Role of Decision Support System for Renewable Energy Outreach

ARTICLE *in* ENVIRONMENTAL SCIENCE & TECHNOLOGY · DECEMBER 2013

Impact Factor: 5.33 · DOI: 10.1021/es404942h · Source: PubMed

5 AUTHORS, INCLUDING:

Borja A. Espejo García
University of Zaragoza
1 PUBLICATION **1** CITATION
SEE PROFILE

Francisco J. Lopez-Pellicer
University of Zaragoza
54 PUBLICATIONS **131** CITATIONS
SEE PROFILE

Miguel Ángel Latre
University of Zaragoza
43 PUBLICATIONS **106** CITATIONS
SEE PROFILE

F.J. Zarazaga
University of Zaragoza
118 PUBLICATIONS **520** CITATIONS
SEE PROFILE

Environmental Science & Technology

Viewpoint

pubs.acs.org/est

Role of Decision Support System for Renewable Energy Outreach

Naveen Kumar Sidda,* Borja Espejo-Garcia, Francisco J. Lopez-Pellicer, Miguel Ángel Latre, and F. Javier Zarazaga-Soria

Computer Science and System Engineering Department, University of Zaragoza, María de Luna 3, 50015, Zaragoza, Spain

Earth is affected by various natural and manmade phenomena such as natural calamities, disasters, urbanization, and pollution. One such major issue is exhaustive usage of fossil energy and its adverse impact on our social, environmental and economical conditions.[1]The study and the increase in awareness levels of '"energy resources and their environmental impact" is essential for the development of a sustainable society. Considering that the society consists of domain experts, policy makers and the general public, it is important for everyone to get familiarized with available renewable energy sources and how to exploit their benefits. Easy access to information on the availability of energy resources and their geographical distribution will help in better planning and determining potential energy investments, development strategies and also increase awareness among the public.

In general, decision-making is the process of selecting the best viable option from a set of different options. Study on spatiotemporal characteristics of the energy sources will guide government, experts or even general public in agile decision-making. For a renewable energy project or for an individual, it is an important aspect to acquaint and select suitable optimized location considering all factors such as best available energy sources, climate, social and economical conditions.

From an investment proposal to complex scientific analysis, decision-making is a key aspect in projects. Decision Support System (DSS) is being used to address various problems like carbon emissions and cost of product designs, impact of pollution on environment, etc. Specifically in the energy field, there are also diverse DSS models such as NREL,[2] and IREL.[3] Nevertheless, a systematic and holistic approach with detailed data structuring, intuitive reporting and integration of other heterogeneous models like demography and climate are missing for local insights and ground realities. DSS should be able to graphically represent the profile of energy sources that includes spatiotemporal patterns, demographics, topography, data history and characteristics of each energy source. This kind of DSS will aid in better planning and enable in finding the resources for governments and experts. As the data presented in an easy and understandable format, it will draw attention from the general public as well.

Study on renewable energy requires understanding various data models and lot of broad and in-depth data analysis. The challenge is to extract the data from various sources, store, analyze, and present the information in an easy and intuitive format to all kinds of users. Different sections of users will have different requirements and different level of understanding about the data as shown in Figure 1. Importance and Maturity of DSS in terms of analytical capabilities and data (quality and quantity) varies from profession to profession and situational requirements. For example, from a common user's perspective, "*what is the annual average energy output that this energy source offers?*" an expert may wish to research, "*why is there a decline in solar radiation in year 2012 when compared to2000; August versus January?*" and governments may ask, "*what could have been the change in energy output and savings if this particular energy source was used over the last five years?*" Hence, DSS should be able to understand the user needs and present the information in engaging and understandable format. The challenges identified from a technical point of view are 2-fold: First, to do a spatiotemporal analysis it is important primarily to analyze huge historical data sets. Second, loading the data with minimal or no latency effects and communicating the processed information in a comprehensive format e.g. drill down chats[4] for *when* and *where* analysis.

Data warehouse (DW), extract, transfer and load (ETL), and business intelligence (BI) are successful business analytics' technologies.[5] They are designed to deal with huge, historical data sets by structuring data into multilevels for rapid exploration and analysis to aid decision-makers. Empowering scientific data with these technologies will assist scientists and government in making faster, productive and sustainable decisions. These technologies have the capability to handle and present the data ranging from global to local level scenarios.

Received: November 6, 2013
Revised: December 2, 2013
Accepted: December 12, 2013
Published: December 19, 2013

dx.doi.org/10.1021/es404942h | *Environ. Sci. Technol.* 2014, 48, 15−16

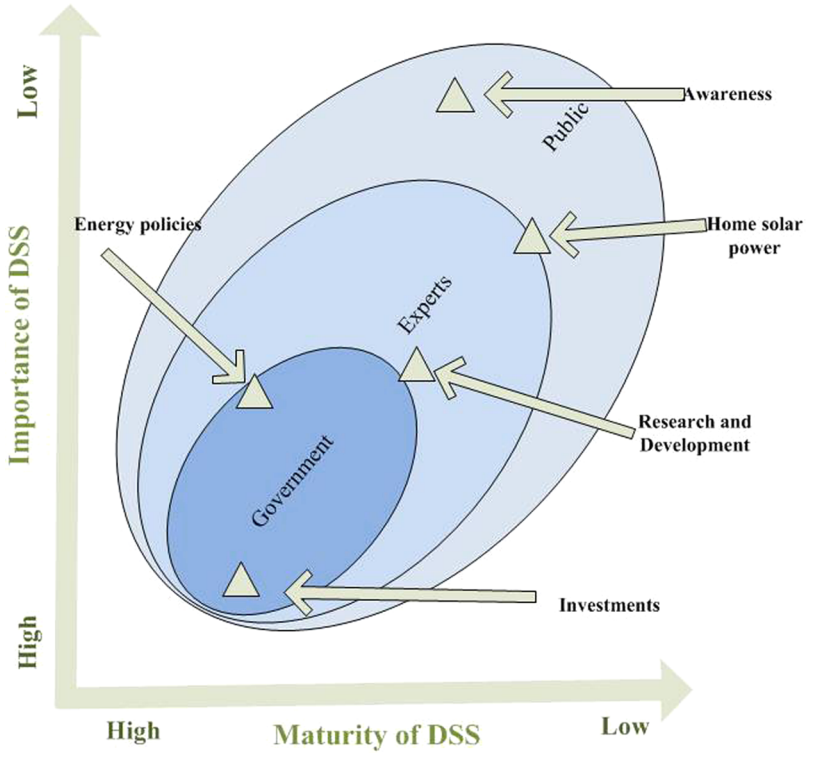

Figure 1. Importance of DSS for various renewable energy actors.

DSS based on these technologies will provide an analytical mechanism from higher level summary to detailed reports to answer questions such as "which, when, and where" scenarios to government and "why" to experts. For example, *"which energy source produces best annual output at local, regional and national level?" '"when is the quarterly Return on investment (ROI) high on solar verses hydro?" "where is the best location to get maximum ROI on wind farms?" "which is the best boiler technology in city X vs city Y, and why?' 'why is this location not suitable for both solar and wind project policies?" "why and by how much is there an environmental degradation after setting the hydro power plant?"* To analyze and answer some of the questions stated above, various data sources like demographic data, topography and climate are also required. ETL helps to integrate the data in diverse and different formats into one single format. This will also help in real time collaboration, loading the data and in responding to user queries with least latency effects. DW technology can be used to seamlessly store huge amount of data in one database. BI then hierarchical structures the processed data into various levels (*e.g., country-city-location; yearly monthly quarterly daily*) for rapid exploration of massive data. With the advancements in geo reporting capabilities, this can be visualized and presented on maps, charts and tables. All these tools and information technologies together play an instrumental role in estimating and tracking of ROI; enabling the government frame better energy policies; providing a finer data perspective for experts and providing self-service interactive accessibility for the larger public.

AUTHOR INFORMATION

Corresponding Author

*E-mail: naveen@unizar.es; naveensidda@yahoo.co.in.

Notes

The authors declare no competing financial interest.

REFERENCES

(1) Asif, M.; Muneer,T. Energy supply, its demand and security issues for developed and emerging economies. *Renewable and Sustainable Energy Reviews*. **2007**, *11*(7).

(2) National Renewable Energy Laboratory. http://maps.nrel.gov/re_atlas.

(3) Tracking the International Renewable Energy Agency globalatlas. http://geocatalog.webservice-energy.org/geonetwork/srv/eng/main.home.

(4) Fusion charts. http://www.fusioncharts.com/demos/features/#linkedcharts-for-easy-drill-down

(5) Inmon, W. H. *Building the Data Warehouse*, 4th ed.; Wilsey, 2005.