Forest energy and certification in Sweden and Europe

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Abstract

Different certification standards, address different needs. Well known examples are the ISO 9000 and ISO 14000 families of management standards, offered by the ISO (International Organisation for Standardization). Some standards mainly concern the need for technical specification and quality assurance; others provide user safety assurance while others certify that specific rules of production have been adhered to for one or several tiers of the supply chain. Certification aiming mainly at business administration and production management will not be dealt with in detail in this paper. Instead, it is focused on certification of sustainability and purposefulness of systems used to produce solid biomass for energy purposes, mainly as solid biofuels, and in particular from forestry.

It is put forward that it is advantageous for many reasons that such certification should be based on existing standards for forest management. These are typically of the Chain-of-Custody (COC) type, meaning that an agreed set of standards is applied throughout the supply chain. Of twenty or so available standards for forestry and forest products, there are two standards that are of main interest in northern Europe: FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification schemes). Both standards are resting on the three fundaments for sustainability: economy, ecology and social values. The current standards regarding forest energy of the two major certification systems are described. Furthermore, illustrated by a Nordic example, an evaluation of how the utilisation of forest energy affects economy, ecology and social values is made.

Keywords: solid biofuels, forest fuels, certification, standardisation, sustainability, forestry

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Introduction

Certification has become an increasingly important factor in various situations; business, management, trade, environment and ethics are some of the issues that can be certified. The certification is normally audited by a separate, third-party organisation, that checks and verifies that the enterprise comply with the certification rules. There are several organisations that provide certification.

The basic idea behind certification is the same as for any standardisation and quality control through technical and economical standardisation, to minimise friction of transactions through common rules of measures, procedures etc that have been agreed beforehand. Through certification, the customer is guaranteed that a product or service incorporates certain defined properties, and these properties do not have to be independently investigated for every transaction.

The most important areas for certification concern technical and administrative specification. ISO (International Organization for Standardization) is the world's largest developer of standards. Although ISO's principal activity is the development of technical standards, ISO standards also have important economic and social repercussions. There are two different, widespread types of ISO certification standards, the ISO 9000 and ISO14000.

The ISO 9000 family is primarily concerned with "quality management", i.e. what an organization does to fulfil:

- the customer's quality requirements, and
- applicable regulatory requirements, while aiming to
- enhance customer satisfaction and value added through logistic services, and
- achieve continual improvement of its performance in pursuit of these objectives

In the field of technical certification of biofuels, the European Committee for Standardisation (CEN) currently carries out some very important work. Technical Committee 335 (Solid Biofuels) are currently, under leadership of the Swedish Standardisation Organisation, SIS preparing some 30 technical specifications for solid biofuels including classification, specification and quality assurance of solid biofuels (Alakangas, Valtanen & Levlin 2005). The classification will be based on origin and source (woody biomass, herbaceous biomass, fruit biomass and mixtures). The specification and quality assurance on detailed technical material characteristics of major traded forms such as briquettes, pellets, olive cake, wood chips, hog fuel, logs, sawdust, bark and straw bales. Significant properties such as calorific value, dimensions, mechanical durability, moisture, ash and sulphur content etc. is covered and classified by the standard. The specification will enable producer and consumer to make case-specific agreements on specifications that may be objectively controlled. The standard will be of utmost importance both to simplify transactions and assure overall quality as international biofuel trade increases. An interesting feature is that the standard will be coupled to CEN/TS 15234 which covers fuel quality assurance and quality control. This means that traceability is guaranteed and that the full supply chain from source to end consumer is controlled and specified.

The ISO 14000 family is primarily concerned with "environmental management". This means what the organization does to:

- minimize harmful effects on the environment caused by its activities, and to
- achieve continual improvement of its environmental performance.

However, the ISO 14000 certificate mainly rates the structure and methods of environmental management in an organisation, and does not define and grade actual performance.

For land based products, e.g. from forestry, certification has received a lot of attention in the last decades. But to other sectors, certification is not a new phenomenon. In the U.S., Underwriters Laboratories have been setting standards and certifying safety for electrical appliances for almost a century (Meidinger, Elliott & Oesten 2003). What is striking about forest certification is not the novelty of the idea itself, but that non-governmental organisations have replaced the public sector in performing the certification functions, largely to guarantee public credibility.

Obviously, it make no sense to certify a forest as such. Instead, forest certification means that the people and organisations responsible for the management of a forest are doing their job properly. To achieve this, we must have a common understanding of what proper forest management means. Further the quality of forest management by the party applying for certification must be assessed by unbiased expertise who will certify that the forest is properly managed or withhold certification if this is not the case (Meidinger, Elliott & Oesten 2003). Thus, as compared to e.g. the ISO environmental standards, forest certification systems normally also define performance levels and achievements. That a forest product is certified as sustainable means that it has passed rigorous guidelines for responsible harvesting, ecosystem management and conservation, and long term sustainable management (Massachusetts Technology Initiative 2005).

Presently, there are around 20 different forest certification programs, of which only a few are affiliated with agencies and ministries (Meidinger, Elliott & Oesten 2003). There are three major standards for forest certification, SFI (Sustainable Forest Initiative of American Forest & Paper Association), FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification schemes). Together, they are currently certifying around 250 million hectares of forestland as properly managed. From a European perspective, the two most significant systems are FSC (60 M ha) and PEFC (130 M ha). Both systems have basic rules that define sustainable forestry in general terms and then allows for specific national regulations.

The objective of this paper is to analyze plausible certification regulations for utilizing bioenergy and especially for energy based on forest biomass. The FSC and PEFC certification schemes will be examined and a further look at how forest energy utilization may affect the general principles of sustainable will be made.

The overriding rationale behind substitution of fossil fuels for bioenergy is to reduce the risk of detrimental climate change. Further, the development of bioenergy technologies is part of a drive for increased sustainability. The aim is to end the dependence of limited resources and to develop technologies with as small negative impact on the environment, and on the liberty of action of future generations, as possible. Although any type of biomass may be used to this aim, forest biomass plays the dominating role. Great importance is attached to forests and forestry as a means of fighting fossil GHG emissions and in the development of sustainable bioenergy systems. The role of forests in this struggle is not only due to its' potential as an alternative energy source with the ability to re-circulate carbon, but also through its' potential to stock carbon either directly in the forest ecosystem or in wood-based products. The principal workings of the forest and forestry systems from a carbon balance perspective are outlined in Figure 1. As seen in the figure, the forest ecosystem contains three main pools of carbon; live biomass, detritus and soils. When forestry converts live biomass into products, additional carbon pools appear in the form of more or less durable products or in landfills. All carbon pools leak carbon to the atmosphere, but only live biomass assimilates carbon from the atmosphere. The use of fossil fuels introduces fossil carbon to the atmosphere in an extent that is not balanced by this assimilation (Vine, Sathaye & Makundi 1999).

(FIGURE 1 AROUND HERE)

Forest management practices may be used in three principally different ways to decrease influx of carbon dioxide into the atmosphere:

1. Management for *carbon conservation* (of existing carbon pools in forests including forest preservation, fire and pest control etc.)
2. Management for *carbon sequestration and storage* (increased area and carbon density of forests, increased use of durable wood-based products etc.)
3. Management for *carbon substitution* (transfer of forest biomass into materials and products that can replace fossil fuel based energy and products)

When biomass is used in place of fossil fuel, net greenhouse gas (GHG) emissions are reduced, as long as the carbon dioxide produced through combustion of biomass is assimilated by new, growing biomass. But bioenergy is not truly GHG neutral since more or less GHG intensive inputs of energy are normally needed for the production, handling and transport of the biomass. Thus, the GHG balance of alternative production chains need to be audited to ensure efficiency in GHG savings. In light of the aim to increase sustainability, it would be counterproductive to promote development of such practices and use of bioenergy that involve serious risk for environmental damages or that may cause unacceptable social effects. For example (LowCVP 2005), production of bioenergy crops on cleared virgin forest land may ‘have implications for both biodiversity and GHG emissions. Large monocultures of bioenergy crops may impact on local biodiversity or place unacceptable demands on water resources.’

In conclusion, certification is needed to ensure that we ‘get things right’ and, due to the likely imperfections of the emerging alternatives, to provide decision support for choice of technology and for perpetual improvement of the chosen alternatives. A certification system for bioenergy must cover carbon balance issues as well as wider sustainability issues such as biodiversity, sustained yield (nutrients, soil and water management) and social issues such as health and safety, fair pay and equal opportunities. This puts bioenergy in the same class of commodities as other land-based products. Although it is possible to construct accreditation systems for bioenergy *per se*, it would also be advantageous if for bioenergy from forestry, the certification dovetail with existing and accepted forestry certification schemes to prevent confusion and duplication. This approach is discussed further in the following section.

Forest certification

The two major international standards of forest certification, FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification schemes) are fundamentally very similar. They are base d on the basics of sustainable forestry as outlined at the Rio summit (United Nations 1992). They endorse the promotion of sustainable forest management resting on the three principles:

- economically viable management of forests for present and future generations
- environmentally appropriate
- socially beneficial

For Swedish conditions both standards state that the forest management should make sure that (the quotation is from FSC 2003, but similar regulations can be found in PEFC 2005):

- *Extraction of biofuels complies with the recommendations of the National Board of Forestry and the volume removed is documented on a stand level. Fertilizing/ash recycling to compensate for biofuel extraction, liming of forest land, and revitalization fertilizing is carried out in accordance with regulations, general guidelines and recommendations of the National Board of Forestry*

The forest owner should in addition keep records of biofuel extraction on stand level. In the FSC standard there is also a general paragraph (FSC 2000):

- *Extraction of biofuels should not be made in such ways that it impairs the conditions for biological diversity*

So the recommendations from the Swedish National Board of Forestry are of vital importance. The Forestry Act states:

- *Under regulations issued by the Government, or public authority designated by the Government, a forest owner is obliged to notify the Regional Forestry Board of:*
  (i) felling operations and ***removal of logging residuals for fuel****, to be carried out on his land;*

In the Board's recommendations the following sentences are the only ones referring to utilization of biofuels (Swedish National Board of Forestry 1998):

- *Leave the needles in the forest and do not utilize other parts than the stem wood more than once during a rotation*

or

- *Compensate by fertilizing with nutrients (primarily using pure wood-ash)*

There are also some statements about the maximum supply of ash during a rotation (3 tonnes dry matter per ha) and in what form (stabilised and slow soluble).

All in all, the certification standards do not in any way prohibit the utilisation of forest fuels. Finland has similar certification rules. To some extent stumps are extracted in Finland for utilisation as fuel, which require more precaution as the risk of damages and other negative consequences are likely to be higher in comparison with when only above-ground biomass is extracted.

Effects of forest fuel utilisation on sustainable management

Possible effects of the utilisation of logging residues for energy may be examined through the consequences of the practice to sustainable forestry, for each of the three main criteria of sustainability; economy; ecology; and social values.

Economy

Forest fuel utilisation is primarily positive to the economy. An additional assortment means an additional income. However, another positive consequence is that the removal of the harvesting debris facilitates the subsequent operations of regeneration. Planting, and to some extent also soil scarification, is much easier and therefore less costly on an area cleared from harvesting residues.

The major concern to the economy is the long-term productivity of the soil, and hence the long term economy. The removal of branches and tops add to the drainage of nutrients from a stand that harvesting implies. As long as the natural long-term soil nutrient status is maintained, the long-term productivity is secure; if not it will be jeopardised.

Studies have shown that even on fertile sites there is a risk of over-utilisation (Sverdrup et al 2002). The recommendation to leave harvest residues for one season to let the needles fall off the branches is due to this reason. The needles contain relatively more nutrients than the lignified parts.

Ecology

The most positive ecological effect of using forest energy is ot found in the stand or even within a region, but on a global scale. The substitution of fossil fuels is increasingly important as the effects of the green house gases to the climate change become more evident. Forest energy is almost carbon dioxide neutral. Just a small amount of fossil fuel (~4% of the produced energy) is required for procurement, handling and transportation of the forest energy (Hansson et al. 2003).

In the Nordic countries, removal of branches and tops from logging sites seem to be insignificant with respect to preservation of biodiversity. But at the same time studies have shown that the high degree of utilisation in harvestings in the Nordic countries has led to a lack of coarse dead wood in the forests, compared to natural conditions. Coarse dead wood in various degrees of decay is important to numerous different species, many of them rare in the north European forests. Different kinds of insects, lichens and fungi thrive on the decaying wood. Hence, it is of importance that the collection of forest energy not gets overambitious, but leaves a sufficient amount of dead wood on the site.

The nutrient balance of the soil has an implication for the biodiversity as well. If nutrients are depleted the biological conditions may change so that the species present at a site may not prevail. This is a slow process and may be very hard to detect.

Social values

Studies on forest recreation preferences have indicated that harvest residues to most people is perceived as very negative (Lindhagen & Hörnsten 2000). The removal of harvest residues will in fact increase the recreational value of a site. Beside the aesthetics, which are very important to many visitors in the forests, the absence of residues increase the accessibility to a site. Even if most forest visitors stay on tracks and pathways, berry and mushroom pickers as well as orienteering people, appreciate the increased ease of mobility over an area.

The big concern is also for the social values that a depletion of nutrients may change the natural conditions in an unfavourable direction.

Conclusions

The utilisation of harvest residues as forest energy has a positive implication on sustainable forest management in general. However, the nutrient balance of the soil has be taken in concern, as a depletion of nutrients may have a negative effect on all the aspects (economical, ecological and socially) of sustainable forestry. Furthermore, to improve the biodiversity, the utilisation of forest energy must not lead to a decline of the amount of coarse dead wood in the forests.

Considering these issues the utilisation of forest energy is mostly favourable to the promotion of sustainable forest management. This is also reflected in the certification regulations which put no hindrance to utilising forest energy, even if they not promote it explicitly.

References

Alakangas, E., Valtanen, J. & Levlin, J.-E. 2005. Classification, Specification and Quality Assurance for Solid Biofuels. In FINBIO publication 32; Proceedings of the International Bioenergy in Wood Industry Conference, September 12-15 2005, in Jyväskylä , Finland.

Aplet, G.H., Johnson, N., Olson, J.T. & Alaric, V. 1993. Defining sustainable forestry, Island press, Washington DC, 328 pp.

FSC 2000. Svensk standard för certifiering av skogsbruk [*Swedish standard for certification of forest management*], Second edition, Feb. 2000. Svenska FSC-rådet, Uppsala, Sweden. [in Swedish]

FSC 2003. Svensk standard för certifiering av skogsbruk [*Swedish standard for certification of forest management*], Proposal, April 2003. Svenska FSC-rådet, Uppsala, Sweden. [in Swedish]

Hansson P-A., Dahlin B. & Blinge M. 2003. Environmental load caused by the fuel supply system of a Swedish CHP plant and effects of stricter emission regulations. Biomass and Bioenergy 24 (2003) 59-68.

Lindhagen A. & Hörnsten L. 2000. Forest recreation in 1977 and 1997 in Sweden: changes in public preferences and behaviour. Forestry 73 (2): 143-153.

Massachusetts Technology Initiative 2005, at: www.mtpc.org/cleanenergy/energy/glossaryAtoC.htm

Meidinger, E., Elliott, C. & Oesten, G. 2003. The Fundamentals of Forest Certification. In: Meidinger, Elliott & Oesten (eds.) Social and political Dimensions of Forest Certification, www.forstbuch.de, 2003.

PEFC 2005. Tekniskt dokument. – system för certifiering av skogsbruk och virkesflöde [*Technical document-system for certification of forest management and wood supply*] Swedish PEFC, 05-1-1. [in Swedish]

Sverdrup H., Hagen-Thorn A., Holmqvist J., Wallman P., Warfvinge P., Walse C. & Alveteg M., 2002. Biogeochemical processes and mechanisms. In: Sverdrup H. & Stjernquist I. (eds). Developing principals and models for sustainable forestry in Sweden. Kluwer Academic Publishers. 91 - 196.

Swedish National Board of Forestry 1993. Skogsstyrelsens föreskrifter och allmänna råd (SKSFS 1993:2) till skogsvårdslagen (1979:429), [*The forestry act*] Swedish National Board of Forestry, Jönköping.

Swedish National Board of Forestry 1998. Skogsstyrelsens författningssamling. SKSFS 1998:5. Swedish National Board of Forestry, Jönköping.

United Nations, 1992. Convention on biological diversity. United Nations Conference on Environment and Development, 3-14 June 1992, Rio de Janeiro, Brazil. United Nations, New York.

Vine, E., Sathaye, J. & Makundi, W., 1999. Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Forestry Projects for Climate Change Mitigation. Ernest Orlando Lawrence Berkeley National Laboratory, LBNL-41877

http://www.bioenergy.org.nz/documents/newsletters/Newsletter_8.pdf

Lowcvp 2005 at: www.lowcvp.org.uk/uploaded/documents/ACFYGA8.a4fi.pdf

Figures

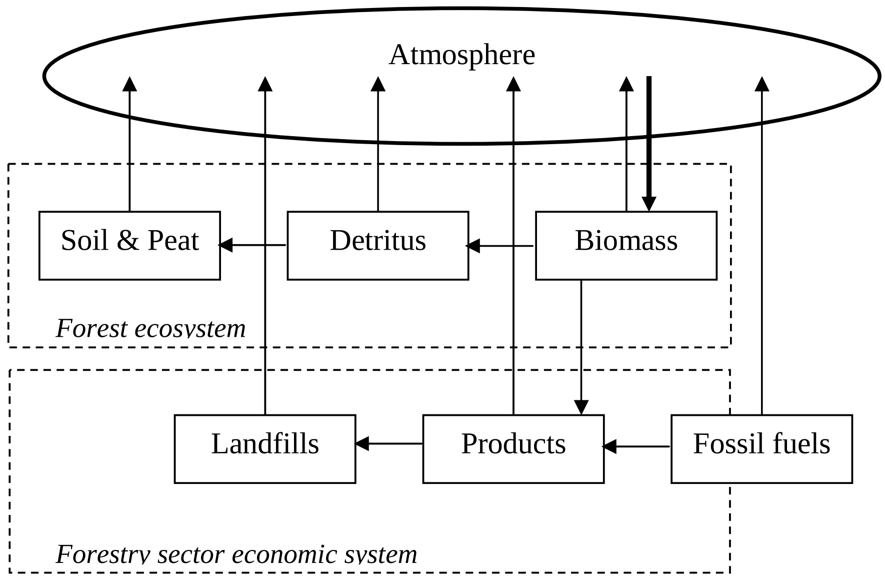

Figure 1. Carbon cycles of forest systems (after Vine, Sathay & Makundi 1999, Apps & Price 1996)