Statements on Bioenergy

by the Energy Committee and the Environmental Committee at the Royal Swedish Academy of Sciences

Introduction

Humankind is currently faced with the huge challenge of ensuring sustainable and ecologically acceptable supply and use of energy. This is accentuated by increasing oil prices, decreasing oil reserves and growing energy consumption accompanied by growing emissions of greenhouse gases which threaten the environment and the climate. Bioenergy will in all certainty increase in importance, but it competes for raw materials with the production of food, paper, cardboard, paper pulp, wood for construction and so on. Moreover, decreasing supplies of cheap energy from fossil fuels, which are a requisite for today's highly intensive agricultural and forestry practices, will result in lower yields. This can be compensated to a certain extent by modern plant breeding, including genetic modification.

Key points

1. Predictions about future bioenergy are uncertain

The annual global energy supply is 130,000 TWh, of which 10-15% comes from biomass. Estimates of the future potential for bioenergy span a wide range. The Energy Committee estimates the potential for an increase of 11,000 TWh as realistic, and that it can be achieved initially through utilization of felling residues from forests and agriculture.

2. Stop the exploitation of the world's forests

In a global perspective, 80% of all renewable energy comes from biofuels, of which 75% comes from the world's forests (4×109 hectares; 30% of the world's land surface). Every year sees the disappearance of 7.3×106 hectares of forest land, i.e. 0.2% of the world's total forested area. In South America and Africa, more than 0.5% is cut down per year. This ongoing deforestation must stop.
Exploitation of tropical forests is not only an ecological catastrophe, but also contributes to the increase in atmospheric levels of CO_2, largely owing to an indirect effect: fewer leaves means decreased uptake of CO_2 for photosynthesis. One effective way of limiting the atmospheric CO_2 content is to curtail excessive felling in the world's forests.

3. Food is more important than automotive fuel

Modern-day intensive agriculture consumes copious amounts of fossil fuel for farm equipment, production of fertilizers and transportation. The need for fresh water is also considerable.
The effort to produce ethanol and other automotive fuels from the agricultural sectors' primary production is questionable for several reasons. One important reason is that around a billion people are chronically undernourished. Another is the considerable amount of energy that is required for production of automotive fuel. With a growing global population, in a competition between food and fuel, food production must take priority.

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4. Cellulose fuels are still a decade away

The "second generation" automotive fuels from farm and forest waste are anticipated to be far more energy efficient than fuels made from primary agricultural products, but it will be another ten years before such fuels can be produced on a large scale. Another attractive possibility is to use the waste products to produce electricity and heat in combined heat and power plants.

5. Europe's land insufficient to attain the EU biofuel production targets

Within the European Union, biomass contributes only 4.4% of the energy supply but nonetheless represents 67% of the renewable energy used (2005). The European Union goal is that 20% of the energy supply should come from renewable energy sources by 2020 and that the proportion of automotive biofuels shall simultaneously have increased from 1% to 10%. It is not realistic to expect to achieve this goal concerning biofuel through increased production solely on European soil (108 million hectares of farmland).

6. Swedish forests can contribute more towards energy production

The contribution of biofuels toward Sweden's total energy supply is 110 TWh or 17% (2004). Total forest biomass in Sweden has been increasing for the past 50 years; this is an important CO_2 sink. With unchanged capacity for CO_2 sequestration, and continued production of pulp and sawn wood products, it is estimated that the energy production from forest biomass can be increased by 20 TWh to the year 2020 through better utilization of felling residues (branches, tops, stumps). On a time scale of 50 to 100 years this figure might increase to 40 TWh through various measures to improve forest growth.

7. Not only the forest provides bioenergy in Sweden

Further contributions towards Sweden's bioenergy production can be expected from farmland currently lying fallow (10 TWh), peat (4 TWh) and organic waste (8 TWh).

8. Bio-cogeneration is efficient

Biomass raw materials from field and forest and organic waste can be used in a more optimal way through simultaneous production of different types of energy carriers – for example electricity, automotive fuel, biogas, pellets, heat and cooling water – in bio-cogeneration systems. This has already been tested and shown to be feasible in combined heat and power plants and in the paper pulp industry. New bio-cogeneration systems will have synergy effects, yielding greater efficiency in terms of resource use than when different energy carriers are produced separately.

9. Environmental concern and a system-wide perspective

Environmental aspects should be integrated into production processes in field and forest right from the start. It is crucial to assess potential consequences for the environment meticulously at an early stage, to delineate environmental problems clearly, and to try to find solutions that benefit both production and the environment. A current example is leaching of nitrogen and phosphorous, mainly from farming, in the countries around the Baltic Sea. The issue of the positive and negative effects of bioenergy must also be broadened from the search for technically and economically viable methods to reduce emissions from fossil fuel, to a more all-encompassing view of bioenergy production in a long-term perspective, including both ecological aspects and societal and socioeconomic ones.

Viewed in the short term, until standing forest biomass has increased to replace felled and burned biomass, use of biofuels results in carbon emissions just as large as those from fossil fuels. This fact must be borne in mind, given the fact that the next 50-100 years will be decisive if we are to keep atmospheric carbon dioxide concentrations within acceptable limits. Biofuel from the

agricultural sector also gives rise to climate effects through production of nitrous oxide, which is a greenhouse gas. New findings indicate that the nitrous oxide formed during the production of liquid biofuels for transportation exerts a greenhouse effect as large as or larger than that of the oil being replaced.

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