



The Biofuels Market: Current Situation and Alternative Scenarios

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The present market

- Ethanol and biodiesel production is growing rapidly, from 0.4 EJ in 2000 to 0.8 EJ in 2005
- Sugar cane ethanol in Brazil; corn ethanol in US; rapeseed biodiesel in Europe
- Biofuel production and use stimulated by mandatory targets and subsidies
- In US ethanol is used mostly as fuel additive
- 1% of total road transport fuel in energy terms, but impact on food prices and environmental consequences
- Limits of present technology

Technology scenario: Shift to second generation technologies

- **Cellulosic or lignocellulosic conversion (crop residues, grasses, woody crops – widespread and abundant)**
- **At present not competitive: cost 2.1 times higher than the cost of gasoline production. Expectations about future costs vary**
- **Energy output per unit of land: 60 oven-dry ton/hectare → double than present output using sugar cane**
- **Competition for land still exists, but less impact on prices**
- **High oil prices could be a sufficient driver to bring along second generation technologies even if costs do not fall**



Production scenario: No climate policy

- **Strongly growing production of biofuels beginning after 2020 driven primarily by high oil price (oil price in 2100 over 4.5 times price in 2000)**
- **In 2050 global biofuels production reaches 30-40 EJ/year (0.8 EJ/year in 2005). 5% of global primary energy use**
- **In 2100 global biofuels production reaches 180-260 EJ/year. 15% of global primary energy use**
- **Global land area required for bioenergy production in 2100: 700 million hectares**



Production scenario: climate-related constraints

- **Carbon policies will result in an increase in energy prices and in demand for carbon-free fuels**
- **Limited alternatives to power vehicles**
- **Bioenergy will be more competitive, but the entry depends on the relative price of fossil fuels and biofuels**
- **The potential of bioenergy is limited by land availability**
- **Global land area required for bioenergy in 2100: 1 billion hectares**
- **Biofuels production of 90-130 EJ/year by 2050 and 250-370 EJ/year by 2100. 30% of global energy needs**
- **Change in energy-producing countries (from fossil fuels to bioenergy) → potential redistribution of wealth, with negative impacts on the Middle East and Russia and the most positive impacts on Latin America and Africa**



Intellectual Property Rights

- **New private sector biofuel technologies will be under tight IPR protection**
- **Refineries will require large investment up to \$ 100 million per facility. They will be located near biomass production areas**
- **ToT will be limited by the scale of operations**
- **Capital intensity could be a driver in concentrating production in fewer countries**
- **FDI is expected in biomass producing regions**





Large scale use of alternative first generation feedstocks: Jatropha

- **Jatropha generally survives drought and flood, but no miracles!**
- **Main use: to power simple engines**
- **It could become the feedstock of choice for the EU, without involving exceptionally large cultivation areas**
- **For this to happen, improvements are needed. Countries like China, India and Indonesia seem better placed than African countries**
- **Should large scale production of jatropha for fuel use take place, a market should be found for its by-product, glycerin**
- **Biodiesel cost estimates using Indian jatropha vary from 0.4 to 0.65\$/litre, cheaper than using palm oil from Malaysia, and much cheaper than using soybean from US and rapeseed from Europe**
- **Using jatropha as a feedstock for large scale biodiesel production will lessen pressure on the other seed oils used both for food/feed or for energy**



Trade scenarios: Unrestricted trade

- **Largest biofuel producers: Latin America, Africa and US because of low land prices and high biomass productivity**
- **Global demand will be supplied by those regions with the lowest cost of production**
- **Production expands in other regions only when the cost of biofuels rises in a low cost region due to the rise of land prices**
- **Bioenergy exports are around 18 EJ/year in 2050 and around 125 EJ/year in 2100**



Trade Scenarios: Restricted trade

- **Policies that block or distort trade will change where biomass is produced**
- **Almost all regions of the world will produce bioenergy. Main producers: Latin America, USA, Africa and Europe**
- **The level of global bioenergy production is lower in comparison to unrestricted trade**



THANK YOU

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