C 2007/INF/17

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September 2007

منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Organización de las Naciones Unidas para la Agricultura y la Alimentación

CONFERENCE

Thirty-fourth Session

Rome, 17-24 November 2007

FORESTS AND ENERGY

Background

1. Fossil fuels (oil, natural gas and coal) meet over 80 % of global energy needs. In spite of rising oil prices, oil-based products are expected to continue to provide the lion's share of world energy for the next decades. However, rising oil prices are having a negative impact on many national economies. For example, in Asia a US$ 10/barrel increase in oil price can reduce GDP growth by as much as 0.8 % and, in the case of poor and highly indebted countries, even by 1.6% (International Energy Agency-IEA, 2004). The burning of fossil fuels also contributes to greenhouse gas emissions, in particular carbon dioxide, and thus to climate change.

2. The substitution of fossil fuels by woodfuels for heat and electricity generation not only diversifies the energy supply, thereby improving energy security, it also reduces greenhouse gas emissions. A sustainable supply of wood-based energy at local and regional levels can support efforts towards self-sufficiency in energy and improve the livelihoods of local communities in rural areas through employment and income generation, thereby helping to reduce poverty. However, a rural economy that depends entirely on wood for energy might find its development opportunities to be restricted; and the use of wood for fuel can result in deforestation or forest degradation if sustainable forest management is not effectively practiced.

3. High fossil fuel prices, the need for secure energy supplies, and concerns over climate change have thus revitalized interest in renewable energy, and bioenergy in particular. Forests are affected by this renewed interest in various ways. On the one hand, forests provide wood fuels (fuelwood and charcoal). On the other hand, forests occupy land which could be used for crops that are used to produce liquid biofuels. Furthermore, forests and forest residues will be in higher demand for direct conversion to liquid biofuel as the so called "second generation" technologies become economical; some experts predict that wood will become the major source of biofuels in the future, replacing agricultural crops and residues.

The role of bioenergy and wood fuels

4. Bioenergy is defined as the generation of energy from fuels of biological origin (biofuels). These include wood fuels (fuelwood, charcoal, black liquor), agro fuels (from agricultural residues and crops - including those used for the production of liquid biofuels), municipal and solid waste, and fisheries products. Biomass destined for bioenergy production may be pelletized, which increases the density of the material and reduces transportation costs while improving handling characteristics of the feedstock. In 2004, about 44 million Terajoule of energy generated from biofuels was consumed globally, of which 38 million in developing countries. At present, bioenergy is important for the total primary energy supply (TPES) mainly in developing countries. However, as the examples of Finland (19% of TPES) and Sweden (15% of TPES) show, it is also gaining importance in developed countries.

5. Wood is the most important biofuel. It has been used for cooking and heating since the Stone Age. Today about 1.8 billion cubic metres per year, or half of the annual harvest of roundwood, are used for energy. In developing countries as a whole, which account for almost 90% of the world's fuelwood production, the share of wood fuels is up to 15% of total energy use. In some countries, particularly in Sub-saharan Africa, fuelwood and charcoal supply 70 % or more of the national energy demand. Particularly in poorer developing countries, which are highly dependent on wood fuels, the unsustainable harvesting and use of wood can have negative environmental impacts.

6. Wood is used for energy generation in households and small industries, and in some cases, also for large industries, e.g. steel production in Brazil. In the northern hemisphere, the USA and Mexico are the most important fuelwood producers and consumers (with 44 and 35 million cubic metres, respectively), followed by North and Central European countries (between 3 and 5 million cubic metres per year).

7. Common technologies for wood energy generation include power boilers, in which biomass is combusted to generate heat and steam, which can then be used to drive turbines and generate electrical power. In these types of facilities, biomass can be used as a sole feedstock or 'co-fired' in combination with fossil feedstocks such as coal. Combined heat and power (CHP) facilities generate electricity but also capture process heat, thus increasing energy efficiency. In particular, sawmills and pulp and paper mills benefit by becoming energy producers. Similar benefits can be observed for many agro-industries, leading to increased productivity and profitability, while improving their "ecological footprint".

Liquid biofuels

8. The rapid surge in global oil prices, and related price increases for transport fuels, has led to increased interest in liquid biofuels, i.e. the production of ethanol or diesel from agricultural crops. In temperate regions, corn or other cereals are used as feedstock for bio-ethanol production. In tropical regions, cane sugar and, to a lesser degree, soya and cassava are used.

9. In Europe, biodiesel is mainly produced from rapeseed, and in South East Asia from palm oil. Diesel production from other oil-producing plants has also begun, although as yet to a lesser degree. A good example is *Jatropha*. However, by 2006, liquid biofuels still only contributed a small portion of the national consumption of transport fuels: USA – 2.6 % from an ethanol production capacity of 19 billion litres; Germany - 3.75% from a diesel production of 2 billion

litres; Sweden - 2.2% and France -1.2 %. As early as 1975, during the first "oil crisis", Brazil launched its National Alcohol Programme (ProAlcoól), producing ethanol from domestic sugar supplies. In 2006, ethanol production in the country was expected to rise to 17 billion litres. ProAlcóol involved not only ethanol producers, but also the transportation industry. A recent development is the "flex" car, a vehicle equipped with a motor that can run on ethanol, gasoline or mixtures. Around 90% of all cars produced and sold in Brazil are now "flex".

Incentives for bioenergy generation

10. Both in order to secure a supply of affordable energy and to mitigate climate change, many countries in both tropical and temperate regions recognize the urgent need for policies to increase the generation of bioenergy. These new policies and incentives are boosting the demand for biomass for electricity generation, heat (wood chips and pellets) and fuels for transport (bio ethanol and bio diesel). These incentives may be targeted at producers, distributors and/or consumers. In some countries, incentives to promote bioenergy are controversial; some economists have criticized incentives for distorting the market, and some environmentalists claim that liquid biofuels have a greater environmental impact than other forms of renewable energy.

11. Incentives in use today include measures such as infrastructure grants, loan guarantees and public-private partnerships designed to create bioenergy capacity, as well as broader measures such as tax exemptions or fixed-price mechanisms. The United States leads in making funds available for the development of pilot and demonstration facilities, primarily in the biofuels area. Tax incentives commonly applied include reductions or exemptions on excise, fuel or sales taxes, and can be observed across the membership of the OECD. Fixed-price mechanisms set a premium or bonus which is paid above the normal rate for energy (normally electricity), directly to the energy producers or distributors; these types of mechanisms are seen in Denmark and Spain.

12. A number of different policies can promote the production and use of renewable energy. For example, feed-in tariffs set a specific price that must be paid by electrical utilities to the domestic producers of green electricity. The additional costs of these schemes are paid by utilities and passed through to the power consumers. Another option is a renewable energy obligation, which establishes targets for the amount of renewable energy that must be used within the total energy portfolio, either as a percentage of total energy use, or as a percentage of energy purchased by various user groups. Renewable energy standards or obligations can be applied to biofuels in a similar fashion. Often, these policy tools will be linked to tax incentives that can be applied to the renewable energy portion.

13. "Green" certificates are currently issued in five developed countries, whilst a number of others are presently considering adopting this mechanism. Under this scheme, renewable electricity is sold at conventional prices; in order to cover the additional cost of producing 'green' electricity, all consumers must purchase a certain number of green certificates from renewable electricity producers in order to cover a quota or percentage of their total electricity consumption. This is essentially a market-based mandate, where renewable electricity producers can compete with one another to sell green certificates to distributors or consumers.

Future developments

14. Rising fossil fuel prices, the call for energy security, and concerns for climate change are driving the increase in energy efficiency and an increased application of combined heat and power systems. They also drive research in the "second generation technologies". These technologies foresee the use of cellulosic energy crops, including perennial crops such as miscanthus and

switchgrass and fast-growing tree species such as willow and poplar, and the conversion of cellulosic material to liquid fuels and other products (biorefinery). The most desirable characteristic of these energy crops is their ability to generate raw biomass with minimal agricultural or silvicultural intervention and inputs. At present, research in these energy crops is actively pursued as an option for bioenergy feedstock, e.g. in the USA and Sweden.

15. Once the conversion of cellulosic material becomes economically feasible, the demand for wood and wood residues for energy will increase considerably. Wood residues and forest plantations will no longer only feed pulp and paper and wood-based panel plants, or provide fuelwood and charcoal, but be directly converted into liquid biofuels. The future implications for land use can be considerable. Instead of forests being cleared to make room for crops, we may see a future in which increasingly crops are cleared to make room for forests.

16. At present, liquid biofuels account only for 1percent of transport fuels. The International Energy Agency (IEA) projects that by 2030, their share in transport fuels will rise to between 4 and 7 percent.

Issues

17. Wood-based bioenergy (wood energy) offers all countries an opportunity to improve their energy security. The use of wood energy can help reduce greenhouse gas emissions, and thus contribute to climate change mitigation. Wood industry can use wood residues for the co-generation of energy, thereby increasing the energy efficiency of their products and the cost-effectiveness of their operations. If properly planned and appropriate policies are put into place, wood energy can also contribute to poverty reduction.

18. Wood fuels will therefore continue to play a major role for energy generation in many developing countries. However, the wood is often harvested and processed in an unsustainable, inefficient and unhealthy way. A large part of it is harvested and used domestically by the informal sector and does not appear in national statistics. The increased use of wood, in particular in peri-urban areas, contributes to deforestation and forest degradation. Deforestation and forest degradation account for 18% of global carbon dioxide emissions, and thus contribute to climate change.

19. There is an increasing interest in the growing of crops for ethanol production (sugar cane, soya, cassava, cereals) or for diesel production (palm oil, Jatropha, rapeseed and others). Liquid biofuels offer an important opportunity to at least partly replace fossil fuels. However, some crops can only be economically converted to liquid biofuels at high oil prices and/or with subsidies. The increase in biofuel production may also trigger competition for land between the energy, food, feed and forest sectors. Development goals of securing the domestic energy supply and contributing to climate change mitigation, securing the domestic food supply, conserving forest biodiversity and the domestic supply of industrial round wood, may enter into competition with each other.

20. Thus, the increase in energy consumption driven by demographic and economic factors and the rapidly changing global energy situation, generate both opportunities and threats for forests. Reactions may differ from country to country, according to conditions:

- The production of energy from existing forests might increase;
- Unsustainable harvesting and use of wood fuels might increase;
- Forest plantations might increase to meet the raised demand for energy from wood;
- As the demand for wood for energy increases, the supply of wood available for other uses might decline, resulting in increased prices for all users of wood;
- Land previously dedicated to food crops might shift to bio-fuel crops. This could benefit farmers' income, but might have a negative impact on local food production;
- Agro-fuel crops might expand into forests, generating land use conflicts and increasing deforestation, with implications for biological diversity, climate change, and water.

Recommendations

21. To cope with these developments, there is a need to:
- develop the wood energy sector in line with sustainable forest management concepts;
- incorporate wood energy policies into poverty reduction policies and strategies;
- transfer know-how and capacity building in the use of sustainable, efficient and healthy wood energy systems;
- transfer know-how and capacity building in the use of alternative renewable energy systems (small hydroelectric turbines, wind and solar energy, biogas);
- strengthen capacities to assess, monitor and report on forest- and wood- energy related information, in particular wood fuel harvesting and consumption;
- develop and implement policies which harness the opportunities forests offer for energy generation, avoiding undue market distortions;
- introduce safeguards for the production of liquid biofuels to avoid unwanted negative impacts on the environment (soils, water) and local population;
- carefully consider possible impacts on other sectors when introducing incentives for biofuel production;
- consider trade-offs between the different land-use options, when embarking on large-scale biofuel production;
- integrate energy, agriculture, forest and land use policies.