Government Support for Energy Saving Projects

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Abstract. We discuss briefly in this paper the design of a knowledge based DSS developed for supporting local government staff in the choice of energy saving projects. The modelling process concerns: the quantitative models, the qualitative knowledge, the data and the user/DSS interface. We show that by combining reasoning and the evaluation of models we can simulate a complex cognitive process and support better the users by providing diagnosis and explanation.

Decision Situation, Nature of Knowledge Involved for a Solution and DSS Functions

Buildings are emitting 25% of total CO₂ as against 28% for transport and 22 % for industry. Buildings are responsible for 45% of energy consumption. One of the important problems faced by governments is reduce these effects. This can be achieved by supporting projects which replace the use of a polluting non renewable energy source by a less polluting energy source or one which reduces the consumption of non renewable energy. In the first category replacing a heating system using fuel by a heating system using solar energy in the second category projects such as insulation of buildings are good examples. It is crucial to allocate properly public money to such projects. Another problem to be solved is related to the rarity of expertise needed to evaluate such projects. The problem to apply this public policy is not only to support the work of members of the service in charge of studying application for financial help it is also to support their learning process. In other words the task is to make the knowledge of a few experts as widely accessible as possible. A more detailed description of the knowledge used in such situation can be found in (Freudiger 2003). The system we have developed is able to:

• create and manage the files of data concerning the project holder and his project.
• guide the user with respect to the data needed to make a good diagnosis .
• capture the data to make a diagnosis or design a solution coherent with the project holder goal and constraints.
• provide a diagnosis on the project and eventually propose other alternatives.
• automatically explain the diagnosis or the proposed solution to support learning.
• manage the parameters of the system not related to the project holder or the project.
• in a later stage, store the accepted projects in a data base to be able to work on a group of projects to evaluate the public policy.
The system is used, not only to help in making a decision, but also in providing a consulting service to project holders. The explanation function is a crucial function in this context. It is crucial because the knowledge is diversified, because it is more complex and because of the learning objective. The complexity comes from the fact that technical knowledge is used in addition to more standard administrative and financial knowledge. The learning objective comes from the desire to improve the working skills of the non expert users and also to make the expert knowledge transferable. The goal is to formalise and model the knowledge of the domain and of the expert so that by dealing with the projects, the other persons of the service can learn as they study projects. The learning theory here is that in showing in many different situations how the knowledge is used to derive a solution a better understanding is obtained. The economic analysis it is necessary to measure a criteria which help decide if the project importance of explanation in learning was stressed in AI (Mitchell et als,1986) and in the DSS context (Klein Methlie,1990,1995). The learning cannot be limited to explanation of reasoning since knowledge is also formalised in models used by the system. Learning also implies understanding of quantitative relations used in models and hypothesis of models. As a consequence very clear notation for the models equations is essential as well as comments to express hypotheses on the equations within the text of the model itself.

**Evaluation Methodology and Modelling of the Cognitive Process**

We shall take the case of a solar thermal project proposed by a private person. This can be a project for providing hot water for a building. The first part of the analysis, once the type of project holder and the type of project is known, is related to administrative rules and legal constraints. These rules are related to the conditions under which the service of the local government can provide its support. A very simple example of such rule is related to the location of the project. The local government, is required by law to only support projects located on its territory. Another set of administrative rules provides the amount of the financial support such a project is entitled to receive as a subsidy. The subsidy is computed as a function of the characteristic of the project. In the case of a solar thermal project the amount of the subsidy is a linear function of the surface of the panels: subsidy = surface * a + b. The value of the a and b parameters changing in step function according to the surface of solar panels. However this subsidy (subvention in French on fig 1) will be allocated only if the project has a minimum of efficiency. A project the technical analysis of which shows it generates a very small amount energy saving will not be granted a subsidy. Such a situation may happen in projects, such as insulation, where wrong design or badly selected material may not improve the situation.

The second part of the analysis is the thermal characteristic of the project. The goal of this part is to identify, with as much reliability as possible, how much energy will be saved.

In our case (a solar thermal project) the answer to this question is a function of the present energy source used and its price and the amount of kwh which will be saved if the project is completed. The amount of energy (E) saved is a function of the technology and the geographical location. The model used is then of the form:

\[ E = F(\text{surface of panels, coefficient, location}) \]