DECISION SUPPORT ANALYSIS FOR THE CONTROL OF SO_2 AND NO_x EMISSIONS-METHODS, MODELS AND RESULTS.

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The damage to forests is a very important public issue in the Federal Republic of Germany. SO_2 - and NO_x -emissions are among others responsible for this damage. The damage has increased very rapidly over the past three years, so the immediate initiation of countermeasures is necessary. Since the benefits of these measures cannot be calculated exactly, political decisions have to be made under conditions that are uncertain. The paper demonstrates how and to what extent different methods are able and have been used to support a rational decision process under these circumstances.

There are two basic approaches for the support of decisions:

- cost-effectiveness analysis via simulation models
- cost-effectiveness analysis via optimization models.

Other methods e.g. the utility analysis cannot be applied, because it is not possible to calculate the quantitative effects of reductions of emissions on the degree of damage.

Simulation models were used by two commissions, that were initiated by the state government of Baden-Wurttemberg. The task of these commissions was to recommend strategies towards reducing SO_2 - and NO_x -emissions from public power plants with a minimum of costs.

After defining a reference scenario, that describes the possible development of the electricity supply system, the cost-effectiveness ratio, i.e. the amount of money needed to reduce the emission by one kilogram of SO_2 or NO_x is evaluated for every possible measure.

After ranking the measures, and taking into account, that different measures could affect each other a cost-optimal control strategy can be found. The results show, that a reduction of the SO_2 - and NO_x -emissions of more than 75% is possible and economically reasonable; the electricity production costs will increase then by approx. 1,4 Pfg/kWh_{el}. This approach at present is also used to examine SO_2 - and NO_x -emissions in the industrial

sector. Another application is the analysis of the emissions of all sectors for an urban area (Stuttgart).

Using an optimization model for the analysis of cost optimal emission control strategies offers the advantage, that the trade-off-curve between emission reduction costs and total emissions can be obtained directly from the model results. If the model used is a realistic representation of the overall energy system, interfuel substitution and its effect on the emissions can also be taken into account. Compared with simulation models, optimization models in general do not allow for the consideration of the same level of details, due to computer time limitations.

The paper will describe and discuss the main results of three studies that deal with the investigation of emissions and their reduction by means of optimization models.

The presented studies show, that the use of simulation and optimization models can be a valuable input to a decision process in an uncertain environment.