Production of Liquid Biofuels

INSIGHTS FOR POLICY MAKERS

Liquid biofuels are made from biomass and have qualities that are similar to gasoline, diesel or other petroleum derived fuels. The two dominant liquid biofuels are bioethanol and biodiesel (i.e. 80% and 20% of the market, respectively), that together meet about 3% of the global transport fuel demand and are produced using 2-3% of the global arable land. Bioethanol can be produced from sugarcane, corn, sugar beets, wheat, potatoes, sorghum and cassava. In 2011, the largest producers of bioethanol were the United States (63%) using corn, Brazil (24%) using sugarcane, and China. Biodiesel is made from vegetable oils, derived from soybeans, rapeseed, palm seeds, sunflowers, jatropha as well as from animal fat or waste oils. The largest producers of biodiesel in 2011 were the European Union (43%), the United States (15%), Brazil and Argentina (each around 13%).

The advantage of biofuels is that they can substantially reduce greenhouse gas emissions in the transport sector (up to 70%-90% compared to gasoline) with only modest changes to vehicle technology and existing fuel distribution infrastructure. The disadvantage is that, apart from sugarcane ethanol, large-scale production of liquid biofuels based on today's technology and feedstock would compete with food production for arable land and water, with limited expansion potential in certain cases. Also of concern would be the conservation of biodiversity and the risk of important land-use changes. The use of shared international standards is crucial to ensure that liquid biofuels are produced in a sustainable manner, minimising these possible negative environmental and social impacts due to land-use change and competition for food.

In several countries, research is currently working on the development of advanced biofuels (i.e. second and third generation biofuels), which are produced from non-food, cellulosic biomass such as woody and straw residues from agriculture and forestry, fast-rotation plants, non-food crops (possibly grown on marginal, non-arable land), organic fraction of urban waste and algae-based feedstock. These kinds of feedstock require advanced, capital-intensive processing to produce biofuels, but they promise to be more sustainable, offering higher emissions reduction and less sensitivity to fluctuations of feedstock cost. While the production cost of advanced biofuels is still high, improvements in process efficiency and cost reductions are expected from many ongoing demonstration projects in many countries, with small plants in operation and large plants under construction or planned.

Biofuels have been produced since the 1970s, but the market has expanded in the last ten years with a six-fold increase in production. This growth has been driven by mandates and tax incentives for blending biofuels with fossil fuels for energy security and emissions mitigation reasons. In general, today's biofuels are not yet economically competitive with fossil fuels, with the sole exception of sugarcane ethanol which enjoys an untaxed retail price as low as US$ 0.6-0.65 per litre of gasoline equivalent (lge). In terms of market potential, the International Energy Agency (IEA) projects that sugarcane ethanol and advanced biofuels could provide up to 9.3% of total transportation fuels by 2030 and up to 27% by 2050. However, this would require at least a three- to fivefold increase in land use for biofuels production and significant yield improvements in developing countries.

The future of biofuels hinges on a number of factors. The economic viability will mostly depend on the price of biomass and oil-based fuels. A large-scale production of biofuels would increase feedstock demand and prices requiring a global market, a similar situation as for oil today. However, technical advances in the production of advanced biofuels from cellulosic feedstock could make available a broader range of non-food biomass such as agriculture and forestry waste, which could ease feedstock supply and prices, and address certain sustainability issues. Policy measures should be very selective in promoting only those biofuel technologies that substantially reduce emissions, avoid adverse land and water uses, and have positive social impacts.

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