

Information Strategy Planning for GIS based Management System Development with New Renewable Energy Resource Information

Kwang-Deuk Kim, Jae-Hyuck Jeong

Department of New Renewable Energy Research,
Korea Institute of Energy Research,
71-2 Jang-dong, Yusung-ku, Daejeon, Korea
E-mail : {kdkim, roknavy }@kier.re.kr

ABSTRACT:

New renewable energy information becomes one of the greatest issues all over the world because of serious environment problems and limited fossil resources. The new renewable energy source information system is treated seriously for efficient management and distribution as dealing with these energy problems. However, it is difficult to manage and utilize new renewable energy information because gathering and surveying information is progressed individually in each research field. Therefore this paper will establish ISP(Information strategy Planning) and propose the basic management system based-on GIS to analyze new renewable energy such as solar energy, wind power, small hydro, biomass, geothermal etc. and build the integration management system. The proposed integration management system can provide spatial analysis using thematic map, data search, data import/export and interpolation about users' queries.

KEY WORDS: New renewable energy, ISP(Information Strategy Planning), Spatial analysis

1. INTRODUCTION

As coming the age of rising oil prices, the necessity of new renewable energy is getting greater and new renewable energy such as solar energy, wind power, small hydro, biomass, geothermal etc. has an important role in replacing existing energy as future energy resources. Especially non-oil nations like Korea have to prepare the energy problem of future time by managing and analyzing new renewable energy efficiently. However, resource information management and use is not done well. As gathering and analyzing information is processed separately in Korea. So standardizing renewable resource information is required necessarily and reviewing and complementation has to be processed steadily for long period. It is needed that building databases for utilizing this research result to related technology fields and studying application system development integrated with up-to-date GIS technology

Therefore this paper will establish ISP(Information strategy Planning) and propose the basic management system based-on GIS to analyze new renewable energy such as solar energy, wind power, small hydro, biomass, geothermal etc. and build the integration management system.

The rest of this paper is organized as follows. In the next section we examine the trend of new renewable energy management system developed in Korea and abroad. In section 3 we survey the proposed domestic

new renewable energy resource and explain the ISP to build the integrated management system. We will design the basic management system for managing the new renewable energy in section 4 and explain the system implementation in section 5. Finally, we will suggest the conclusion and future work.

2. RELATED WORK

This section gives the major researches about the new renewable energy information developed and supplied in USA, Swiss and Canada.

NREL(National Renewable Energy Laboratory)[1] examines new renewable energy and processes developments and economy by studying new energy technologies. It develops the new renewable energy, the high efficiency technologies, national energy and related environment field.

CEDRL(CANMET Energy Diversification Research Laboratory)[4] produces energy used for various forms of new renewable energy technology. And it develops the standardized and perfect new renewable energy analysis program which can decrease gas emission that generates the green effect. Even though search result is provided in the form of excel, CEDRL can supply data analysis and re-calculation in the form of real data which users want to get.

SOLMET(SOLar METrology)[9] is the data management system which stores and manages insolation energy

data measured in 20 cities and gives internet service using WebGIS. This system manages insolation energy databases and produces the search and query results of stored data by forms of texts, graphs, charts, contour lines and so on. However this doesn't support data search service through web interface. All of these related works can't provide data analysis and operation in forms that real users want to get. The systems give only simple data related to weather information and hydro power in the domestic level. A variety of services can't be done according to users' needs by systematic database of new renewable energy.

Therefore this paper will establish the ISP that stores and manages national new renewable energy such as solar energy, wind power, small hydro, biomass, geothermal etc. by integrated form and design and implement the basic management system.

3. INFORMATION STRATEGY PLANNING FOR NEW RENEWABLE ENERGY RESOURCE SURVEY AND INFORMATION SYSTEM

ISP researches the state of each energy resource information and conducts the aim of developing information strategy plans and basic management system based on GIS. The information strategy plan is composed of 4 stages for developing new renewable energy resource information system and basic management system based on GIS. Figure 1 shows overall information strategy plan for integrated management system of new renewable energy based on GIS.

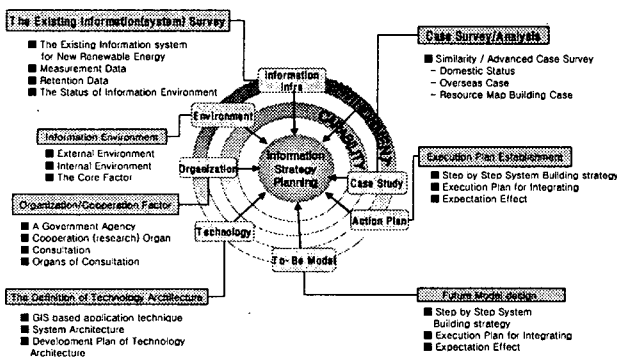


Figure 1. The ISP model for GIS based management system

3.1 Stage 1 : Preparation & data survey for establish ISP based on GIS

Stage 1 plans the administrative points, organizations and roles that establishing new renewable energy resource GIS information strategy plans. And this is the stage which analyzes outer environments, inner environments and the existing information infra related to this project.

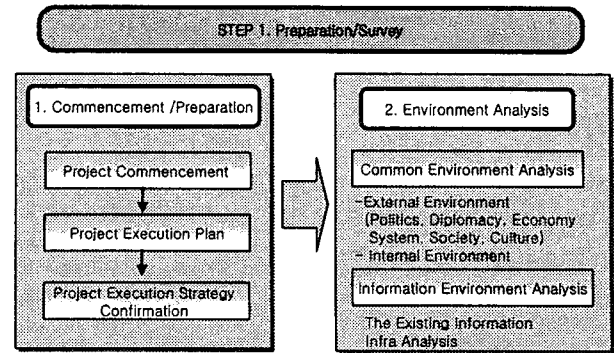


Figure 2. Detail operation and procedure of Stage 1

3.2 Stage 2 : Understanding status for establish ISP based on GIS

Stage 2 finds the detail ways by related documents survey, operation survey, interview, questionnaire survey and advanced domestic and overseas case survey/analysis.

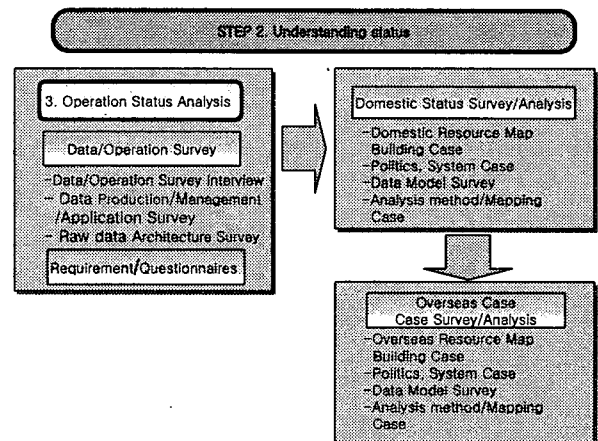


Figure 3. Detail operation and procedure of Stage 2

3.3 Stage 3 : Future Model Design for establish ISP based on GIS

Stage 3 is the stage that establishes system building strategy and information strategy by deriving information subject.

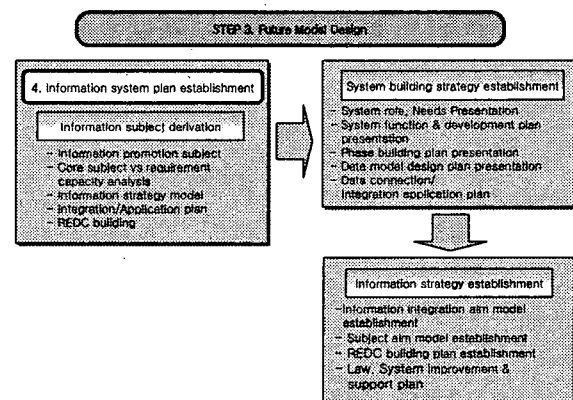


Figure 4 Detail operation and procedure of Stage 3.

3.4 Stage 4 : Execution plan for establish ISP based on GIS

Stage 4 establishes the execution plan and defines the step by step system building plan, integration execution plan, investment contrast effect and expectation effect.

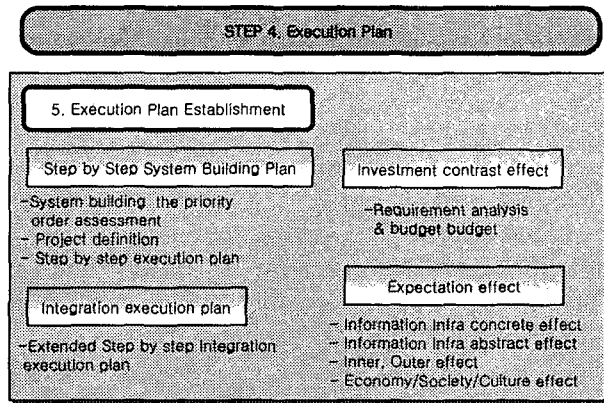


Figure 5. Detail operation and procedure of Stage 4

4. DESIGN OF INTEGRATION MANAGEMENT SYSTEM FOR NEW RENEWABLE ENERGY

The integrated management system of new renewable energy resource stores and manages the each energy resource in the integrated form. Thus the standardization of data for new renewable energy resource gathered and produced in each field has to be done and the forms of data result to be provided.

4.1 Integration Data Model

Integrated management system of new renewable energy resource classifies new renewable energy such as solar energy, wind power, small hydro, biomass, geothermal etc. into Location information, Meta information, Data information and Data measurement/production. It integrates data according to identification information, measurement period, measurement location (latitude/longitude), production institutes, measurement facilities, spatial-temporal identification information-mean value/real time, time interval(day/hour/minute/second), measurement value (production value). The structure of integration data model is following figure 6.

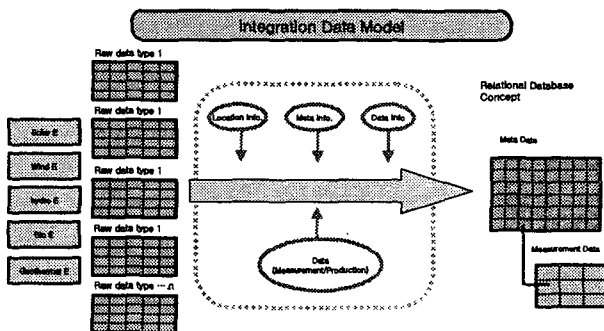


Figure 6. Integration Data Model for New Renewable Energy

4.2 Structure of Integration Management System

The integrated management system of new renewable resource produces the various forms of spatial information of each field new renewable energy resource through GIS Analyst and GIS Component with integrated information on the GIS Base Map. Moreover, this provides spatial analysis using thematic map, data search, data import/export and interpolation about user's queries. The structure of basic management system is following figure 7.

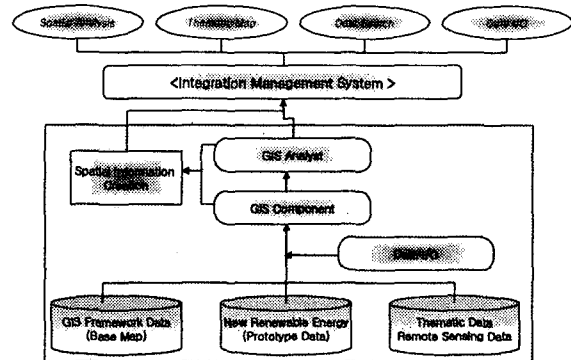


Figure 7. Structure of Basic Management System

5. THE IMPLEMENTATION OF INTEGRATION MANAGEMENT SYSTEM

The proposed integrated management system uses ArcGIS Engine as GIS tool and ArcObjects Macro Language as programming language in the Intel Xeon MP 2.8 X2 Workstation(HP XW6000) of Windows 2003 Ent. Edition Server. This utilizes Microsoft Jet Driver and MS Access as database and new renewable energy resource data of solar energy, wind power, geothermal provided by research dept. in Korea Institute of Energy Research.

Figure 8 is the main screen of the implemented system. This system can provide the basic GIS function like map enlargement, reduction, feature search, monitoring and print out maps using Arcpress. Moreover, it is easy to establish newly, change and dispose of measurement location of new renewable energy resource and to supply the Map Template production and management function.

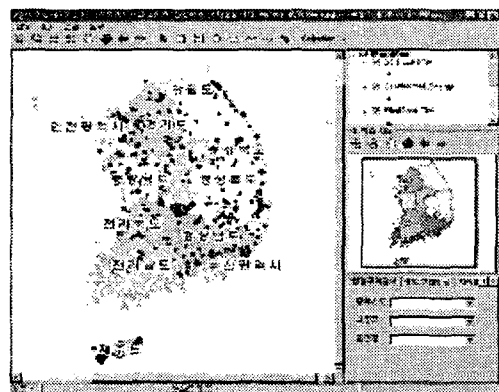


Figure 8. Main screen of Basic Management System

5.1 Spatial Analysis

The proposed system provides the various thematic map, applying the spatial interpolation method(IDW, Spline, Kriging) about each new renewable energy resource. Also this system extracts isograms for interpolation result according to selected range by user queries.

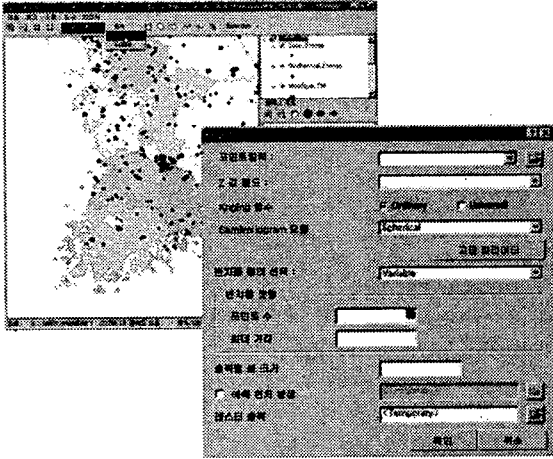


Figure 9. Spatial Analysis of Basic Management System

5.2 Data Conversion

The proposed system loads Excel-formatted data directly that can be applied to in this system. The interpreted loading Excel data is stored in the form of MDB. Moreover this system converts the existing MDB data into Excel data.

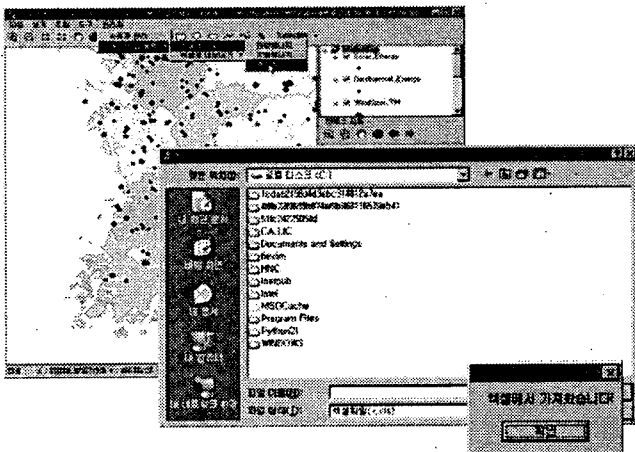


Figure 10. Data Conversion of Basic Management System

6. CONCLUSION

The new renewable energy information has been more necessary and important because of the rising oil prices all over the world. Especially, the efficient management system of new renewable energy is required in the condition of lacking resources. However the current

situation of new renewable energy management is not systematic enough to cope with the energy problems. The study of new renewable energy information strategy and management system development is necessarily needed.

This paper establishes the information strategy plans based on GIS about new renewable energy sources and proposes the basic management system. The proposed system builds the basic information for analyzing states and conditions of new renewable energy source spatially and provides the distributed states analysis, measurement values analysis, optimal sites analysis for new development according to the kinds of energy source.

This version is currently not fixed one, because modification and complement is needed according to project progress status. Therefore the future work builds the new renewable energy information management infra updating the new renewable energy source by accumulating continuing databases.

REFERENCES

- [1] L. M. Murphy, J. Brokaw, J. Pulaski, K. McCormack, "The National Alliance of Clean Energy Business Incubators", Report NREL/BK-720-28724, National Renewable Energy Laboratory, USA.
- [2] Rredc, "Renewabl Energy Resources in the United States", <http://rredc.nrel.gov>, 2002
- [3] Fsec, "Automated Field Data Management and Quality Assurance", FLORIDA Solar Energy Center, <http://logger.fsec.ucf.edu/met>, 2002
- [4] D. Anderson, The Meteorological Service of Canada. Annual Report pp.4-25, 2000-2001
- [5] B. W. Forgan, "BSRN Specification related to Aerosol optical Depth", 6th BSRN Science and Review Workshop, Autralia, <http://bsrn.ethz.ch>, 2000
- [6] B. A. Wielicki et al., "CERES(Clouds and the Earth's Radiant Energy System) Validation Plan Overview", Technical Document, Release 4, <http://bsrn.ethz.ch>, 2000.
- [7] G. O. P. Obasi, "Reducing Vulnerability to Weather and Climate Extremes", Switzerland, World Meteorological Organization, 2002.
- [8] M. Erwig, R.H. Guting, M. Schneider and M. Vazirgiannis, "Spatio-temporal Data Types : An Approach to Modeling and Querying Moving Objects in Databases", Chorochronos Technical Report, CH-97-8, 1997.
- [9] I. B. Oh, Y. A. An, K. H. Ryu, K. D. Kim, "Design of a History Data Management System for the Renewable Energy Resources", Korea Information Processing Society D, pp.531-540, 2003