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Certification of Forest Fuel Production

Task 31 produced a Technology Report 'Certification of Forest Fuel Production Systems: a Solution for Sustainable Use of Biomass from Forest Residues for Energy' prepared by the Task Leader J. Richardson, R, Björheden, and C.T. Smith for ExCo56 in Dublin.

Overview

In many parts of the world, energy supply is either insufficient and too expensive, or dependent on non-renewable and environmentally undesirable fossil fuels. While the lack of energy is a main obstacle to development and progress, the same regions often have abundant but under utilised biomass resources. The energy supply problems can be addressed by utilising biomass for energy, a main source of biomass being forests and forest plantations.

Ongoing concerns about the possible environmental, economic, and social effects of greatly increased use of forest biomass for energy may create obstacles to clear commitment from decision makers. Third party certification has become an increasingly accepted tool for satisfying customers that forest products such as lumber, paper, and panelboard originate from sustainably managed forests. Existing forest certification schemes could readily incorporate forest fuel as a certified 'green' product, taking into consideration such criteria as site productivity, other environmental impacts, carbon neutrality, energy balance, economics, and social considerations. While other components of the energy supply chain also need to be considered, assurance of sustainable 'green' fuel production could lower the barriers to increased use of forest residues for energy and increase renewable energy supplies. This paper offers a preliminary analysis of criteria to incorporate in a certification procedure for forest energy, which would facilitate increased use of biomass for energy in many regions of the world today.

Forest Energy Production Systems

The supply of energy is a critical factor for welfare, development, and social stability [1]. Globally, forests are the main source of energy for domestic use and also provide energy for many industrial processes [2]. The use of forest (and other) biomass for energy production does not increase greenhouse gas (GHG) emissions, provided that the fuel is harvested from sustainable practices where the harvested biomass is replaced through equal or greater growth in the remaining forests.

Yet, the forest cover of the world has been declining at an exponential rate for several decades [3]. Clearly, practices of forestry, of forest harvesting, and of forest energy production systems must be developed further, for societies to be able to draw full economic, social and environmental benefits from such systems. On the other hand, while non-sustainable forestry systems may deter more widespread use of forests as a source of energy, there are many examples underpinning the fact that forestry practices can be developed that enable sustainable, simultaneous production of wood and fibre for industry, energy crops, and other, non-wood forest products [4, 5].

Development of such sustainable forest energy production systems can be stimulated through analyses of existing practices combined with applied research and development efforts. However, efficient dissemination of the results is needed to bring the new, improved technologies and methods into practice. Task 31 is dedicated to the development of sustainable forest bioenergy production systems, and to the dissemination of technical information to key stakeholders who fill various roles along the supply and value chain, including capital venture organisations and policy makers.

Local and regional factors including physiography and forest ecosystems, culture, and energy needs strongly affect the suitability of alternative bioenergy supply systems. Developed, urbanised countries with a strong industrial sector pose different demands on forestry than developing countries relying on a more traditional, agricultural economy. For example, there are vast differences between systems characterised by women gathering firewood for their families in the Ethiopian countryside and the operations in the mountainous forests of the US Southwest seeking to reduce the risk of wild fire resulting from decades of no forest harvesting and hazardous forest fuel accumulation [6]. In spite of such obvious differences in drivers of forest management activities and utilisation of forest biomass for energy production, Task 31 and associated efforts have demonstrated the ability of operations research and systems analysis procedures to evaluate and therefore improve the net efficiency of alternative production systems, and at the same time evaluate the resulting outcomes in environmental, economic and social terms, which can lead to ranking and selection among alternatives [7]. The development of sustainable forest management systems certified by third party audit will necessarily include assessment of biological and ecological, social, and economic criteria within an overall framework provided by Environmental Management Systems (EMS) inherent in International Standards Organization (ISO) 14001 and Forest Stewardship Council (FSC) certification schemes which also necessarily incorporate provision for Adaptive Forest Management [4]. Thus, to be regarded as sustainable, a production system must meet the following criteria.

- Environmental, biological, and ecological criteria. The production system should not entail depletion of water or nutrient resources, diminish biological diversity, or lead to a build up of toxic substances in the ecosystem.
- Social criteria. The production system must be socially acceptable and appropriately consider social and institutional issues such as land tenure and customary rights, fair returns and benefits to the local society, and a safe and healthy working environment [8].
- Economic criteria. The efficiency of the production system, measured as the output/input ratio for resources created versus resources utilised, must be attractive when compared to the alternatives. The analysis may include appropriate costing of non-commercial resources such as clean water, air, or aesthetic values.

Development and deployment of a framework for sustainable forest management for bioenergy production, which incorporates elements of certification and third party audit, and leads to continual improvement via Adaptive Forest Management is an essential step which can contribute to the development and establishment of sound methods and systems for the sustainable production of forest energy. Sweden and Finland have both developed very comprehensive production systems for forest energy, mainly based on residual wood from industrial manufacturing processes and from logging operations. In the last three decades of development, both countries have applied a number of techniques to test the sustainability of the new systems. The overall goal is to improve current systems and to select the most sustainable, attainable solutions. Examples of techniques used are EMS (Environmental Management Systems), LCA (Life

Cycle Assessment), EIA (Environmental Impact Assessment) [9] and other, less complex and comprehensive, indicators such as the ratio of fuel consumption/produced unit. While these assessment tools are useful for comprehensively evaluating alternatives, it may only be possible to assure the sustainability of forest energy production systems, and to relieve the doubts and concerns of energy consumers about the use of biomass for energy from the forest, through forest certification.

Forest Certification

Forest certification has the purpose of providing an independent, third party audit of forest management systems, often more broadly termed EMS, with respect to stated management objectives, including environmental soundness and sustainability. The evaluation is provided through private organisations such as the American Forest and Paper Association (AF&PA), ISO or FSC [10]. Adherence to such schemes has been voluntary rather than government enforced, and is increasingly seen as a marketing strategy leading to enhanced public acceptance of 'green' forest products that are independently certified as coming from environmentally sustainable management of forest lands.

Existing forest certification schemes vary in their details. Although most are basically voluntary, the AF&PA requires certification under the Sustainable Forest Initiative (SFI) scheme of its members. Geographic scope varies: FSC certification is used by all types of forest ownership around the world; SFI is primarily focused on industrial forests in the United States and Canada; the Program for Endorsement of Forest Certification schemes (PEFC) provides for assessment and mutual recognition of national forest certification schemes primarily in Europe. FSC certifies forest management systems based in countries as widely dispersed ecologically and geographically as Brazil, Canada, South Africa, the United Kingdom, and the United States. [10]

Multiple stakeholders are typically involved in development of EMS assessment standards, as well as the certification, audit, and verification procedures applied to individual forests managed by private families or forest industry. Public consultation is commonly part of these processes. However, not all schemes provide for public disclosure of evaluation results. Standards address environmental and silvicultural criteria, as well as, in many cases, social and economic issues. Most schemes assess performance on the ground as well as examining internal management systems, with the notable exception of ISO 14001 which does not specifically address field aspects of forest management [10].

Where applied in certification schemes, chain of custody tracking follows the forest products through each stage of manufacturing and distribution to the final consumer. However, EMS certification schemes do not necessarily include chain of custody provisions. Such systems are more appropriately applied to forest products sold by wholesale or retail outlets where merchants believe 'green' product labelling has important market benefits. While there are some advantages to certifying forest products, including biofuels, at the wholesale or retail end of the value chain, complex feedstock supply and procurement systems often realistically only result in vendors being able to certify that some proportion of their products come from sustainably managed forests. Having both EMS focused on forests and chain of custody focused on products traded in the open market makes sense.

FSC has perhaps the most widespread impact globally. It has certified about 3600 companies in 75 countries, involving about 50,000,000 ha of forest land; FSC has about 500 member organisations in 59 countries. SFI, by contrast, has certified 57,000,000 ha in the United States and Canada, of which 42,000,000 ha have been third party audited; AF&PA recognises 45 'organisations supporting the goals of the SFI Program.' [10]

Instead of performing a full evaluation of sustainability criteria for each market transaction or choice of system, different certification programs act to ensure that a certain system or product fulfils basic requirements of sustainability. In the forestry sector, social issues are not yet fully addressed since certification issues have so far been mainly designed around environmental rather than social criteria due to pressure from environmental groups. Both FSC and PEFC do, however, include social criteria in their certification standards. The evaluation of economic criteria is incomplete in most current certification programs and may need to be developed through consideration of more levels of the economy [11]. Economic criteria that are seldom part of certification programs pertain, for example, to the degree of integration between different production systems which can often enable more efficient use of resources. All certification schemes applied to individual, private, or industrial ownerships essentially assume financial survival or failure will be an adequate indicator of the economic sustainability of the system being certified. However, this scale of evaluation clearly fails to address economic criteria that might be essential to ensure economic sustainability at community, regional, or national levels of resolution, and will fail to understand the implications of globalisation of forest industry or energy markets on local economic development.

To date, forest certification has been applied to forestry operations producing conventional products such as lumber, paper, and panelboard. It is relatively straightforward to affix 'green' labels to such solid products or to secondary products derived from certified forests, such as furniture, magazines, or houses. While it might be more difficult to affix 'green' labels to energy products such as electricity, heat and liquid fuels derived from forest biomass, the forestry systems from which forest fuels are produced generally involve 'conventional' forestry systems, and could therefore be certified under EMS developed for forests managed for a different array of goods and services. Labelling issues should not be insurmountable either, given the current marketing of 'green electricity' in a number of countries, and environmentally friendly gasoline (bioethanol blends) and biodiesel.

Two companies in South America produce forest biomass for energy purposes from forest lands whose management has been FSC certified. V&M Florestal Ltda, and Plantar S.A. Reflorestamentos, operating in the State of Minas Gerais in Brazil, grow eucalyptus in short-rotation plantations specifically for the production of charcoal used in their steel production operations. About 128,000 ha of V&M eucalyptus plantations (producing 1,280,000 m^3 of charcoal annually) and 23,000 ha of Plantar eucalyptus plantations have been certified according to FSC principles and criteria [12, 13, 14]. The authors are not aware of other cases of certification of forest biomass production for energy at present.

The criteria that should be used for evaluation of forest management systems including energy as an end product are essentially the same as for systems producing only conventional products. They fall into the four main categories mentioned above: environmental, silvicultural, social, and economic. Environmental criteria include sustainability of soil and site productivity, hydrologic values, biodiversity and forest habitats. Broader environmental criteria such as carbon neutrality and energy balance of the complete system should also be considered, since one of the major premises for the wider adoption of bioenergy is its offer of an environmentally friendly substitute for fossil fuels. Silvicultural criteria include protection of natural regeneration, improvement of conditions for reforestation, and reducing the danger of natural disturbances such as wildfire and insect and disease outbreaks. Social criteria relate mostly to employment, rural development, rights of indigenous people, and attitudes of urban populations. Economic criteria used to assess the sustainability of forest management systems for energy production are often linked to the sustainability of soil and site

productivity, but must also consider the potential for employment, rural economic development, the competitiveness of forest fuels versus fossil fuels, the effectiveness of government financial or market incentives, non-market values such as air and water quality, and future market trends, however difficult to forecast.

Integration between different production systems should also be considered. Forest industry and energy sectors should be integrated to utilise industrial residues. Forest energy procurement should be integrated with conventional logging and forestry practices. Energy production and silviculture can be integrated for land restoration and ash recycling to sustain soil productivity [4].

Certification of forest energy products is essentially similar to certification of conventional forest products. Suppliers of energy products ranging from firewood and logging residues to biodiesel, heat, and electricity could certify that feedstocks were derived from forests managed under certified EMS. Chain of custody tracking could be applied as for conventional products, though recognising that feedstocks used to manufacture the end product of heat, electricity or liquid fuel will often represent a mixture of materials derived from certified and uncertified sources. With present green power schemes, a proportion of consumers seem willing to pay a premium for such mixed-source energy products. Forest certification, increasingly widely recognized by the public as a 'green' stamp of approval on paper and wood products, can be expected to enhance the acceptance of forest bioenergy.

Future Directions

Increasing the amount of forest biomass contributing to reduction of net emissions of GHG and global climate change, through reduction in use of fossil fuels and expansion of renewable energy supplies, will be possible if socially acceptable and sustainable production schemes can be developed and deployed. The mission of Task 31 is to develop such systems, as applied to conventionally managed forests throughout the world, and to contribute to system deployment through technical information dissemination.

The probability that forest management systems to produce energy will gain social acceptance will be increased through the application of certification schemes involving independent, third party audit of EMS developed for forest operations. In addition, development of chain of custody schemes for certifying feedstocks of energy products were derived from sustainably managed forests can make an important contribution from the market end of the value chain. Chain of custody schemes will be increasingly important as energy feedstocks and products are traded globally.

International research and development programs should focus resources on the development of scientifically valid technical information necessary to underpin certification of forest bioenergy production schemes and products.

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