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OPPORTUNITIES AND BARRIERS FOR SUSTAINABLE INTERNATIONAL BIO-ENERGY TRADE: TOWARDS AN STRATEGIC ADVICE OF IEA TASK 40.

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ABSTRACT: A key element of the work programme of IEA Task 40 (Sustainable International Bio-energy Trade; Securing Supply & Demand), is to monitor and analyse experiences with the rapidly growing international bioenergy trade in solids, liquid fuels and power while simultaneously evaluate opportunities and barriers for the development of a sound international market. This paper provides an overview of the work of Task 40 so far. It is based on country reviews with respect to bio-energy trade and related issues, as well as various international meetings organzied by the task. It.presents the findings on barriers and formulates preliminary strategic advice on how such barriers can be addressed by the various stakeholders involved. The main targets and spinn-offs of biotrade should lead to a stable and reliable demand for rural communities, provide a source of additional income and an increase in employment for exporting countries, contribute to the sustainable management of natural resources, fulfil cost-effectively GHG emission reduction targets and diversify their fuel mixA variety of issues can hamper the development and growth of international biomass trade flows. On the other hand, it has been shown that further growth is needed to develop working markets and the related industries. To achieve both growing markets and long-term sustainable biomass trade, a pragmatic approach is needed. A compromise should be found between developing certification efforts and ensuring sustainability of bioenergy and developing the market. While not all biomass types may fulfil the entire set of sustainability criteria initially, the emphasis should be on the continuous improvement of sustainability. For such an approach, public information dissemination and support is crucial.

Keywords: International Bio-energy trade, biomass markets, IEA Task 40, sustainability, certificiation.

1. BACKGROUND AND RATIONALE

Ambitions for biomass use for energy high in many countries, for the EU and also on a global basis, give a variety of policy objectives and long term energy scenario's. A reliable supply and demand of bioenergy is vital to develop stable market activities. Given the expectations for a high bioenergy demand on a global scale and for many nations, the pressure on available biomass resources will increase. Without the development of biomass resources (e.g. through energy crops and better use of agro-forestry residues) and a well functioning biomass market to assure a reliable and lasting supply, those ambitions may not be met. The development of truly international markets for bioenergy may become an essential driver to develop bioenergy potentials, which are currently under-utilised in many regions of the world. This is true for both residues and for dedicated biomass production (through energy crops or multifunctional systems such as agro-forestry). The possibilities to export biomass-derived commodities for the world's energy market can provide a stable and reliable demand for rural communities, thus creating important socioeconomic development incentives and market access.

Many developing countries have a large technical agro-forestry residue potential as well as for dedicated energy plantations e.g. ethanol from sugar cane, pellets or charcoal from eucalyptus planations. Given the lower costs for land and labor in many developing countries, biomass production costs can be low, and thus offer an opportunity to export biomass to developed countries. The possibilities to export biomass derived commodities for the world's energy market can provide a stable and reliable demand for rural communities particularly in many developing countries, thus creating an important incentive and market access in many areas in the world.

In the past decade such trade flows have been increasing rapidly. Many trade flows are between neighboring countries, but increasingly, long-distance trade also occurring. Examples are export of ethanol from Brazil to Japan and the EU, palm kernel shells (a residue of the palm oil production process) from Malaysia to the Netherlands, wood pellets from Canada to Sweden.

These trade flows may offer multiple benefits for both exporting and importing countries. For example, exporting countries may gain an interesting source of additional income and an increase in employment. Also, sustainable biomass production will contribute to the sustainable management of natural resources. Importing countries on the other hand may be able to fulfill cost-effectively their GHG emission reduction targets and diversify their fuel mix.

For market parties such as utilities, companies providing transport fuels, as well as parties involved in biomass production and supply (such as forestry companies), good understanding, clear criteria and identification of promising possibilities and areas are of key interest. Investments in infrastructure and conversion capacity rely on minimization of risks of supply disruptions (in terms of volume, quality as well as price).

Task 40 under the IEA Bio-energy Agreement entitled: '*Sustainable International Bio-energy trade; securing*

supply and demand', started in 2004 and now has 10 country members and two affiliated international bodies, FAO and the World Bank. A key element of the work programme is to monitor and analyse experiences with the rapidly growing international bioenergy trade in solids, liquid fuels and power while simultaneously evaluate opportunities and barriers for the development of a sound international market. This paper provides an overview of the work of Task 40 so far. It is based on country reviews with respect to bio-energy trade and related issues, as well as various international meetings organzied by the task. It.presents the findings on barriers and formulates preliminary strategic advice on how such barriers can be addressed by the various stakeholders involved. As other deliverables of Task 40 are expected to yield additional insights, a final strategic advice will be drafted over the course of 2006.

2. INVENTORY OF BARRIERS

Based on literature review and interviews, a number of potential barrier categories have been identified. These barriers may vary a great deal in terms of scope, relevance for exporting and importing countries and how stakeholders perceive it. A summary of the main barriers is given below.

Economic barriers:

- competition with fossil fuel on a direct production cost basis (excluding externalities). For example the market price in 2004 for biomass pellets in the Netherlands was about 7-7.5 €/GJ, and is expected to stabilize around 5.6-6.4 on the short term, while the cost of coal remains generally about 1.2 €/GJ. On the other hand, current production costs lie between 1-2 US$/GJ in Brazil. Thus, the high prices seem to be caused by a current constraint on the supply side.
- In order to promote bioenergy many developed and some developing countries have stimulated the development and use of biomass for electricity, heat and transportation by the introduction of different measures e.g. governmental RD&D programs, tax cuts and exemptions, investment subsidies, feed-in tariffs for renewable electricity, mandatory blending for biofuels or biofuel quotas. However, an often-heard criticism from the market side is that these measures may not be sufficient (e.g. no mandatory target for the EU-25 biofuels directive), since they are mostly temporary and tend to change frequently. This discourages long-term investment, as this is considered too risky.
- Due to the, often small, size of bioenergy markets and the fact that biomass by-products are a relatively new commodity in many countries, markets can be immature and unstable. This makes difficult to sign long-term, large-volume contracts as this is seen as too risky. Also, with no harmonised support policy (e.g. on a EU level), new national incentives (and associated demand for bioenergy) may distort the market and shift supply to other countries within a short timeframe. Due to expected increasing international competition Dutch traders expect a growing demand for cheap biomass streams in the mid-term (5-10 years) both in developed and developing countries due to expected local demand.

Technical barriers

A general problem with specific biomass is its physical and chemical properties such as low density e.g. high ash and moisture content, nitrogen, sulphur or chlorine content, making it difficult and expensive to transport; and often unsuitable for directly use, say for co-firing with coal or natural gas power plants. Power producers are generally reluctant to experiment with new biomass streams, e.g. bagasse or rice husks. As these streams often do not have the required physical and chemical properties, power producers are afraid to damage their installations (designed for fossil fuels), especially the boilers. While technology is available to deal with the fuels (e.g. different types of fluidized bed boilers), it may take several years or even decades before the old capacity is replaced. On the longer term, the limited ability to use different fuels may lead to a restricted availability of biomass fuels.

Logistical barriers

- Lack of technically mature pre-treatment technologies in compacting biomass at low cost to facilitate transportation, although this fortunately improving. Densification technology has improved significantly recently e.g. for pellets although this technology is only suitable for certain biomass types. Also, the final density per cubic meter is still far less than e.g. oil or coal given the nature of biomass. Pyrolysis or torrefaction may be a possible pre-treatment option, but still needs to be proven on a commercial scale. In the case of the import of liquid biofuels (e.g. ethanol, vegetable oils, biodiesel), this is not an issue, as the energy density of these biofuels is relatively high.
- Various studies have shown that long-distance international transport by ship is feasible in terms of energy use and transportation *costs* (see bellow) but availability of suitable vessels and meteorological conditions (e.g. winter time in Scandinavia and Russia) need be considered.
- Local transportation by truck (both in biomass exporting and importing countries) may be a high cost factor, which can influence the overall energy balance and total biomass costs. For example, in Brazil, new sugarcane plantations are considered in the Centre-West, but the cost of transport and lack of infrastructure can be a serious constraint. Harbor and terminal suitability to handle large biomass streams can also hinder the import and export of biomass to certain regions. The most favorable situation is when the end user has the facility close to the harbor avoiding additional transport by trucks.
- The lack of significant volumes of biomass can also hamper logistics. In order to achieve low costs, large volumes need to be shipped on a

more regular basis. Only if this can be assured, there will be forthcoming investment on the supply side (e.g. new biomass pellet factories) at this will reduce costs significantly.

International trade barriers

- A lack of clear technical specifications for biomass (see above) and specific biomass import regulations. This can be a major hindrance to trading. For example, in the EU most residues that contain traces of starches are considered potential animal fodder, and thus subject to EU import levies. For example, rice residues containing 0-35% starch are levied 44 €/ton (i.e. about 3.1 €/GJ). For denaturised ethanol of 80% and above, the import levy is 102 €/m3 (i.e. about 4.9 €/GJ), representing substantial additional costs. Other biomass streams such as wood pellets are currently exempted in the EU. It is important to bear in mind that some technical trade barriers can be, in fact, imposed to constraint imports and to protect local producers.
- Transport tariffs. In recent years, general transport tariffs have increased quite significantly e.g. wood pellets to the Netherlands were on average 1.75 €/GJ (on a total cost of 7-7.5€) in 2004.
- Possible contamination of imported biomass with pathogens or pests (e.g. insects, fungi) can be another important limiting factor in international trade. For example, round wood from outside the EU can currently be rejected for import to Finland (whole of EU), if they are contaminated with pests. Similarly, agricultural residues which could be used both as fodder and biomass, may currently be denied entry if it does not meet certain fodder requirements. However, it is important to bear in mind that these limitations are not exclusive to bioenergy.

Land availability, deforestation and potential conflict with food production

- Competition for land: while theoretically large areas of (abandoned/degraded) crop land are available for biomass cultivation, biomass production costs are generally higher due to lower yields and accessibility difficulties. Deforested areas may be easier as may have more productive soil, but is generally considered unsustainable in the long term. Food security, i.e. production and access to food, would not probably be affected by large energy plantations if proper management and policies are put in place. However, in practice food availability is not the problem, but the lack of purchasing power of the poorer strata of the population.
- In developed countries, a key issue is competition with fodder production. If there was a large increase in demand for energy, say of agricultural residues, scarcity of fodder products may occur, leading to price increase. Furthermore, in the Netherlands, the fodder industry sees the feed-in tariff for electricity from biomass as an indirect subsidy for agro-residues [2]. On the other hand, also the fodder market is subsidized.

Sustainability issues

- Large-scale biomass dedicated energy plantations also pose various ecological and environmental issues that cannot be ignored, ranging from monoculture, long term sustainability potential loss of biodiversity, soil erosion, fresh water use, nutrient leaching and pollution from chemicals. However, various studies have also shown that in general these problems are less serious when compared with similar plantations for food or fodder production.
- Also linked to the potential large scale energy plantations are the social implications, e.g. the effect on the quality of employment (which may increase, or decrease, depending on the level on mechanization, local conditions, etc.), potential use of child labour, education and access to health care. However, such implications will reflect prevailing situations and would not, necessarily, be better or worse than any other similar activity.

Methodological barriers – lack of clear international accounting rules

- A lack of clear rules and standards for e.g. allocation of GHG credits and the related issue on methodologies to be used to evaluate the avoided emissions, considering the fuel life cycle.
- Another issue is the indirect import of biomass for energy (processed biomass). Biomass trade can be considered as a direct trade of fuels and as indirect flows of raw materials that end up as fuels in energy production during or after the production process of the main product. For example, in Finland the biggest international biomass trade volume is indirect trade of round wood and wood chips. Round wood is used as raw material in timber or pulp production. Wood chips are raw material for pulp production. One of the waste products of the pulp and paper industry is black liquor, which is used for energy production.

Legal (national) barriers

Biomass for energy may be limited by international environmental laws. For example, in the Netherlands, four out of five major biomass power producers consider obtaining emission permits as one of the major obstacles for further deployment of various biomass streams for electricity production. The main problem is that Dutch emission standards do not conform with EU emission standards. In several cases in 2003 and 2004, permits given by local authorities have been declared invalid by Dutch courts.

3. PRELIMINARY RECOMMENDATIONS AND STRATEGY SUPPORTING DEVELOPMENT OF SUSTAINABLE BIOMASS MARKETS

Domestic production vs. import/export

Because biomass use is in particular favored because of it's desired impact on lowering GHG emissions, resources and chains should be favored (and perhaps certified) that maximize GHG mitigation. This implies minimisation of energy inputs, but also optimising the use of biomass, e.g. including comparison between indigenous use versus export.

While many developing countries have a low energy consumption compared to developed countries, their energy demand is increasing rapidly. Should biomass for energy be utilised locally or for export; should market forces have the last say? For example, Brazil is planning to increase ethanol production drastically over the next 8 years, and to start up biodiesel production from soy beans, palm oil, etc. Only a fraction will be exported, the rest will be used domestically. A similar situation can occur in developed countries, e.g. in Finland which currently exports large volumes of pellets to EU, which could also be utilized domestically. The main driver being the different national incentives paid to pellets. In general, it would be more rationale to use the biomass primarily locally, and only the (certificated) excess should be exported. However, it should be borne in mind that international competition will force domestic producers to be more competitive.

In addition, biodiesel production in Western Europe, and ethanol in the EU-25, USA and Canada has been increasing rapidly over last few years. Even though these biofuels are often far more expensive (e.g. factor 2-3 compared to Brazilian ethanol), and the energy balance may be questionable. This is due to a combination of other factors e.g. fuel security, and employment in the agricultural sector. Therefore, these biofuels are currently subsidized or enjoy fiscal advantages (e.g. tax exemptions) in many countries.

Solving sustainability issues: International classification and certification of biomass.

Certification of biomass may be one way to prevent negative environmental and social side-effects. By setting up minimum social and ecological standards, and tracing biomass from production to end- use, the sustainability of biomass can be ensured. In a exploratory study has been shown that such social and environmental standards do not necessarily result in high additional costs.

However, when implementing a certification scheme for sustainable bioenergy, several other issues have to be dealt with. Firstly, criteria and indicators need to be designed/adopted according to the requirements of a region. Also, the compliance with the criteria has to be controllable in practice, without incurring high additional costs. Secondly, avoidance of leakage effects (leakage can be defined as activity-induced changes in land use that occur outside the area in which the activity takes place). The net effect is that carbon benefits gained in one place are partially lost in (leak away) in another location. Leakage in the context of biomass trade could stand for an unwanted shift of activities from the area of biomass production to another area where it leads to negative effects on the environment.

It should be investigated whether an independent international certification body for sustainable biomass is feasible. This should be done by a consortium of all stakeholders in the biomass for energy production chain. Probably a gradual development of such a certification scheme is most feasible with gradual learning and expansion over time. Any certification scheme should on the one hand be thorough, comprehensive and reliable, but also not become a barrier to markets in itself.

Setting up technical biomass standards

By setting up an internationally accepted quality standards for specific biomass streams (e.g. CEN biofuel standards). biomass end users may have a higher confidence in using different biomass streams. Task 40 may possibly contribute on this, e.g. by collecting information on technical specifications required by consumers and convey them to potential suppliers. Furthermore, classification of organic matter streams as specific biomass fuel may aid WTO classification as EGS (Environmental Goods and Services).

Lowering of trade barriers

Biofuels could help industrialized countries to promote reduction of carbon emissions but, in some cases – as is the case of ethanol exporting to US and EU – exporting countries face trade barriers. Most of these barriers are established based on technical reasons, but the aim is pretty much to protect local producers that have production costs much higher than developing countries. The solution pointed by some analysts is to liberalize environmental goods and services – EGS – and to include biofuels as EGS.

Building up structural international statistics (volumes and prices) on bioenergy trade are desired, this is not done so far.

Building up long-term sustainable international bioenergy trade

As described above, different issues can hamper the development and growth of international biomass trade flows. On the other hand, it has been shown that further growth is needed to develop working markets and the related industries. To achieve both growing markets and long-term sustainable biomass trade, a pragmatic approach is needed. It is recommended to focus first on routes with low-barriers. A compromise should be found between developing certification efforts and ensuring sustainability of bioenergy and developing the market. While not all biomass types may fulfil the entire set of sustainability criteria initially, the emphasis should be on the continuous improvement of sustainability. For such an approach, public information dissemination and support is crucial.

The main targets and spinn-offs of biotrade should lead to a stable and reliable demand for rural communities, provide a source of additional income and an increase in employment for exporting countries, contribute to the sustainable management of natural resources, fulfil cost-effectively GHG emission reduction targets and diversify their fuel mix. Sustainability may best be addressed by a sound certification framework. A gradual process in an international setting seems best to develop this, keeping in mind that a certification process should not become a barrier in itself.

4. REFERENCES

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