certain countries (e.g. about 23 percent in Brazil in 2009). In 2010, biomass generated 1.5 percent of global world electricity and 8 EJ of biomass-based heat were used in the industry sector. According to the International Energy Agency, by 2050: biofuels could provide up to 27 percent of total transport fuel worldwide; biomass could provide 7.5 percent of total electricity generation; and heat from bioenergy could provide, respectively, 15 and 24 percent of the final energy consumption for the industry and building sectors.

### ENVIRONMENT



Traditional use of biomass for heating and cooking can exert significant pressure on forest resources. On the other hand, the International Energy Agency estimates that transport biofuels in 2050 could potentially lead to an almost five percent reduction in energy-related CO<sub>2</sub> emissions, compared to 2005 levels. Further GHG emission reductions could potentially be brought by increased electricity and heat generation from bioenergy, especially by the industry and building sectors. However, the production of bioenergy feedstock can also have negative impacts on biodiversity and water balances, especially in the case of large-scale cultivation for biofuel or woody bioenergy production purposes.

### GOVERNANCE



The food and energy nexus presents several challenges, ranging from conflicting use of natural resources to price surges. While bioenergy is key to energy security in rural areas, large-scale bioenergy production for commercial purposes could pose equity concerns. Depending on governance structures, bioenergy activities could yield beneficial or negative outcomes to the environment and society. Good governance and inclusive decision-making is therefore essential to sustainable bioenergy development.

## Biomass

refers to non-fossil material of biological origin, such as energy crops, agricultural and forestry wastes and by-products, manure or microbial biomass.

## Biofuel

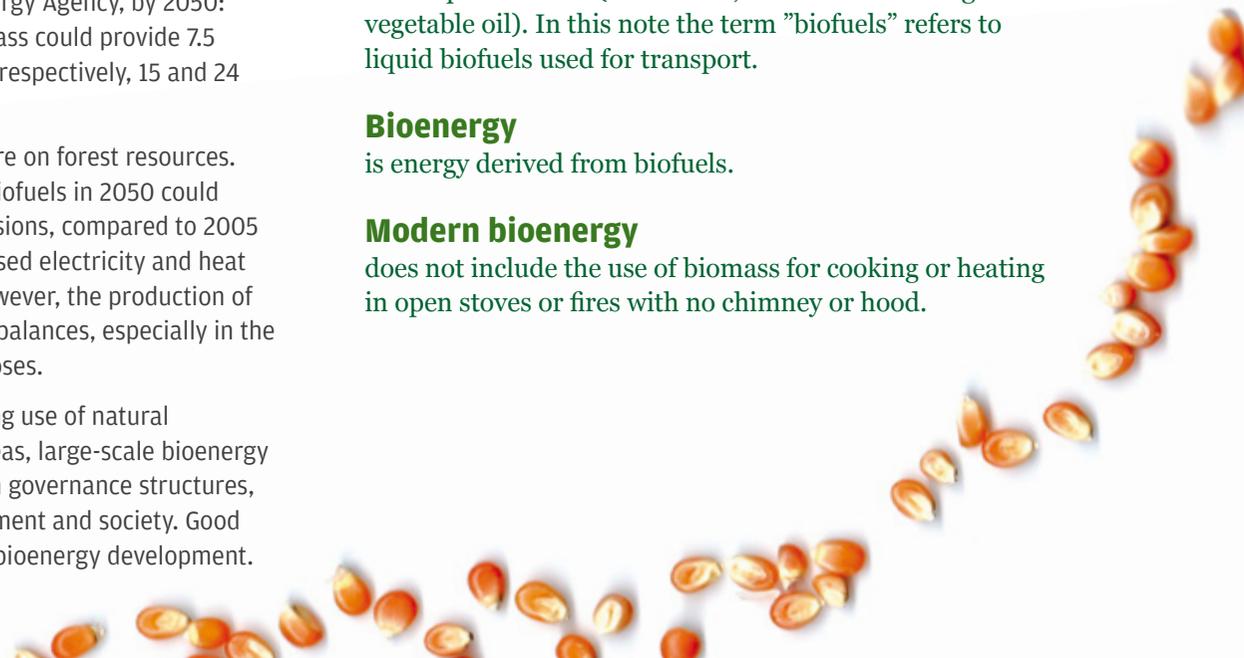
is fuel produced directly or indirectly from biomass such as fuelwood, charcoal, bioethanol, biodiesel, biogas (methane) or biohydrogen. However, most people associate biofuel with liquid biofuels (bioethanol, biodiesel and straight vegetable oil). In this note the term "biofuels" refers to liquid biofuels used for transport.

## Bioenergy

is energy derived from biofuels.

## Modern bioenergy

does not include the use of biomass for cooking or heating in open stoves or fires with no chimney or hood.





## WHY DOES BIOENERGY MATTERS TO SUSTAINABILITY?

- Modern bioenergy can provide new opportunities for modernisation of agriculture and the rural economy. It can improve access to modern energy services for billions of people in developing countries if used in a sustainable way. If techno-economically viable, bioenergy can also contribute to energy security, by diversifying a country's energy mix, broadening sources of supply and reducing energy import bills where nationally produced bioenergy substitutes for imported fossil fuel.
- Compared to fossil fuels, bioenergy has the potential to reduce greenhouse gas emissions because the carbon released during fuel combustion can be recaptured during plant growth. However, actual emission reductions depend on the type of bioenergy production and processing processes, and more importantly, on the location where the feedstock for bioenergy is produced. Converting carbon-rich land (such as natural forests or peat land) to produce bioenergy feedstocks - or to produce other crops displaced by feedstock production - can release more greenhouse gases than the annual emission reductions provided by many years of bioenergy feedstock production on that land.
- In 2008-2010, almost two percent of global arable land was used to produce biofuel feedstocks and 11 percent of the global production of both coarse grains and vegetable oils was used to produce biofuels. The share of arable land and biomass used to produce biofuels is expected to increase in the coming years to five-eight percent. The rising demand for liquid biofuels can put pressure on land (including forests, wetlands and peatlands), water and other natural resources. Biofuel demand is also one of several factors driving up commodity and food prices. Higher food prices particularly affect the poorest segments of the population that spend a large share of their income on food.
- Bioenergy offers opportunities to increase income and employment in rural areas, especially if appropriate measures are put in place to foster smallholder inclusion in bioenergy markets. The increase in agricultural investments driven by the growing demand for biofuels can also stimulate sustainable agricultural development through the development of dual purpose crop, integrated food energy systems and clarification of tenure, should good practices be implemented.



# HIGHLIGHT

## BIOGAS PROGRAMME IN VIET NAM, AN INTEGRATED FOOD-ENERGY SYSTEM

Following the socio-economic reform or “Doi Moi” in 1986 and the resulting land redistributed to peasant households, the Vietnamese Gardener’s Association (VACVINA) was mandated with the responsibility to promote low-capital, high-efficiency, small-scale integrated farm management systems, in which vegetables and fruit production, fish ponds and livestock are closely integrated with biogas production.

In VACVINA households, some products from the garden are used to feed the fish, while the fish pond provides water, mud and slime to irrigate and fertilize the garden. Fish waste is given to animals as feed and animal manure is used as fertilizer for plant and food for fish, as well as for biogas production. Meat, milk, fish and vegetable from the garden are used for household consumption and the surplus sold on the local market. Biogas digesters using animal manure as input generate enough daily fuel for cooking and lighting, and the resultant slurry used as a fertilizer to improve soil quality for vegetable production. Latrines can also be added to the system to enable human waste to be used for energy.

As a financial incentive to purchase a biogas digester, VACVINA offers an earlybird discount which reduces the original price by up to 30 percent. On top of this, a household saves on firewood and synthetic fertilizer, breaking even after ten years. The biogas produced displaces the use of firewood estimated at 2 500 kg per household per year for which families spend between USD5 and USD10 per month. The application of the organic fertilizer reduces the application of synthetic fertilizers by about 50 percent.

Apart from these financial benefits, the farmers’ standard of living increases significantly. Long hours formerly needed to collect firewood can be saved, and respiratory and eye diseases related to smoke decrease significantly. The unpleasant odour of unhygienic pig and manure operations, and the pollution of nearby waterways, vanishes, which does not only serve the farmer but also the environment.

At the same time, integrated agricultural practices increase the capacity to adapt to climate change by increasing farmers’ resilience by making him/her more self-sufficient in terms energy and agricultural inputs, and through income diversification (e.g. if they sell the compost generated through biogas production, or the biogas itself).





## PRODUCERS

- Foster smallholders' participation in bioenergy business models.
- Minimize negative environmental impacts (on biodiversity, soil quality, water availability and quality) and ensure that operations effectively mitigate climate change.
- Consult with local communities on provision of energy for local use, in order to ensure that modern bioenergy production fosters both food and energy security.

## CONSUMERS

- Consider efficient small-scale bioenergy applications for household energy needs.
- Purchase heat and electricity produced from sustainable biomass sources.
- Lobby governments for strict sustainability requirements for bioenergy, including for heat and power production.

# HOW CAN YOU HELP?

## FOOD INDUSTRY

- Make sure that waste residues are used for bioenergy production.
- Ensure that the use of biomass for energy production does not compete with food and/or feed production and the use of agriculture residues for soil fertility.
- Use bioenergy to power operations and recycle local agricultural residues.

## POLICY-MAKERS

- Develop bioenergy policies and strategies based on a thorough assessment of the environmental and socio-economic implications of different bioenergy development pathways.
- Providing incentives for 'good' practices and disincentives for 'bad' practices for modern bioenergy development.
- Appraise proposed bioenergy projects through an assessment of the main environmental and socio-economic effects associated with such investments/projects.

## RESEARCH REQUIREMENTS

- Examine the indirect effects associated with increased biofuel demand, especially in terms of land use change and food security.
- Assess the techno-economic viability and the environmental and social sustainability of integrated food-energy systems.
- Research, develop and deploy advanced (i.e. not first generation) biofuels, including alternative feedstocks and innovative processing technologies.



In order to help countries understand and manage both risks and opportunities associated with bioenergy development, and design and implement sustainable bioenergy policies and strategies, the FAO developed the 'Support Package for Decision-Making for Sustainable Bioenergy: Making Bioenergy Work for Climate, Energy and Food Security'.

For more details: [www.fao.org/bioenergy/28392-0a61de8f511d0a4d08b2137bc929214a7.pdf](http://www.fao.org/bioenergy/28392-0a61de8f511d0a4d08b2137bc929214a7.pdf)