

## **DISCUSSION ON NRP ASSESSMENT REPORT "ENERGY SUPPLY AND ENERGY AND MATERIALS SAVINGS"**

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### **1. INTRODUCTION**

In a break-out sessions (session 20.I) at the conference, one of NRP's assessment reports "Energy demand and supply mitigation options" was discussed. The report was presented by its author, prof. dr. Wim Turkenburg. On the basis of the presentation discussion took place.

In this report the main issues of the session will be discussed. Turkenburg's presentation will only be discussed briefly, as his complete assessment report is published elsewhere in these proceedings [1].

### **2. RESULTS FROM THE NRP**

Turkenburg started his presentation by referring to the recent emission scenarios of the IPCC. Although there have been changes with respect to the 1990 scenarios the conclusion is still valid that considerable emission reductions with respect to 'business-as-usual' developments of emissions are necessary. He estimated that for the next century measures have to be taken that lead to a total emission reduction of 1200 GtC (4400 Gtonnes of CO<sub>2</sub>). A range of options is available that may contribute to such reductions. A number of these options have been subject to study in the National Research Programme.

A list of the subjects discussed is as follows:

- Energy efficiency improvement.
- Material efficiency improvement
- Biomass as an energy source
- Decarbonization of fuels and fuel gases
- Integrated assessments of energy and material systems

This presentation and discussion is meant to react on the quality of the work and to determine what is missing (e.g. is the focus on CO<sub>2</sub> right?).

### **3. DISCUSSION**

#### *Energy efficiency improvement*

Q. Up from the midst of the seventies there was a stabilization of energy consumption and on average an economic growth. Is it a simplification to say that this difference is due to energy efficiency improvement?

A. It is, but in the eighties energy efficiency improvement is responsible for about three quarters of the effect.

Q. With respect to long-term efficiency improvement, also the relation between energy efficiency and structural change should be considered. Especially the rebound effect may be important: due to efficiency improvement energy services become cheaper and will be used more.

A. This was not the subject of the study. It was shown that *in principle* major efficiency improvements can be attained. Of course, also other effects, like the one mentioned, may play a role.

Q. Will all the barriers for energy conservation be translated to cost categories in ICARUS?

A. (by Kornelis Blok) This seems hardly possible. But we try to introduce characterizations of energy conservation measures (e.g. typical size of the investment) that can be used for calculation of, e.g., transaction costs under various circumstances. It should be noted that transaction costs depend on the way energy efficiency improvement is stimulated. For instance, if standard setting is applied, the information phase for investments may become cheaper as the number of options to be considered is reduced.

#### *Biomass energy*

Q. In the case of biomass energy production, is the energy required to produce fertilizer, for harvesting, etc. taken into account? Does biomass result in net savings of primary fossil energy?

A. This issue has been investigated. It turns out that for all the biomass energy options considered, there is a positive net gain. The net gain is, in terms of GJ per hectare, highest for production of wood, Miscanthus, etc. combined with gasification. For production of transportation fuels, e.g. rapeseed oil, the net gain is smaller.

#### *Integrative studies*

Q. With respect to the integrative studies, a ranking of options (amount of CO<sub>2</sub> avoided, costs per ton of CO<sub>2</sub>) is desirable; this can not be obtained from the Markal results.

A. This is true; but such figures can already be obtained from the analysis of individual options. Tom Kram, one of the authors of the integrative study, adds that the advantage of an integrated model like Markal is that the mutual influence of various options is taken into account.

Q. Other studies, for instance the reports written by McKinsey, give different results for the costs per tonne of CO<sub>2</sub> avoided.

A. There may be various reasons for differences, and one should always be cautious in using the figures. But also the aim of the studies may differ. McKinsey carried out its analysis for the Netherlands energy distribution companies for the evaluation of concrete plans, and used a discount rate of 10 or 15%. The Markal evaluations have a national-economic perspective and use real interest rates and depreciation over the lifetime.

Q. There is a need for more extended overviews listing all the options with their costs.

A. There are overviews, Markal is a way of integration, ICARUS gives an overview of demand-side saving potentials. It should be noted that thousands of data may be needed. For instance, in Markal, wind energy may be represented by only a few figures; however, the costs of wind energy at the coast will be very different from the costs of wind energy inside the country. So, for a good description one should

have an extended database only for wind energy already. It seems impossible to cover all these data in one set.

#### *Future research*

Q. The winning of renewable energy may be economically more attractive in other countries in Europe (e.g. wind energy in Scotland, solar energy in Spain). Is this taken into account?

A. This first phase of the NRP has a national perspective, although some studies were carried out, e.g. into wind energy potentials in European countries. It is agreed that the international perspective should have much more attention in future studies. Other aspects are international exchange of energy-intensive materials, and of course burden sharing in international climate agreements. A better understanding of potentials and costs per country (determined on a common basis of analysis) is also important for evaluating the possibilities of joint implementation. Within parts of NRP not reported here, some studies for other countries have been done. For instance, a study into CO<sub>2</sub> emission reduction for China was conducted. Anyway, more international cooperation in this field is important.

Q. Why are other greenhouse gases than CO<sub>2</sub> not taken into account?

A. The reason to pay so much attention to CO<sub>2</sub> is that it is the most important greenhouse gas, and this is still the case. In phase 2 of the programme there is room for research into emission reduction of other greenhouse gases.

It should also be taken into account that there are many research programmes in the fields of energy and environment. In general the research in the NRP should have a clear added value for a better understanding of the climate problem and the response options.

#### **REFERENCES**

1. W.C. Turkenburg, Energy demand and supply mitigation options, Proc. of the International Conference on Climate Change Research, ....