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Multi-Disciplinary Framework for BioEnergy Assessment

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Bioenergy assessments have been characterized in the past by poor availability and quality data, an over-emphasis on potentials and availability studies instead of feasibility assessment, and lack of comprehensive evaluation in competition with alternatives – both in competing bioenergy options. The BioEnergy Atlas addresses some of these deficiencies, and identifies specific areas of interest where future research and effort can be directed.

We develop an approach that successively constrains biomass that is potentially available with environmental, social, financial, technical, and economic constraints, leading to an objective selection of appropriate feedstocks, land allocation, technology, and feasible projects for detailed investigation. We discuss methodology, availability of biomass and potentials, and the feasibility results of four case studies in respect of biomass application: (1) co-firing of woody biomass for electricity generation; (2) use of oil-bearing crops for biodiesel production, (3) applications for organic components of domestic solid waste and wastewater; and (4) use of woody biomass as a feedstock for an existing CTL refinery.

Findings include

- Availability is not a fixed quantum. Availability of biomass and resulting energy products are sensitive to both the exclusionary measures one applies (food security, environmental, social and economic impacts) and the price at which final products will be competitive.
- Availability is low. Even without allowing for feasibility and final products costs, the availability of biomass is low.
- Waste streams are important. There are significant waste streams from domestic solid waste and sewage, some agricultural production, and commercial forestry.
- Rural firewood use is problematic. This is a significant resource, plays a large role in the energy budget of poor and rural households, and current use means that it will have little impact on the GHG emissions balance.
- Process technologies are not all mature, cost-competitive or efficient: We have investigated 52 different process technologies in respect of costs, economy of scale,

energy efficiency, greenhouse gas emissions and job creation impacts and maturity of technology.

- Solutions are probably ‘packages’. One has to balance the diversity of available resources streams and processing technologies against the need to focus resources on development of critical mass (workforce skills, support industries, expertise). Combining feedstocks and aligning with other government initiatives or subsidies can achieve such critical mass more easily.
- Solutions must be robust in future too. Feasibility studies that focus on the current situation only ignore the fact that future sustainability is strongly dependent on assumptions on relative economic growth (influences household and industrial energy consumption, and the limiting cost for energy), cost of capital and inflation (affects choices of labour – or cost of capital and industries), exchange rates and fossil fuel prices (huge effect on selection of alternatives).
- The most promising biomass source is medium-term mining and eradication of invasive alien plants, but this source is limited in time and if exploited as proposed, will not be available after about 20 years.

There is a need to focus research and development efforts in respect of specific technology / feedstock combinations that show future promise.