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Design of Graphic Aggregation Model for Evaluation of Energy Systems

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1. Introduction

Korea is meeting the growing electric power needs by mix of nuclear, fossil, hydro energy and so on. But we can not depend on fossil energy forever, and the people's concern about environment has been changed. So it is time to plan future energy mix considering multiple parameters such as economics, environment, social, energy security, etc. A multiple aggregation model has been used for decision making process in which multiple variables should be considered like energy mix.

In this context, we designed Graphic Aggregation Model for Evaluation of energy systems (GAME) for the dynamic analysis of decision on the energy systems. It can support Analytic Hierarchy Process (AHP) analysis based on Graphic User Interface.

2. Development of GAME

2.1 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a powerful and flexible decision making process to help people set priorities and make the best decision when both qualitative and quantitative aspects of a decision need to be considered. By reducing complex decisions to a series of one-on-one comparisons, then synthesizing the results, AHP not only helps decision makers arrive at the best decision, but also provides a clear rationale that it is the best. Designed to reflect the way people actually think, AHP was developed in the 1970's by Dr. Thomas Saaty, while he was a professor at the Wharton School of Business, and continues to be the most highly regarded and widely used decision-making theory.

2.2 Graphic Aggregation Model for Evaluation

The AHP and Graphic Aggregation Model for Evaluation (GAME) software engage decision makers in structuring a decision into smaller parts, proceeding from the goal to objectives to sub-objectives down to the alternative courses of action. Decision makers then make simple pair-wise comparison judgments throughout the hierarchy to arrive at overall priorities for the alternatives. The decision problem may involve social, political, technical, and economic factors. The AHP helps people cope with the intuitive, the rational and the irrational, and with risk and uncertainty in complex settings. It can be used to: predict likely outcomes, plan projected and desired futures, facilitate group decision making, exercise control over changes in the decision making system, allocate resources, select alternatives, do cost/benefit comparisons, evaluate employees and allocate wage increases.

GAME is intuitive, graphically based and structured in a user-friendly fashion so as to be valuable for conceptual and analytical thinkers, novices and category experts. Because the criteria are presented in a hierarchical structure, decision makers are able to drill down to their level of expertise, and apply judgments to the objectives deemed important to achieving their goals. At the end of the process, decision makers are fully cognizant of how and why the decision was made, with results that are meaningful, easy to communicate, and actionable.

To support Analytic Hierarchy Process, we designed Graphic Aggregation Model by using Microsoft Visual C++ 6.0. First, user configures the item and link node. Item node means a specific decision value each and link node indicates weight vector of that item. After user configures the item and link node, input the value and weight vector of each item.

After user made one workspace, he can save and load his work. So if he wants to change his conditions, he just changes his data from his work. And he can add or remove item by clicking item. GAME is shown in Figure 2-1.

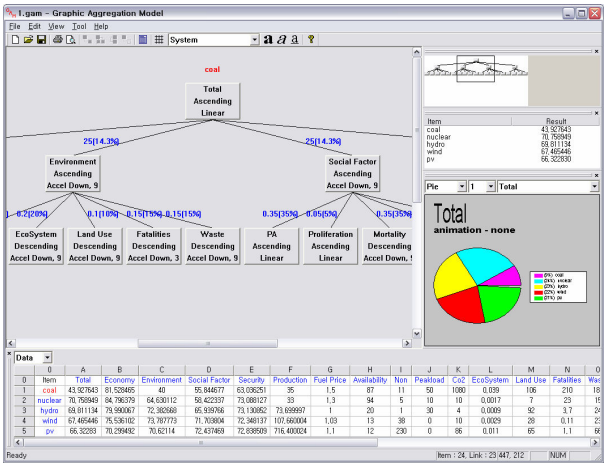

Figure 2-1. Graphic Aggregation Model for Evaluation

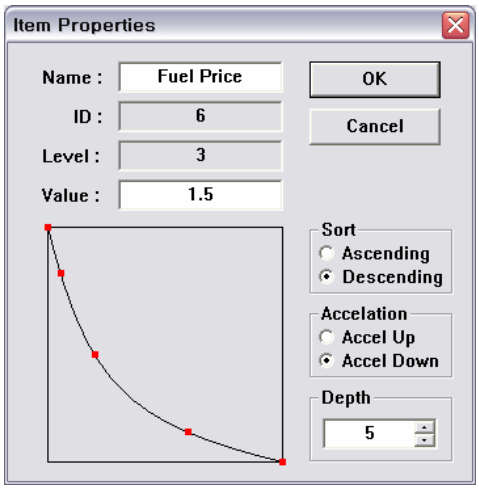

Figure 2-2. Item properties

3. Results and Discussion

After we tried first trial, we could find out the conditions can be changed by the time goes on. So we made dynamic analysis tool to support dynamic analysis on changing conditions. Graphic Analysis Model for Evaluation (GAME) can support those jobs. Every time user wants to change functional requirements or weight vector, he can get his goal by GAME.

By adjusting weightings shown in the figure 2-2, different value system can be adopted into the model.

4. Conclusions and Further Study

In this study, the graphic add for multiple aggregation, GAME, is developed.

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