An Approach for Integrated Energy-Economy Decision Analysis

The Case of Austria

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1. Introduction

Many modeling efforts have been undertaken to gain better insight in the interactions between the energy sector and the rest of the economy. One of the first attempts was made with ETA-MACRO [1], consisting of a macro-economic model linked with an energy model, that had its main focus on electricity generation. One of the latest developments in that field is the ZENCAP model [2]. It is based on a multi-sector economy model consisting of an input-output table and a large number of econometrically estimated equations, e.g. for investments, energy demand and employment.

This paper describes an instrument that falls into the same category of models. However, by reducing the detailed representation of the economic relations and focusing more on an exact description of the energy system, it is easier to handle than the ZENCAP model. This model is designed for the investigation of different energy strategies considered in energy importing countries. The economic submodel serves as a tool for an overall consistency check of the energy scenarios investigated. In general the setup of the model allows to exclude an optional economic sector from the internal logic of the model and investigate it separately in a more detailed model. This separate model is driven by the demands calculated from the economy model. Its results are then used as input to the economy model. For objectives related to the energy system the model system described here supports multi-objective decision analysis [3].

The following section gives an overview of the current energy situation. Thereafter the mathematical formulation of the model is outlined, followed by some preliminary results in the last chapter.

G. Fandel et al. (eds.), *Large-Scale Modelling and Interactive Decision Analysis*

2. The Current Energy Situation

After more than a decade of tight energy markets we are now facing a buyer's market where energy exporters fight for their market position by lowering export prices. This is certainly a situation where research in energy related matters seems to be of no great importance. However, periods like this allow one to prepare for the future. Nobody can predict the development of energy prices over the next few decades or even over the next few months with certainty. Thus various strategies should be tested against conceivable energy price and availability scenarios. Their effectiveness in avoiding future shocks should be proved.

One of the most important factors influencing the development of energy prices are the decisions taken in the oil importing countries. If consumption begins to increase due to the low energy prices and investments in energy conservation are reduced, the current buyer's market may soon turn into a seller's market again and thus allow for price increases. If, on the other hand, the efforts for fuel saving and diversification are continued an energy price increase becomes more unlikely. An ongoing effort in fuel saving can only be imposed by the governments and be enforced by keeping the domestic energy price stable at near the current high levels.

Since the model system was initially developed for Austria, some specific problems of this country will be addressed in the following. Besides the effects mentioned above, where small countries like Austria can only react, a number of internal problems require a careful investigation of the future development of energy demand and supply options. The problem is two-sided. Given the assumption that domestic energy prices will be kept at a high level, then, at least for the next ten to twenty years the growth in energy consumption will be limited and even a decrease in energy consumption due to savings is conceivable. Such a situation requires extreme care when investment decisions are to be taken. In periods with high growth a wrong decision can be paid from future income relatively easily. In low or zero growth periods a wrong investment decision can cause serious financial problem. On the other hand, if consumption increases due to falling energy prices, new power plants have to be taken into operation. But recent developments in public perception of large scale investment projects has hindered the construction or operation of three large power plants. The nearly completed nuclear power station in Zwentendorf was, due to a referendum, not taken into operation. The construction of the base load hydro-power plant near Hainburg and the peak-load hydro-power station in the Dorfer Tal, was--at least--delayed due to strong public protest and the desire to create natural resorts at these locations.