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## Kooperative Planung von Kommunen und Stadtwerken Ausweg aus der Klimafalle?

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### Zusammenfassung

Die kommunale Energiepolitik steht vor der großen Herausforderung, finanzierbare Strategien für die Reduzierung der CO<sub>2</sub>-Emissionen zu finden, denn letztendlich werden alle Strukturanpassungen zum Erreichen der nationalen Klimaschutzziele im örtlichen Bereich umgesetzt. Hinzu kommt, daß viele Stadtwerke, bisher zuverlässige Partner der Kommunen, ihre Kooperation bei der Entwicklung von Energie- und Klimaschutzkonzepten wegen dem verschärften Wettbewerb in den liberalisierten Energiemärkten aufgekündigt haben. In diesem Vortrag wird ein kooperativer Planungsansatz vorgestellt, der den Zielkonflikt zwischen unternehmerischen und gesellschaftlichen Zielen moderieren soll. Dieser Ansatz umfaßt ein „Kooperatives Modellsystem KMS“ als Werkzeug für den Planer, eine übersichtliche Strukturierung des Planungsprozesses sowie die Einbindung aller Schlüsselpersonen aus EVU, Kommune, Industrie und Bürgern in einen gemeinsamen Kommunikations- und Lernprozeß. Der Einsatz von Energiemodellen ermöglicht eine ganzheitliche Bewertung der unterschiedlichen Strategien aus der jeweiligen Sichtweise.

## Co-operative Planning by Utilities and Local Authorities A Solution to solve Climate Change?

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### Abstract

Since the deregulation of German energy markets 1998 we can observe diverging planning interests and priorities of the local communities on one side and the local energy utilities on the other side. This seriously endangers the consensus in local energy planning achieved in the past which will be crucial in order to identify and implement effective greenhouse gas (GHG) mitigation strategies. This paper presents a co-operative planning approach which embeds systems analysis into a well structured communication, mediation and learning process for decision making. This process is supported by the cooperative modelling system MESAP, a software for energy and environmental planning, which integrates different energy models with an energy information system. This allows to combine traditional local energy planning with the more business oriented view of the utilities. The specific design of MESAP allows for a continuous "sustainable" planning and monitoring similar to business tools for accounting and controlling in companies.

### 1. The Challenge of Climate Change

Two trends have characterized the last two years: ongoing climate change and increasing competition in the energy markets. The latest IPCC reports have shown dramatically the degree of climate change and have triggered intense international negotiations. The increasing degree of deregulation of European energy markets creates a tendency to consider environmental protection as a burden to competitiveness.

It has become evident to an increasing number of decision makers, that society must develop a „culture of sustainability“, if we do not want to damage the possibility for future generations to satisfy their needs in an irresponsible and irreversible way. Therefore the European commission and the national governments have started to create a policy framework which induces GHG mitigation projects and fosters competition at the same time, a difficult task because of the conflicting objectives.

In order to change the level of GHG emissions, specific actions to change technical equipment or to influence consumer behaviour have to be taken. These decisions are taken at the local level, either by local authorities, private energy consumers, industry, agriculture, tertiary sector or the energy providers in order to adopt to the changing conditions of the political framework. These decision makers feel the need to improve their competence of strategic planning in order to identify robust decisions and to make better investment decisions.

This paper presents a new approach for advanced local energy planning (ALEP) based on a Co-operative Modelling System CMS. The approach is co-operative in two senses: first the actors co-operate during the planning process and secondly energy models with different scopes and objectives co-operate to reflect the different positions and views of the actors in the accompanying scientific analysis.

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The CMS has been implemented with the decision support software MESAP (Modular Energy System Analysis and Planning) developed at IER since 1984.

## 2. The Planning Objective and Philosophy

Planning is regarded as a continuous process and not as a one-time-action. Planning is not a prediction of the future but a tool that provides a rational basis for making decisions which involve high investments with a long impact into an uncertain future. Planning is a dynamic iterative process that includes economic, environmental and social concerns and attempts to identify robust solutions.

Co-operative Planning is a planning methodology based on systems analysis embedded into a communication and learning process for decision making. The objective of co-operative planning is to assist local communities, to achieve a sustainable development path, to protect the environment, to avoid climate change, to reduce the energy costs through rational use of energy, to protect the natural resources and finally to increase quality of living.

Co-operative planning is based on the following principles:

- Concrete actions for sustainable development start at the local level
- Sustainable Development is not possible without sustainable planning
- The interests of all important actors have to be respected
- Planning goal is an efficient consensus within conflicting interests
- Alternative strategies are analyzed based upon energy systems analysis
- Planning does not stop with a decision but accompanies project implementation
- Continuous monitoring is necessary to assure a constant quality increase

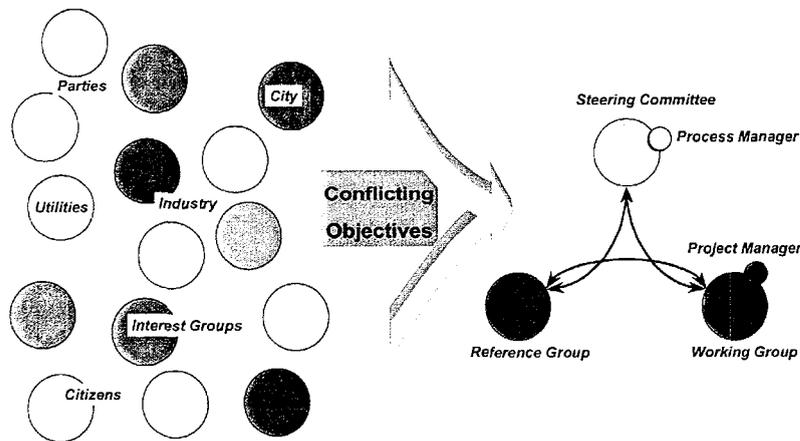


Figure 1: Organisational Set-up of Communication Process for Co-operative Planning

## 3. The Four Elements of Co-operative Planning

### 3.1 A Project Embedded into a Communication Process

The CMS approach establishes an organisational set-up integrating representatives from all relevant interest groups. From the beginning on it promotes communication and fosters negotiation to resolve conflicting objectives. Figure 1 shows the organisational set-up.

The steering committee is the initiator and host of the project and controls the process. It can consist of representatives from the city authorities like the planning commission or the agency for environmental protection and from the local utility. The process manager is representing the institution that has initiated the project.

The reference group consists of dedicated representatives from various interest groups, such as political parties, city council, municipal building authorities, real estate agencies, industry, research institutes, energy utilities and citizen interest groups (agenda 21). It may also contain external experts who can be invited to advise on specific issues of the energy debate. The reference group meets 4 to 5 times during a project and advises on all strategic decisions in the planning process.

The working group consists of energy and modelling experts in charge of the scientific analysis throughout the project. These scientists perform the model runs for various scenarios in order to provide the hard facts for the evaluation of the strategies proposed by the steering committee and the reference group. In addition it is the task of the project manager to organize the communication process and mediate in case of conflicting objectives. The organisational learning experienced by all participants throughout the planning exercise creates the confidence into the results necessary for a broad endorsement of the strategy that is finally decided. The CMS approach aims at negotiating a good compromise in order to lay the foundation for a successful implementation.

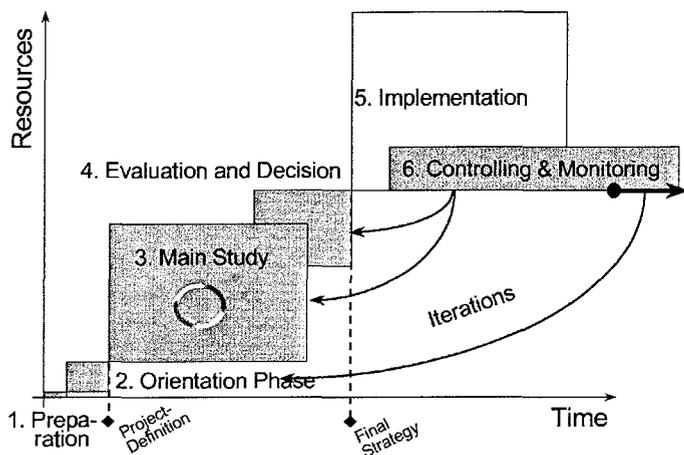


Figure 2: Structure of a Co-operative Planning Project

### 3.2 A Well Defined Project Organization

The „Structured Analysis Procedure SAP“ is used to structure the planning project into distinct phases, mile-stones and feed back loops. Figure 2 shows that a project starts with a pilot study analysing the strengths and weaknesses of the system, focussing the problems and creating an overview on possible future strategies. The main study serves to validate these strategies using computer models based on a comprehensive representation of the whole energy system. In the decision phase, the results are presented to the reference group. Finally a monitoring phase checks the effectiveness of the implemented strategies. The area of the different boxes in the figure gives an impression of the resource allocation within SAP.

The Structured Analysis Procedure SAP allows to set a clear focus within each of the different planning phases and ensures an efficient progress of the project. Figure 3 shows a flow chart of the different stages of an SAP project.

Planning is an iterative procedure that has to be reviewed when new problems arise, values or perceptions change, additional aspects have to be considered, new technologies or strategies become available, new information becomes accessible, improved analysis tools are developed or the institutional framework changes.

Because of the many feed-back links, SAP leads to a process of organisational learning among all participants. New insights at each planning stage allow for an iterative improvement of the agreed strategy. Co-operative planning thus uses SAP to systematically create a target oriented strategy for sustainable development.

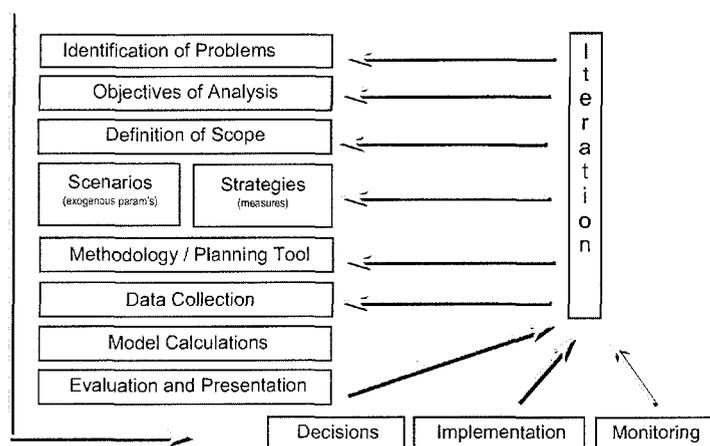


Figure 3: Phases of the Structured Analysis Procedure SAP

### 3.3 A Co-operative Modelling System for the Analysis

A co-operative modelling system combines energy models available for the different planning tasks and integrates them in a modular way through a central database management system. The MESAP software (Modular Energy Systems Analysis and Planning) developed at IER University of Stuttgart is such a CMS. MESAP supports each step within the SAP planning process from problem definition down to monitoring the effectiveness of the implemented strategies.

MESAP integrates all information relevant to planning, structures the planning tasks according to SAP, uses methodologies based on systems analysis, automates the work flow for energy modelling, visualises findings and results as much as possible and documents all working steps transparently.

Energy systems are represented in MESAP in a standardised form as a network of commodities and transformation processes, the so called „Reference Energy System (RES)“, a flexible process-engineering oriented bottom-up technique widely used for modelling energy systems (figure 4). The RES creates a process-engineering oriented accounting framework which leaves a high degree of flexibility for the evaluation of energy and environmental strategies. Models with different scopes and methodological approaches co-operate to analyse different aspects of the same local energy system or subsystem (part of a RES). The models can work on different levels of aggregation (time, space, detail) and they can use different methodologies such as simulation or optimisation using LP, NLP, MIP.

MESAP combines this methodology for energy system modelling with a user friendly relational database management system, that is similar to a time series oriented data-warehouse. The central energy information system connects all energy models through a standardised interface and allows to manage the data independently from the models. Since the database also supports the scenario technique used by energy models to derive robust strategies, consistency is assured since all models share the same (common) assumptions of the scenarios. The models can also pass the results between each other via the standardised database. It is even possible to link external model calculations with Excel into the database.

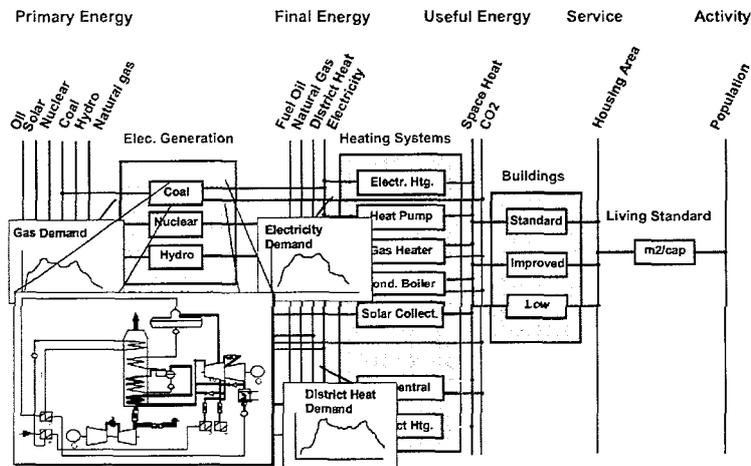


Figure 4: The Reference Energy System RES as Modelling Principle

The CMS allows to evaluate the impacts of a modelled strategy from the perspective of different agents (the utility as a company, the city as a political body). In figure 4 the electricity generating sector can be modelled from the utility perspective in much more detail than the rest of the RES.

Figure 5 shows the architecture of the MESAP software with the database management system at the centre. The main MESAP tools are the Navigator for data entry and retrieval, the Case Manager for scenario management, the RES-Editor to manage reference energy systems, the Analyst for creating Excel reports linked to the database, the DataCube for multidimensional analysis based on OLAP technology (Online Analytical Processing) and the Excel-Interface to Export or Import data.

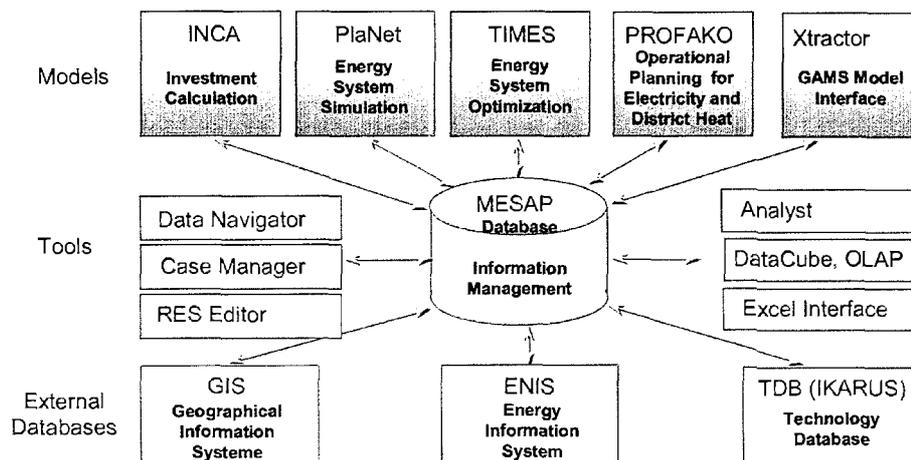


Figure 5: The Architecture of the MESAP Software

The top layer of MESAP locates the models that can be used for energy systems analysis. INCA allows a detailed dynamic investment calculation for the comparison of investments in different power plants.

PlaNet is a linear network model that creates an accounting framework to calculate energy and emission balances combined with a detailed cost calculation.

TIMES ("The Integrated MARKAL-EFOM System") is a mathematical modelling scheme for representing, optimising and analysing energy systems on a flexible time and geographic scale. It follows the RES bottom-up systems engineering approach which allows a detailed technical description and economic evaluation of the energy system. TIMES has been developed under the auspices of the International Energy Agency (IEA/ETSAP) and can be used e.g. to determine cost efficient mitigation strategies for energy related emissions, i.e. to minimise the total discounted system cost for a given energy demand and a limitation on CO<sub>2</sub> emissions.

PROFAKO is the MESAP optimisation model for optimal load dispatching of utilities based on mixed Integer linear programming. PROFAKO allows for load forecasting based on artificial neural networks, contract bench-marking and portfolio optimisation, including typical futures electricity contracts.

The Xtractor is a standardised interface to manage input data and results of generic GAMS models. IKARUS offers a validated Energy Database for Germany which can be used in MESAP for data import.

The Energy Information System ENIS contains economic data, energy data, technical data and environmental data, which can be visualised by tables and graphs. ENIS can be used to build up tailor made information systems, which can share the data among all MESAP planning modules.

The intended GIS interface for local energy planning allows to directly connect GIS-related data to RES oriented planning modules and to visualise results.

#### 3.4 A Continuous Monitoring and Controlling Process

The main result of co-operative planning is a local/regional energy plan. During the implementation steps of this energy plan the real trends should be compared continuously with the anticipated development and the plan corrected if necessary.

After the implementation phase the planning process shifts to a monitoring phase. Continuous monitoring and evaluation is necessary to detect significant changes in the prerequisites of the systems environment for the local energy system. Such changes can make it necessary to adjust some of the goals and parts of the action plan which may have been based on other assumptions. A monitoring activity could be a yearly report to the decision makers.

The MESAP software is designed to allow for an easy update of database and model runs. Updating a case study takes less than 20% of the efforts originally invested to set-up the system the first time. Reporting formats can be easily adopted to new reporting periods. Updating the database does not require modelling skills. The information system is designed for regular (e.g. yearly) reporting. Finally it is possible to access the information system via Internet, a perfect mean to publish trends and results and to attract public awareness.

#### 4. Case Studies for Co-operative Planning

CMS has been applied in various case studies. MESAP has been used for local energy planning in Mannheim, Wiernsheim, Stuttgart and Lissabon (Expo'98). Ongoing projects for co-operative planning are taking place in Rottweil and Friedrichshafen (Germany). Co-operative planning has also been applied within other projects of the IEA Annex 33 "Advanced Local Energy Planning" in Cities of Italy, Holland and Sweden. In these projects the MARKAL software was used.

#### 5. Summary

Clear targets and consistent strategies are necessary for the development of sustainable energy systems. Energy and environmental planning has to be embedded into a communication and mediation process in order to reflect the often conflicting objectives of the actors. Otherwise it will not be possible to achieve an action plan endorsed by broad consensus. To avoid, that a planning study "ends" in large reports which "rest on the shelf", planning must be an ongoing exercise.

This requires tools supporting "sustainable planning", i.e. tools which support a continuous improvement and controlling process. In the future, planning tools for energy and environmental planning will have to be used in a similar way as business tools for accounting and controlling in companies, i.e. on a regular basis.

Co-operative modelling systems such as MESAP which combine the strengths of modern data management systems with the flexible analysis capabilities of different systems engineering methodologies may help to reach this target.

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