

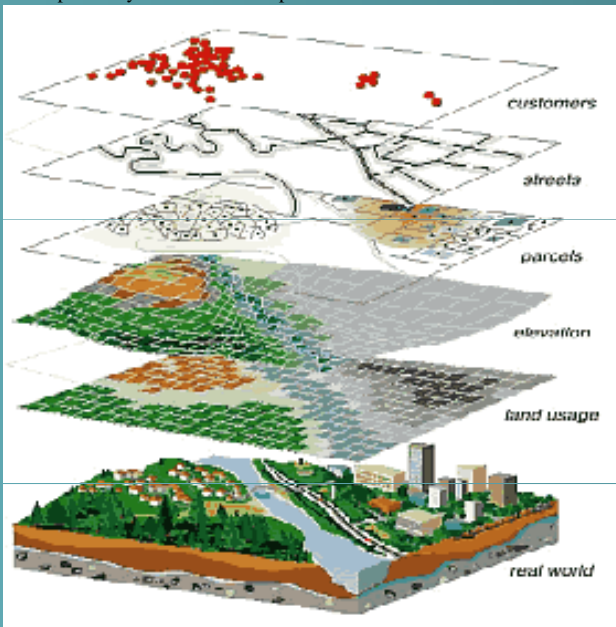
Athanasios Papantoniou

Abstract

The global requirement for sustainable energy has become increasingly important issue the last decade and will continue to be, as the environmental effects of fossil fuels become apparent. Renewable Energy Sources- RES (solar, wind, hydro and biomass) are becoming one of the most important energy options in the future generation system. However locating optimal sites for the utilization of RES is a complex task involving many environmental, economic, social constraints and factors associated with the energy potential, existing central power plants, substations, transmission and distributions lines, networks of power systems, etc. A Geographic Information System (GIS) is an appropriate tool to address this issue, since it efficiently stores, retrieves, analyses, and displays geographically referenced information according to user-defined specifications. This thesis presents an overview of GIS applications in energy related operations, specifically on the RES sector, and highlights their support in decision making. Furthermore a case study for the location in Greece is presented and analyzed.

Aims and Objectives

The aim of this project is to investigate the capabilities of GIS in decision making in general and in energy related operations specifically. Different aspects of the use of GIS in energy sector will be mentioned and critical issues will be discussed regarding their usefulness in day-to-day operations of the engineer and the decision maker. Furthermore, a case study on the use of GIS in the Renewable Energy Sector will be explored, as a proof of concept. The specific details of the case study will be defined in a latter time but in general it will associate the context of decision support on RES investments and location-based characteristics. The objectives of this project have to do with the understanding of the basic mechanisms of GIS (data capture, storage, management, retrieval, analysis, display) and their particularities in the sector of energy. Moreover, the business model behind GIS technology will be examined which consists of the data providers and the organizations promoting GIS technology (with the respective software tools), the committees worldwide that promote the concept of spatial information. Finally, a survey on the existing open source GIS software tools will be made for the selection of the most appropriate, while also standardization and interoperability issues will be explored.



Description of the project

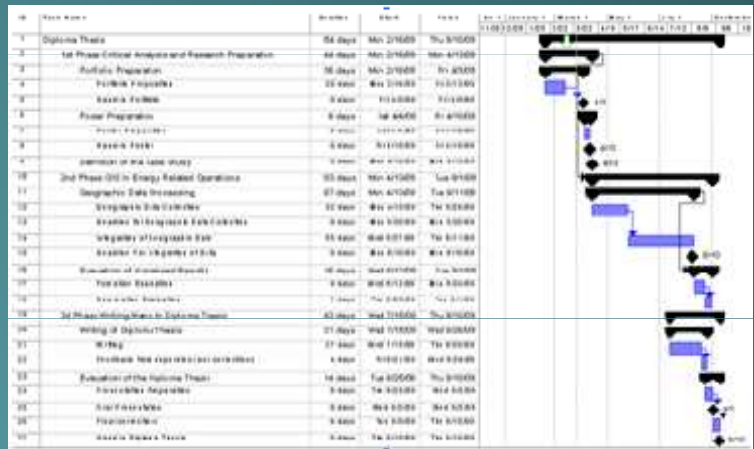
The project can be divided in three phases. In the first phase the literature associated with the GIS technology and applications of GIS in energy related operations will be examined. In the second phase analytical geographic data (wind velocity and solar radiation) for a specific location for a typical year will be collected and evaluated. In the third phase the integration of these data in a GIS environment is going to take place. The GIS software used for the integration will be selected from a plethora of free open source tools. After the integration of the data in the system and the visualisation of the information further improvements would be made by defining some criteria for decision support, for example location-based criteria for supporting the RES investments in the area.

Our scope is to investigate the basic mechanisms behind GIS technology, mechanisms which have to do with capture of the data, storage, management, retrieval, analysis, display. We will denote the particularities for using them in the energy sector. GIS technology is already used for decision making in both conventional energy resources and renewables. We direct towards the RES sector, and our prothesis is to investigate the capabilities of GIS in operations related with RES investments depending on location based characteristics. Our work will emphasize the usefulness of GIS in day-to-day operations of the engineer and the decision maker. The particularity of our case study, is based on the fact that no commercial GIS tool will be used, instead the capabilities of open source GIS software tools in decision making will be examined.

Literature Review

At a first level we can consider the mapping of the available data (solar, wind). However geographic data, cannot be easily accessed by individuals, since in many cases are commercially exploited by different organizations (ministries, public and private organizations). Furthermore, in case these data are obtained a possible improvement in the previous statement would be the further processing of data according to specific mathematical formulas to extract e.g. the available energy potential of the studied area and the corresponding mapping in GIS. However a more accurate investigation of the advantages of GIS in energy-related decision making processes would require the insertion of some restrictions as exclusion criteria of some cases. These restrictions are related for example with the special characteristics of the studied area e.g. high altitude areas or high slope areas.

Gantt Chart



References

- [1] Irish Spatial Data Infrastructure Demonstration Programme – Flood Management for Clonmel, Final Report March 2005
- [2] The GIS Ethics The code of ethics for GIS practitioners, *Maria Stybli_ska* University of Silesia ,Faculty of Computer Science and Materials Science,The Institute of Computer Science, Poland
- [3] Ethical Implications of Information Technology in Government: A Closer Look at GIS, Akhlaque Haque, PhD, Assistant Professor and Senior Research Associate ,School of Social and Behavioral Science ,Department of Government and Public Service ,The University of Alabama at Birmingham
- [4] Wind Energy Potential in Southern Sweden, Example of Planning Methodology. Bengt Hillring and Roland Krieg
- [5] Application of geographical information systems to rural electrification with renewable energy sources, J. Amadora, J. Dominguez, Department of Electric Engineering, EUTI
- [6] Spatial analysis methodology applied to rural electrification, J. Amadora, J. Dominguez.
- [7] Developing and applying a GIS-assisted approach to locating wind farms in the UK, Serwan M.J. Baban, Tim Parry