Algae-based biofuels:

Challenges and opportunities for developing countries

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"Aquatic Biomass: Sustainable Bioenergy from Algae?"

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FAO views on sustainable biofuel development

- Protect the poor and food insecure
  - assess bioenergy potentials in light of food security risks – tenure, access
- Ensure environmental sustainability
  - good practices for soil, land, water, biodiversity
- Invest in rural development and innovative production
  - 2nd-generation technologies, adapted crops, processing infrastructure, integrated and diversified system approaches, algae-based biofuels
- Adjust current biofuel policies
  - reduce distortions and trade barriers in EU, USA, support frameworks
- Coordinate domestic bioenergy policies/strategy
  - international forums - agriculture, environment, trade, energy

FAO and algae-based biofuels

- FAO Inter-Departmental Working Group on Bioenergy reviewed the state-of-knowledge on ABB to assess relevance and potential applications in developing countries
- FAO review paper on algae-based biofuels: challenges and opportunities for developing countries - finalized in May 2009

Macroalgae 1/3

- Seaweed can be grown directly in the open sea
- Japan and China are still the main producers of cultured seaweed, mainly used as a food product
- Part of the current seaweed production comes from harvesting natural populations or collecting beach-cast seaweed: unsustainable for application on a very large scale
- Techniques are usually labour intensive and restricted to regions with the lowest incomes

Macroalgae 2/3

- For energy production, growing seaweed species attach to underwater ropes or similar support structures (floating, anchored to the sea or both). These can include a slow-release fertilizer.
  Problems of damage to rope structures and washed off biomass have been reported

- For large scale cultivation (1000s ha), a system that is simple, low-cost, low maintenance, and has a high light capture, productivity, resilience to climatic conditions, and durability, while allowing easy harvesting and replantation, is a great challenge

- Availability of existing offshore infrastructure (oil and gas platforms/pipes; offshore wind turbine parks) is key

Macroalgae 3/3

- Only the utilization of the entire biomass is an option (conditions in the open sea not easily controlled for production of alkanes, lipids or H_2)
- Reith et al. (2005): after economic analyses of anaerobic digestion, ethanol fermentation, HTU and super critical gasification, conclusion is that only anaerobic digestion allowed for a feedstock price to be paid
- Distance from shore is important, as it implies energy and time spent on transportation (fresh seaweed contains around 90 percent water). Pressure filtration removes around 20 percent of the water. Treatment of the released press water still needs to be addressed

Outcomes and challenges 1/2

- ABB hold promise for developing countries ... but probably not in short- or medium-term
  - new industry, potential to generate jobs and income, energy mix
  - developing countries are often situated in regions suitable for algae cultivation (solar, low labour costs, availability of suitable land esp. arid zones)
  - need for assessments of potential suitability in developing countries
- ABB requires capital investment, technology capacity
  - economies of scale are significant for ABB
  - access to foreign investment is limited or unreliable
  - technologies require high levels of engineering expertise which will probably remain limited in lower income countries

Outcomes and challenges 2/2

- Capacity requirements:
  - productivity gains require innovation, knowledge, experience with industrial processes
  - operation, maintenance, processing can be mostly done without specific educational requirements

- Knowledge gaps:
  - due to limited industrial scale experiments, insufficient knowledge to judge accurately economic viability
  - productivity data often extrapolated from limited experiments; is varied and lacks consistency
  - analysis of energy balances, GHG balances and CO_2 abatement potential, sustainability impacts

Thank you

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