

PUBLIC UNDERSTANDING OF BIOTECHNOLOGY







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Benefits Security of energy supply The finite reserves of fossil fuels means that oil supplies will decline after the point of peak supply is reached in the period 2006- 2007. Prices of petroleum products will rise, impacting particularly on energy-poor countries. All countries will need to develop alternative sources of energy and as a renewable energy source, biofuels could decrease dependency on declining fossil fuels.

BIOFUELS: BENEFITS AND RISKS

Lower greenhouse gas emissions There is much debate over this issue. Whereas

Risks and Challenges Quantities

Biofuel production is insufficient to fully meet the demands for fuel, but can contribute to sustainable renewable energy resources and reduce the demand for fossil fuels. Technological advancement and new generation

"Food vs. fuel" debate

biofuels can increase output.

Can agriculture concurrently provide enough food and biofuel to meet the needs of the world?

Interplot of lossifIarge-scale req areas of land.fuels and may therefore increase greenhouse gas emissions. In theory, efficient production of biofuels and their use could be carbon neutral.technological advancements, biofuels may be able to provide use and their use could be carbon neutral.large-scale req areas of land.Rural developmentBiofuels will provide a new rural industry, increased economic activity in rural areas, more jobs and income generation through labour- intensive agriculture, particularly in Africa.2nd generation biofuels relying on non-food sources such as cellulose from switchgrass could largely avert competition for land and water with food production.Maize and soy (1nd generation sources) requir fertilisers and sourd largely avert competition for land and water with food production.Maize and soy (1nd generation sources) requir fertilisers and production.Cheaper energy imports and should contribute to addressing imbalances of energy resources in countries over the world. All countries have the potential of generating their own fuel from biomass and thereby reduce their dependency on fossil fuels.2nd generation biofuels cources such as algae will not only provide biofuels but it will also provide a renewable feedstock for the chemicals industry, replacing petrochemicals. The use of biomass as a feedstock is already im- pacting on the chemicals industry, in practicalBiofuel crops such as sweet stem sorghum can simul-Higher food proBiofuel crops such as sweet stem sorghum can simul-Some biofuel crops such as sweet stem sorghum can simul-Higher soch as aread food crop for biofuels.	of fossil houseIt has been predicted that with technological advancements, biofuels may be able to provide up to 30% of fuel demands in an environmentally friendly manner, without affecting food production.Producing biofuels on a large-scale requires huge areas of land. Many coun- tries cannot afford to divert agricultural land use away from food production, e.g., Malawi, Rwanda, Burundi, South Africa.TV, as, more bour- ica.2nd generation biofuels relying on non-food sources such as cellulose from switchgrass could largely avert competition for land and water with food production.Maize and soybeans (1* generation biofuel sources) require fertile land, fertilisers and pesticides.pense of untries balances reversed toy reduce2nd generation biofuels can be grown on poor agricultural land, and require low input of pesticides and energy. Some crops such as jatropha can be grown on infertile soil.Food and fuel crops com- pete for the same resources: land, water, chemicals, skilled farmers, capital, infrastructure.rce pout it will the mactical.Food crop residues may be con- verted to biofuel, e.g., maize husks, sugarcane bagasse.Higher food prices occur when food crops are used for biofuels.rce sout it will the mactical.Some biofuel crops such as sweet stem sorghum can simul-Some biofuel crops such as sweet stem sorghum can simul-
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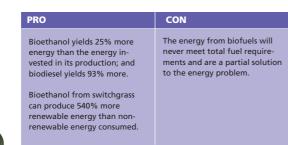
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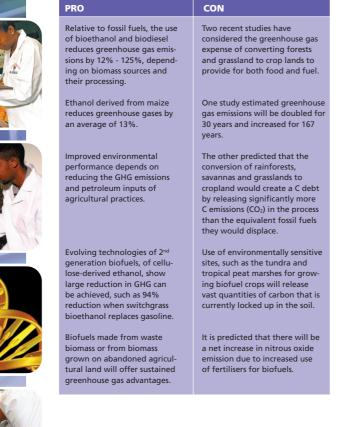
Net energy balance

Biomass production often involves the consumption of fossil fuels. Is there a net gain in energy output? Is it efficient enough to warrant the process? Can biofuel production be developed to the point where zero fossil fuel consumption occurs?



Greenhouse gas (GHG) emissions There is currently a debate as to whether substituting

There is currently a debate as to whether substituting biofuels for petroleum may increase rather than decreases greenhouse gas emissions.



Soil health

PRO	CON	
2 nd generation biofuels can be grown on land with a low agricultural value, having less impact on soil quality.	High quality, rich land will be overused.	
Farmers can reduce nutrient	Marginal lands are extremely	
depletion of soil by allowing	vulnerable to erosion and the	
nutrient rich portions of the	loss of soil health, especially	
plant to decompose into the	under intensive culture of one	
soil.	crop only, i.e. biofuel crops.	
Harvesting can be timed so that	A focus on cellulosic biofuels	
the portion of the plant that is	will remove crop "wastes"	
harvested has relatively low	which are essential to maintain	
nutritional content.	soil health.	
Rotation of crops and good	Complete harvest of the plant	
management will prevent soil	also increases soil erosion by	
depletion.	leaving soil barren.	

Loss in biodiversity

As with any agricultural practice, the risks associated with the exclusive culture (monoculture) of biofuel sources exist, but can be avoided by good management practices. The use of 2nd generation biofuel sources such as native grasses in mixed plantations can improve biodiversity.

Water quality and shortages

Future increases in the cultivation and use of maize for bioethanol may harm water quality due to excessive use of fertiliser. Other rapidly growing bioenergy crops consume more water than natural vegetation or other food crops and consequently water shortages may occur.

Economic sustainability

The production and use of biofuels still require financial incentives such as subsidies and tax credits for both producers and consumers to be economically viable and competitive with petroleum-based fuels. The competitiveness of biofuels currently depends on the relative prices of oil and of agricultural feedstock for biofuels.

Technological advances needed to improve the benefits of biofuels

- Increase biomass of plants. Increase yield of plants.
- Lower agricultural input, i.e., water, fertiliser, agrochemicals.
- Improve management of soil health under intensive agriculture.
- Improve ethanol yield of fermentation processes.
- Develop viable large-scale processes for the production of biodiesel from algae.
- Develop efficient compression combustion engines to use plant oils directly, avoiding the esterification step of biodiesel.
- Improved processing, requiring less energy input from fossil fuel.
- Improved vehicle efficiency.

The PUB programme is an initiative of the Department of Science and Technology and is implemented by SAASTA. The mandate of PUB is to promote a clear, balanced understanding of the potential of biotechnology and to ensure broad public awareness, dialogue and debate about biotechnology and its current and potential applications. For more information visit **www.pub.ac.za** or contact **info@pub.ac.za**, Tel: 012 392 9300 or Fax: 012 320 7803

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