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Elements of a Strategy for a Sustainable Energy Supply

Summary



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SUMMARY

The problem of shaping our future energy supply has taken on new weight and urgency with the debate over the exit from nuclear energy, and specifically with the June 2000 agreement between the German Federal Government and the energy supply companies on limiting the period of use of the remaining nuclear power stations. In the present TAB study, which has the nature of a preliminary study and is based on suggestions by the FDP, CDU/CSU and Bündnis 90/DIE GRÜNEN parliamentary groups, key elements of a strategy for a sustainable future energy supply are explored.

The starting point for the study is a comparative analysis of selected scientific studies on the energy, ecological and macro-economic effects of abandoning the use of nuclear power in Germany carried out for the TAB by the Institute for Energy Management and Rational Energy Use (IER) of the University of Stuttgart. This analysis shows that the results of the studies are comparable only to a very limited extent, if at all and that it is impossible to derive a single overall statement on the likely effects of a withdrawal from nuclear energy.

The overwhelming majority of »exit studies« included in the comparative analysis focus on the consequences of an early exit (by 2005) and generally investigate cost-minimising substitute strategies, ignoring external costs and benefits. Given these premises, these »exit studies« naturally arrive inevitably at the conclusion that renewable energy and the energy and electricity savings can only make a very minimal contribution towards replacing nuclear energy. They are accordingly largely unusable for a debate over the strategic options for a sustainable energy supply in Germany which is realistic in current terms.

This explains the IER's call for an »exit study« using significantly improved methodology. The current state of the debate about ending nuclear power use means, however, that carrying out a new and extensive exit study is not a matter of urgency. By contrast, there is urgent need for more detailed studies of the potential, conditions for use, promotional possibilities and impacts of the strategic options which will in any event have central importance for long-term sustainable energy supply in Germany. These involve primarily stepping up efforts to save energy and making greater use of the important potential of renewable energy. It is also necessary, however, to consider the potential and problems of increased use of fossil fuels, and specifically natural gas. These options are the subject of this report, with special attention to identifying priority issues for study and research.

SAVING ELECTRICITY

More economical use of electricity and energy generally is a key approach in putting the energy supply on a sustainable basis for the future. Various scenarios show clearly that there is great potential for saving electricity and cutting CO₂ emissions available in all sectors of consumption. Depending on the framework conditions and the intensity of energy policy action, a reduction of total electricity consumption between 10% and 30% by 2020 is seen as possible compared with the »business as usual« trend. The greatest potential for saving is in the domestic sector (up to 60%), but there is also significant potential which can be cost-effectively tapped in »crafts, distributive trade, services« (44%) and »industry« (18%).

To take full advantage of these potential savings, however, a whole range of obstacles and market inadequacies have to be overcome in all sectors of consumption. Significant factors, for example, are the low cost of electricity, which prevents vigorous action and investment to improve energy efficiency, and insufficient knowledge about existing possibilities for energy saving. These and other obstacles would have to be tackled by energy policy instruments and other measures. The increasingly competitive structure of the energy sector also means that the selected instruments will have to be adapted for this new framework conditions.

One priority need for research in terms of an electricity saving strategy is, in the view of TAB, the growing »Internet economy« and its effects on energy consumption. In addition, strengthening research into motivation and decision-making seems to be urgently necessary to support such a strategy.

INCREASED USE OF FOSSIL FUELS

One much-debated possibility for covering future shortfalls in the energy supply due to the run-down of nuclear power would be to make greater use of fossil fuels. Apart from the problems posed by this option with regard to its associated environmental pollution (which we will not go into further in this study), this would quickly further reduce the reserve life of petroleum and natural gas – which even today is rated as comparatively short – due to significant increase in demand. The key consideration for this option is accordingly the problem of reserve life of petroleum and natural gas.

There is also no expert consensus on the future state of supply of petroleum and natural gas. Differences in reporting petroleum and natural gas resources and reserves are due to technical, economic and political factors but chiefly to the different weighting given to data sources. Reported »increases« in reserves are increasingly due to retroactive revaluations divorced from new discoveries.

Statements about the reserve life of fuels have limited validity. A more decisive measure of structural change is the point in time at which technical and economic considerations make it impossible to increase production of petroleum and natural gas beyond a given level. From this point, when around half of the available petroleum and natural gas is used up, growing demand can no longer be met by increasing production in the short term. However, there is controversy about the timing of this »depletion mid-point«.

Possibilities for making up any shortfall in supply from conventional petroleum include increased use of natural gas. This would exacerbate the competition for natural gas use already emerging in various market segments. It accordingly appears necessary to investigate if serious bottlenecks can arise in the natural gas supply with grave consequences in national terms.

Other priorities for study relate to the development of market-ready technologies to extract methane hydrate and the analysis of possible impacts of such extraction on the climate and environment.

INCREASING THE SHARE OF RENEWABLE FUELS

Another central option is to increase significantly the share of renewable fuels in the national energy supply. The theoretical potential of such energy sources represents a multiple of annual world energy consumption, but its availability for use is limited by specific features of renewable energy supply (e.g. localisation, competing use of sites, varying availability of the energy source). The focus is initially on the technical potential of renewable energy (hydropower, wind power, bio fuels, solar energy, geothermal energy) in Germany. Attention is given to the temporal and geographical structure of supply, possibilities of balancing the timing and quantity of the supply of renewable energy and compensating demand-side effects.

The conclusion is that the significant technical potential of renewable energy in Germany is currently far from fully utilised. There are specific features which characterise the structure of the supply of renewable fuels. A significant expan-

sion in renewable energy generation would mean an increase in the share of fluctuating energy (specifically sun and wind). There are, however, possibilities for matching the supply and demand for energy better (e.g. shifting peak electrical loads between users, balanced time profiles for supply and a favourable local breakdown of the supply of electricity utilising all available forms of energy in a balanced mix, importing renewable electricity). A significant increase in the share of renewable fuels would reinforce the existing trend towards operating a large number of decentralised smaller installations with growing decentralised electricity feed.

The potential technical impacts of an exit from nuclear power are discussed in full for the generating sector (influence on reliability of generation and control concepts) and the distribution sector (influence on grid load and reliability, voltage quality and grid losses) with increased use of supply-dependent fuels.

Renewable energy is still at a disadvantage in competition with conventional electricity generation. This is also due to the fact that the negative environmental impact of energy generation is borne by society as a whole and specifically is not reflected in electricity prices. Despite considerable progress in recent years, renewable technologies accordingly need specific support to ensure further expansion. This is particularly true since the Federal Republic of Germany has set itself the ambitious political goal (in international terms) of at least doubling the share of renewable energy in electricity generation by 2010. A key issue is accordingly which instruments can be used to pursue promotion of renewable energy in a liberalised electricity market effectively, efficiently and on market lines.

To provide a solid basis for this debate, a criteria matrix was developed which can be used to evaluate the various instruments in terms of their suitability for advancing the goal of increasing the share of renewable energy in electricity generation. Both statal (electricity tax, feed and quota regulation) and voluntary instruments (»green supply«) were included in the study.

There is extensive need for study in connection with the option of increasing the share of renewable energy. TAB sees the priority fields as being:

- > technical further development and testing of electricity generating technologies which have previously been underrepresented in Germany, e.g. offshore wind-powered installations and geothermal energy,
- > the technical questions and R&D needs involved in increased grid integration of electricity from renewable energy, and specifically supply-dependent energy and the introduction of new supply structures,

- > the influence of European integration and the liberalisation of the energy markets on options for action by national legislatures in energy policy, and the interaction between various environmental policy instruments to promote the use of renewable energy in a liberalised electricity market.

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