Decision Making in Energy Policies with Conflicting Interests

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ABSTRACT

Decision analysis has frequently been criticized as an inappropriate tool for complex policy issues since it presupposes a rational and homogeneous decision maker and a consistent set of values from which preferences can be derrived and ordered according to importance. A typical policy situation is characterized, however, by a heterogeneous group of decision makers mainly interested in the justification of a preformulated policy vis-a-vis competing interest groups and by conflicting values and objectives. Therefore, a modification of the original decision analytic approach will be presented focussing on plural value inputs and participatory weighting procedures.

The approach was tested in a large policy study on future energy strategies. The study contains three major components: in a first step values and criteria were elicited by interviewing the leading representatives of nine stakeholder groups in the Federal Republic of Germany and structured in the form of a joint value tree. Second, the revealed criteria were translated into indicators. Four different energy scenarios were evaluated with respect to each indicator making use of physical measurement, literature review and expert surveys. Third, the weights for each indicator were elicited by interviewing randomly chosen citizens. Those citizens were informed about the scenarios and their impacts prior to the weighting process in a four day seminar. The results of the study were reported to the policy making bodies and served as a discussion outline to form a viable compromise for future energy politics.The chances, prospects and limitations of the applied model are discussed during the presentation and some guidelines are developed for an effective and implementable policy consultation.

INTRODUCTION

After the accident in Tschernobyl policy making and implementation of energy decisions have become more difficult than ever. On one hand side the public reacts with fear and opposition to a possible extention of nuclear power, on the other hand the economic prosperity of a country depends on an inexpensive and non-exaustive energy source like nuclear energy. Energy planning is necessarely associated with conflicting values. This situation is true for industrialized and developing countries alike. What can policy analysts do in order to resove the conflict and initiate a rational and a publically acceptable energy program?

The following paper desribes a concept of energy planning developed by a study group of the Nuclear Research Centre in Julich (FRG). The concept is based on the idea that in a pluralistic society different social groups should participate in the policy formulation process and that the values of the public should be incorporated in the weighting process to make choices between given options. As reference theory we use the basic framework of decision analysis.

The essential guideline of decision analysis is to lay out the decision options, assess the often probabilistic consequences of each option and select the one option that offers the highest expected value.This may not be of strategic interest to public decision makers. In many instances transparency of the motives for a specific decision and publicising the trade offs used in the analysis might create a political disaster, in particular if health effects are traded off against economic benefits. In addition, the policy making bodies form a heterogeneous group of individuals with different personal values, aspirations and perceptions of the institutional tasks that they are obliged to perform. The specific goals of a proposed policy might be obscure or controversial and there might also be no clear distinction between means and ends.

Hence, many policy analysts have come to the conclusion that the specific tools of decision analysis only apply to situations in which individuals have to choose between personal options almost unrelated to potential consequences for third parties. As soon as preferences of decision makers with conflicting values have to be taken into account and as soon as collective goods with external effects play a major part in the analysis, the one-dimensional process prescribed by decision theory must fail according to many investigators.

Although this criticism is true with regard to a naive adoption of decision analysis into the policy sector, there is a wide range of potential modifications of the original decision analytic framework

providing for multiple decision makers and conflicting values. Furthermore, the decision analytic perspective has proven to be a rewarding heuristic concept for analyzing factual policies and an - easy to cummunicate - prescriptive method to assist policy makers to determine potential options for resolving social problems.

THE BASIC STEPS OF DECISION MAKING

According to the basic axioms in decision theory any planning process consists of seven different steps:

- Commitment and specification of *needs or goals* with respect to overall values in society.

- Choice of appropriate *criteria or dimensions* which can be used as a heuristic classification to assess consequences for each option and to define violations or fullfillments of the specified goals or values.

- Transformation of criteria in measureable *indicators* to assess the consequences of various options in a most objective manner.

- Definition of *options* that are technically feasible and correspondive to the overall aim specified in the first and second step.

- Assessment of *consequences* for each option according to the preformulated indicator list (extent and probabilities).

- Assignment of *relative weights* to each indicator (or -if appropriate- subcriterion).

- Selection of an *aggregate model* to combine assessed probabilities and weights. Usually for each indicator the assessments are multiplied with the perceived probability and with the relative weight and afterwards summed up.

As long as the total range of consequential effects (from best to worse) is taken into account, as long as individual utility functions for variations in probabilities are considered and as long as independence and non-redundancy of all dimensions have been assured, the seven-step model has proved an excellent normative guideline for rational decision making. But this good record can only be applied for decision making by individuals or by homogeneous groups. As soon as different groups with different criteria and values are involved in the decision-making process, the simple model fails, because rationally derived means to summarize values or to aggregate weights between groups are not available. All attempts to construct social utility functions are either too abstract so that they are impossible to use in a concrete case or they are rather adoptive to strategic maneouvers.

A PLURALIST APPROACH TO DECISION MAKING UNDER CONFLICT

Any approach to build a model for decision making in energy planning has to face the difficulty that not only values and criteria are disputed, but also the facts, e.g. the assessments with respect to each option. Thus disagreement is expected to appear also in step 5 describing the assessment of consequences and their transformation into indicators.

When designing the research program the study group had to consider the characteristics of the political arena in which energy policies have to be formulated and implemented.

In contrast to some other political arenas the energy scene in Germany, as in many other western countries, is characterized by the following four major features:

- A lack of unanimity among the scientific experts (or those regarded as experts) about facts
- The public's lack of confidence in scientists and policy makers
- The assignment of symbolic values to nuclear energy including moral and ethical considerations regarding industrial society as a whole
- The unwillingness of the stake-holder groups to move towards a compromise

The lack of general agreement about future energy policies among experts, politicians and interest groups has led to frustrations amongst the general public and has promoted a feeling of distrust and scepticism towards official decision makers. Public media and opinion leaders have transferred the controversy to the public, forcing people into the role of arbitrators between scientific camps. Needless to say, most people feel overtaxed by this task and recommend a more cautious strategy incorporating all the critical remarks of professional scientists. Since scientists for various reasons disagree on the question of acceptability of nuclear power, a loss of credibility has occured which makes it difficult to convey trust in the regulating bodies.

This specific situation leads to the necessity to alter the steven steps of decision making in order to cope with the conflictual situation and to gain approval by the different stake-holder groups which take part in the decision-making process.

The basic framework for our analysis was conceptualized as a modified version of the traditional decision analytic approach. The study was carried out in the years 1982 to 1985 initiated by the Federal Ministry

for Research and Technology. We were asked to investigate the possibilities of designing an energy policy programme which would not only satisfy the needs and requirements of an energy-seeking society, but also provide a way of resolving the related conflicts within German society. In particular the prospective outlook and the further development of nuclear energy were to be investigated, taking into account social and psychological aspects and constraints.

Since we basically followed the idea of the seven step model of decision making, we can best describe our approach by referring to this concept.

The specifications of policy goals

The controversial question in step 1 deals with the problem if the government in a pluralist society is justified to specify universal goals and needs or if all groups in society should have an equal right to come up with their own definitions what kind of basic aims a society should pursue. We decided that any political system - even the most democratic society - should base their decisions on a few mandatory criteria, namely that the physical needs of the public should be served, that the civil rights should not be violated and that social change is not prevented or hindered. In the case of energy we specified these criteria in the following way: energy systems should provide all the services that people demand today and they will probably demand in the future; energy systems should not lead to a considerable restriction of personal freedom in order to insure protection against sabotage or terrorism nor to control and enforce state laws on energy conservation; energy systems should be flexible enough to adjust to changes in the societal structure of needs and demands. These criteria were considered as meta-criteria for the energy planning process regardless if groups in the society shared this view or not.

As expected there were no objections from any of the querried groups with respect to these three yardsticks. They were later used to specify the options that were regarded feasible. Any option which did not meet one of the main criteria was excluded from the analysis.

The selection of criteria.

The choice of appropriate criteria beyond the rather abstract level of meta-criteria involves several procedures which go beyond the normal method of decision theory by asking the decision maker what matters to him. First, we had to take into account that in democratic societies

many decision makers are part of the decision process and secondly, that relevant groups in society demand that their values and interests should be considered when making collectively binding judgements. Thus, the problem had to be solved in which way we could select appropriate criteria that in principle could be approved by a group of heterogenious decision makers and be accepted by major interest groups in society.

We could use intuition, analysis of current documents in the political debate, brainstorming with experts, or surveys among the public. But these methods don't meet the two relevant conditions: approval by the decision makers and acceptance by societal groups.

Thus, we selected a rather new technique referred to as value tree analysis, which was developed at the Social Science Research Centre of the University of Southern California.

The value tree analysis is an interactive, iterative and integrative method. Individuals or representatives or important societal groups are interviewed in order to determine their relevant values and concerns about the domain of investigation. The values formulated as statements about desired states, positive intentions or preferred directions with respect to possible decision options, are organized in a value tree representing the hierarchy of values of the particular group. Each group had to approve of its value tree.

In order to cover the wide spectrum of views on energy systems in the contemporary German society, ten stake-holder groups were invited for the value tree analysis. The politically most controversial organizations were probably the Power Plant Manufacturer and the Nature Conservation League. With nine of the ten groups interviews were conducted and individual value trees were constructed. The list of participating organizations is shown in Table 1.

Insert Table 1 here

The value tree represents an hierarchical structure with the general values and concerns on top, and the specific criteria and value dimensions at the bottom. Most of the groups expressed a common understanding of the basic objectives for energy systems, but differed in their comprehension of the meaning of each value.

Accordingly, the individual trees have a similar superstructure with different focus on the degree of refinement of particular branches. Without giving preference to any individual value tree, the tree structures for the German Catholic Church and for the Federation of the German Industries are illustrated in Tables 2 and 3.

Insert Tables 2 and 3 here

The nine individual trees were used as the basic elements to construct a combined value tree for all groups respectively. Such a joint tree can be understood as the representation of major concerns in a pluralist society without focusing on the differences in weighting and importance for each value item.

But the combined tree represents more than just a list of concerns mentioned during group interviews. It is an attempt to structure various, even conflicting values and criteria in a logically consistent, generally acceptable manner which is a prerequisite for the formation of a societal consensus on how to resolve the conflict about the criteria used for evaluating different energy options.

The combined value tree was generated in the following way: The main values of the overall tree were formed by clustering and contrasting the general values of the seperate trees. All other items and terms were listed according to the hierarchical level of appearance. Then, the whole set was sorted and clustered around the respective lexical content of the main values. Finally, the clusters were aggregated and rearranged hierarchically in the overall tree with the eight main criteria:

- Energy systems aspects,
- Impacts for the national economy
- Impacts on the natural environment,
- Health and safety,
- Political impacts,
- Social impacts,
- International impacts.

The criteria "energy systems aspects" and "national economic impacts" cover costs, efficiency, security of supply, and market consequences of different energy systems. The criteria "impacts on the natural environment" and "health and safety" are self-explanatory. The criteria "political impacts" and "social impacts" include consequences for the social structure, quality of life, political decision processes, democracy and its institutions, options for future generations, etc. The criterion "international impacts" includes issues of peace, distributional justice in international affairs, and options of international policy.

The combined tree contains the concerns and evaluative criteria of all participating groups. All groups were asked to approve of the overall value tree. There was a mutual agreement among all groups that they would respect the values of the other participating groups provided that their own ones were equally accepted and considered. The acknowledgement and acceptance of each other's values structure was facilitated by the procedural mechanism that each item on the tree could be weighted by zero and thus elliminated from the list. For this reason an agreement

among the interviewed groups was achieved, since every group found itself represented.

It should be noted that in this step no compromise between groups was needed, as all concerns were adopted regardless if they were perceived as important or not. Therefore, the joint tree is assumed to account for all viewpoints in the German society on energy system options. Since the joint value tree consists of more than 100 different items, omly a selection of the tree may be presented in this paper. The social and political criteria of the combined value tree are reproduced in Tables 4 and 5.

Insert Tables 4 and 5 here

By using the joint value tree as criteria list we were able to meet the second condition - approval by societal groups - by definition. The political decision makers were also satisfied with the catalogue of criteria, since the main interest of politicians is to maximize public support. A criteria list which combines all the concerns of the relevant groups is the best mean to assure this objective.

The transformation of criteria into indicators.

The next step refers to the transformation of the value tree structure into an operational system of dimensions and indicators. Ideally this task should also be performed by the various groups forcing them to be more precise in what they mean by using various terms. However, because of lack of time of the representatives of each group and the difficulity of combining different operational definitions of the same term, we used our own expertise and transformed all lower level criteria into indicators which in principle should provide us with the possibility of physical measurement or at least of scaling expert ratings.

Our group catagorized the eight main criteria of the combined tree into a catalogue of nine criteria with up to ten sub-criteria each.

Although requiring simplification of clusters and aggregation of branches this process had to maintain the content and the meaning of the overall tree. It resulted in the following categories:

- Operationality of the energy system,
- Environmental impacts,
- Health and safety,
- Security of supply,
- Economic effects,
- International effects,

- Political impacts,
- Social impacts,
- Personal impacts.

The list of criteria, indicators and subindicators is illustrated in Tab. 6.

Insert Table 6 here

In the next step we selected measurement scales to assign physical or judgemental data to each indicator. In response to the complexity of the technical information and the degree of uncertainty we used different scaling levels:

- Quantitative scaling,
- Ordinal rating,
- Rank ordering,
- controversial statements (categorial measurement level)

In order to improve the readability and apprehension of the assessment all ratings were then standardized on a four scale rating scheme (from very weak to very strong).

The final set of criteria and indicators represent a comprehensive, complete, independent, meaningful and adequate list for the evaluation of energy policies. The criteria have deliberately not been weighted, and the indicators have not been aggregated according to an index construction rule. Rather the catalogue of indicators and measures should be regarded as an approximately objective list of social concerns which render the measurement of each scenario's performances with respect to these concerns.

The generation of options.

On first glance it seems odd to look for possible options in such a late stage of the decision-making process. There are two reasons for the placement of this step after the specification of the evaluative criteria.

First, options generate positive or negative associations which unconsiously shape the analysts' selection of criteria and indicators. In most cases the criteria are defined in such way that the intuitively best option will inevitably turn out to be the "winner of the decision game". Second, the set of indicators and criteria are an excellent tool to search for new options which have not been included in the discussion so far. If one knows in advance, which criteria potential options must

meet, one's imagination for totally new options might be encouraged and new solution might be envisaged.

In our study we did not construct our own scenarios, but used four existing ones. In 1979, the German parliament adopted unanimously the resolution to establish the Enquete-Commission on "Future Nuclear Energy Policy". The commission consisted of seven members of parliament and eight experts representing the fields of engineering, natural and social sciences. Because of the nuclear energy controversy in Germany and the development of the fast breeder reactor the commission assembled proponents of the nuclear energy as well as opponents.

The commission designed four scenarios of future energy situations or paths into the energy future which were supposed to comprise the full range of opinions on energy systems. This fan of prospective solutions did not only express the possible future mixes of the available energy sources, but also the value orientations of the commission members.

The scenarios were constructed in such a way that different political options were operationalized in terms of consistent energy supply and demand models for the years 2000 and 2030. The four scenarios are illustrated in Fig. 1.

Insert Figure 1 here

In particular the role of nuclear energy differs among the four scenarios: Path 1 and 2 utilize this technology to a large extent, options 3 and 4 do not use nuclear energy after the year 2000. With respect to energy conservation and solar systems paths 1 and 2 provide for a moderate amount of conservational and solar technologies, options 3 and 4 concentrate on these two means of energy conversion.

The advantage of using the four energy scenarios of the German Enquete-Commission is the approval by most societal groups including pro and antinuclear activists. Both sides could find themselfes represented in the four scenarios.

Assessment of consequences according to the indicator list.

Since the effect of the consequences of various energy systems are disputed among scientists, it was not possible to employ physical measurements for all indicators. At least we were confronted with a broad range of estimations depending on the point of view that the analyst had taken in the energy debate. For many indicators, in particular those referring to social and political aspects, the status of scientific methodology does not imply a clear theoretical or

empirical relationship between the implementation of any energy system and its possible outcomes. In this situation two methods of impact analysis were used:

- *Professionals were asked to give estimations* for each indicator that they felt to have expertise in. In addition they were asked to determine the range of other possible answers to the problem given a confidential interval of 95%. Those ranges were collected and later sent back to each participant again, contrasting the position of each consultant with the ranges of all the other experts. After the revision we were able to construct a probability function for each indicator summarizing the ranges given by each expert.

- We invited energy experts and trained professional in the field of impact analysis to a *delphi seminar in order to assess the rather controversial economic, social, and political consequences* of each energy option based on their best estimate of their factual knowledge.

  A group of 17 experts employed at German universities or institutes attended the two day Delphi seminar. They were selected because they had previously published articles or books on social or economic impacts of energy systems. Deliberately we looked for scientists with different educational background. Engineers, natural scientists, economists and social scientists were invited to participate. We also tried to include persons with diverging attitudes towards the four scenarios.

  The Delphi method is an iterative and integrative procedure used to arrive at a consensus on the forecast or estimate of specified future events or situations. The experts were querried in iterative rounds with feedback supplied in between concerning the group's comments and responses.

Because the assessment had to be made for future energy situations, the participants made their intuitive subjective judgements based on a rather high degree of uncertainty. But on overage the ratings turned out to be generally sufficient for evaluating the different scenarios at least on an ordinal measurement level. The results are reproduced here in detail for the political impacts (Tab. 7).

Insert Tab. 7 here

Assignment of relative weights.

Similar to the selection of criteria and indicators it seems impossible to presume that there is a unanimous consent within society about the importance of each criterion for evaluating different energy options. There is no legitimate rationale to combine different assignments of weights elicited from stake-holder groups or the general public into a single societal weight. There are in principle four different approaches to come up with a generalized weight:

- Direct negotiations among the decision makers *(unanimious vote)*
- *Selection of a few respresentatives* out of the decision making body and using their mean weights (benevolent dictator)
- Utilization of different *voting models* (ordinal pair comparison, assignment of points, majority vote of options)
- Elicitation of *weights among relevant groups* in society and transfer of the results to client oriented politicians
- Elicitation of weights among a *representative sample* of the general public and adoption of their mean value.

We tried to elicit the relative weights by organizing a survey of the general public (one man - one vote), but we used the results of our surveys only as an informational input for the legitimate decision maker. We thought it necessary that the decision maker should have a most realistic impression as how the public at present assignes trade offs between different values. Some of the disadvantages of public surveys were overcome in our study by a special survey method, called planning cell procedure.

A planning cell consists of a group of citizens who are selected by a random process and are given paid leave from their workday obligations for a limited period of time in order to work out solutions for given, soluble planning problems with the assistence of advisors on procedure.

A group of citizens actually means a small group of about 25 people who work on a predefined task in a group process. Since the citizens involved have been selected by a random procedure they are not individually concerned in the planning problems to be solved. In order to encourage them to participate they are assigned the socially highly esteemed role of a "consultant" in the public planning process. The seriousness of the planning task to be solved is also made clear by the honorarium which the citizen receives for his function as a "consultant". The limited participation period prevents the citizen

from being alientated from his real social role; he only changes his perspectives for a brief period.

In our study 24 planning cells all over Germany were organized and confronted with our impact analysis of the four energy scenarios. The task of the citizen was to rate each scenario according to the main criteria, assign relative weights to each criterion and formulate a recommendation about the desired future energy policiy.

Again it should be emphasized that all the results of the planning cells are regarded as an input for the decision-making process, and not as a substitute for the decision. This input should be regarded as a decision aid to form and shape political judgements according to the latent and overt value structure of the concerned public. If this assumption is accepted, the planning cell might be a good instrument to collect the relevant feedback from society and to reveal the intuitive preferences and values that should be the guidline of democratic policy making.

Aggregation of weighted assessments.

We considered the aggregation as a fundamental political process which should not be confined to a mathematical formula. If the help of a decision analysist ist still demanded (and this is usually not the case), he or she should concentrate on revealing the salient dimensions that define the borderlines between the preferences for one option or the other.

May be specific political procedures can be implemented to overcome some negative impacts associated with the most promissing option. May be a recombination of options can be initiated, may be a compromise can be found by compensation or by accepting compromises in other political issues. Negotiations are so complex that it is almost impossible to press them into a procedure of rational reasoning.

The dialogue of the decision maker with the policy maker is usually referred to as sensitivity analysis. By changing the different parameters or the different evaluations or assessments the decision maker gets a feeling which aspects exercise the strongest influence on the overall evaluation. Also he gets more aware of the uncertainties involved in any decision model. We think that it is most appropriate to combine the aggregation of the weighted assessments with the sensitivity analysis to provide a framework in which a most rational decision-making process can be initiated.

If the decision makers have a good impression of what to expect when aiming for any of the possible options, if they are sure that they have

considered all relevant aspects and if they found a compromise in assigning weights to each dimension incorporating the wants and trade offs of the general public - if all this is accounted for, then the decision makers have all the necessary input to make a rational and - for the time being - non-improvable decision. There is no further need to confine the ultimate decision to a specific aggregational procedure.

RESULTS OF THE PLANNING CELL PROCEDURE.

So far we desribed the procedure and the methodology of the study. Although our emphasis for this paper is on the methodological aspect, we would like to report on some of the main results of the study. The evaluation of a new methodology in policy analysis certainly depends on the soundness, validity and reliability of the results that can be expected from its implementation. Therefore, we will present some of the outstanding results from the planning cell procedure.

The first task of the participants was to assign weights to each subcriterion and criterion, and later on to evaluate the four options according to each criterion. We assumed that the rank order of criteria is derived from personal values and should therefore not be altered by the information process; our information was meant to focus only on facts and their (controversial) interpretation. In order to test the influence of the information process, we asked the participants to make rank order of the main criteria on the first and the last day of the seminar.

Figure 2 illustrates the medians of the rank order for all eight criteria, comparing first and second measurement. Evidently all observed changes are only of minor magnitude and the sequential order remains the same.

Insert Fig. 2 here.

Looking at the priorities revealed by the weighting procedure it does not seem surprising (knowing the general beliefs) that health/safety and environmental quality form the top of the hierarchy. The general economic concerns - in particular, security of supply - are rated higher than the more specific concerns of financial and material requirements. It is interesting to note, though, that this criterion gained more importance over the four days information period, whereas the relevance of the environmental effects is rated slightly lower on the last day compared with the rating of the first day. Political, social and international aspects were regarded as less important for the evaluation of energy systems.

Figure 3 shows the results of the intuitive preference measurement with respect to the four energy scenarios. Intuitively the moderate pronuclear option 2 has gained the highest approval, followed by the most moderate non-nuclear option 3 (43 percent and 39 percent respectively).

Insert Figure 3 here.

Most of the respondents who gave first priority to option 2 or 3 assigned also the second priority to the other moderate option (either scenario 2 or 3, respectively). Thus, there is a clear indication for the preference of more moderate scenarios.

The two pronuclear options together were chosen less frequently than the two non-nuclear options. Approximately 16% of participants preferred the extreme solar and conservational scenario 4 as opposed to only 3% preferring the extreme pronuclear scenario 1. Evidently, there is a considerable group of highly motivated and convinced citizens with a strong antinuclear commitment, whereas an equally sized pronuclear fraction is missing. Also, more than 70% of the persons who preferred option 2 (moderate pronuclear) moved to the moderate non-nuclear scenario 3 when asked for the second priority. The proponents of scenario 3, however, were equally divided: 50% assigned their second priority to scenario 2, the other 50% to scenario 4.

When we take a closer look to the the perceived performance of each energy scenario according to the main evaluative criteria, scenario 3 receives the highest scores on average. Scenario 1 is almost inferior to all three alternatives, whereas scenario 4 is associated with positive scores with respect to environment and health and negative scores with regard to economy and security of supply. Scenario 2 is regarded as superior in all economic aspects compared to scenarios 1 and 4 and not significantly different from scenario 3. But with respect to environment and health the scores are considerably lower than the ones of scenario 3. Fig.4 illustrates the mean values of performance for each energy scenario.

Insert Figure 4 here

If we use the mean values of performance, the incorporation of any weighting assignment performed by any of the participants would have resulted in a calculated preference for scenario No 3 if the weighted means for each scenario were summed up in a simple linear model. But as mentioned before this was not the case. More than 40 percent of all respondents voted in favour of option 2. How can this overt contradiction between perceived performance and preference be explained?

Our study revealed four different reasons for this discrepancy:

- The weighting process was highly influenced by a common understanding of "social desirability". Most people did not dare to express a high preference for economic prosperity since this value could be interpreted as "egoistic" and "self-centered".

- Many respondents felt that options which receive rather negative scores on all three economic criteria should gain extra negative weights which should not be compensated for environmental benefits.

- Many participants did not share the presumption of the Enquete Commission that all four scenarios represent feasible energy options. They were convinced that scenario 3 might indeed be associated with the best possible outcomes, but that it would not meet the precondition of securing the energy demand for the next 50 years.

- Some respondents claimed that the politicians and opinion leaders to whom they had trust and confidence had expressed their preference for scenario No 2. Therefore they felt obliged to vote alike. This effect may be labelled "loyality vote".

So in spite of the highest score for the moderate pronuclear option 2, there is a tendency to perceive the share of nuclear energy as a burden which almost half of the respondents are ready to accept for mainly economic reasons, whereas the other half would prefer this burden to be replaced by conservation or solar systems.

This ambiguity in the perception of nuclear energy is even more visible if we look into the results of the questionnaire dealing with the future of nuclear energy. The vast majority of participants perceived nuclear power as necessary, economical, and promising, but on the other hand they expressed a strong degree of discomfort with this type of electricity generation. Most people supported the recommendation to confine the use of nuclear energy to that amount that all other energy sources together could not meet. However, almost everyone of this majority group voted against a complete shutdown of nuclear power plants. They were convinced that nuclear energy might play a major role in the future, provided the safety problems, the reprocessing and waste disposal problems, and the negative social impact (like police state methods) could be managed in a satisfactory way.

Also most people believed that in the long run nuclear energy had the potential to be the most important energy source for the Federal Republic of Germany, but the appropriate technology for this purpose was still to be developed. More than 70% of all repondents were convinced that the problem of waste disposal was not solved in a satisfactory way, but 60% agreed with the statement that nuclear power is safe and clean.

Whereas sex had no impact on the formation of nuclear attitudes, we detected quite intensive relationships between age, party preference, and the evaluation of nuclear power. The more conservative people voted in national elections, and the older they were (in particular over 40 years old), the more they preferred the pronuclear options 1 and 2. Older people and conservative voters tend to express more trust in

established institutions and assign a higher degree of credibility to politicians and scientists. Younger people with less conservative background were more inclined to adopt the arguments of the antinuclear experts. They also assigned higher weights to environmental values and scored nuclear energy as more environmentally harmful compared to older or more conservative persons.

These results support the observation that nuclear energy has gained a symbolic position to represent industrial values in general. Persons who favour the industrial society are more inclined to evaluate nuclear energy in a rather positive manner; persons holding a sceptical view of the industrial society reject nuclear energy more frequently.

Those results were revealed before the Tschernobyl accident. Therefore, fears for accidental release of radioactive material were not very strong. As recent opinion polls demonstrate the German public has dramatically increased its concern for nuclear accidents. But with time passing by the preoccupation with nuclear accidents migh fade away, in particular if similar events do not occur in Germany itself or in the surrounding countries. In the past changes of attitudes because of nuclear incidents (like Three Miles Island) did not prevail over a longer period, but adjusted to the former level of attitude structure.

CONCLUSIONS

The techniques and methods presented in this paper can be considered as an aid to improve the political decision-making process. In a society with pluralist values and commitments technical and economic criteria are not sufficient for policy formulation and implementation. Potential conflicts have to be indentified in advance, and the pros and cons with respect to relevant societal groups have to be gathered and systematically classified.

The study on "decision analytic tools for resolving conflicts about energy policies" has been carried out to analyse, systematize and evaluate the interrelationship of energy systems characteristics and their societal perception. The comparison of the assessment profiles with holistic judgements of the possible future energy options can probably facilitate the process of finding desirable and acceptable solutions for the future technical development and its societal implementation. For this purpose we have enlargened the traditional decision theoretical approach to incorporate conflict resolution and pluralist value commitments.

We are not sure if our model will also work in different cultural contexts. But in cases that the decision making bodies do not form a homogenious entity and different social groups demand to be part of the decision process, there might be a good chance to implement similar procedures.

With respect to Indonesia we would recommend to use our model of value tree analysis for getting a feeling of society's needs and desires and integrating important social groups in the policy formulation process. By interviewing the leading representatives of important stake-holder groups the planning task force will receive information on what people are concerned about and what they would like the government to do. Unpleasant surprises and -sometimes avoidable- public opposition might thus be mitigated.

The transfer of the planning cell method does not seem advisable for Indonesia if the random selection process to recruit the participants is adopted. But we could think of a modified version of a planning cell in which representatives of social groups, highly educated citizens and government officials meet together to discuss the various options and evaluate them according to the concerns expressed by the stake-holder groups.

It would be worth while trying to apply the model of decision making under conflict in different nations and for different purposes. The model certainly needs further refinement and improvement. But it can be

regarded as a first step towards an efficient policy tool which combines the often conflicting goals of rationality and public involvement.

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