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A Study of Decision Support System on Renewable Energy

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Abstract- The aim of this paper is to provide renewable energy sources with the future of the energy industry, and it is through supportive and extensive legislation covering all possible aspects of the energy sector that these revolutions should be regulated. The government's decision to expand its consumption of renewable energy should be effectively implemented. In this study, the existing renewable energy legislation and regulations mechanism in India is analyzed and the barriers and challenges to the renewable energy industry are examined. A benchmark study of the best policies and legislations for renewable energies adopted by different countries is therefore included in this thesis, which will help shape India's effective policy. In addition, there is no single comprehensive renewable energy policy statement in the country. Policies were developed to support the growth of specific technologies in the field of renewable energy. The renewable energy sector development plans formulated in the past do not correspond to current policies and initiatives. Whereas the Renewable Energy capacity increase of MNRE is not sufficient to meet the RE Generation Objective, which is mandated under the Jawaharlal Nehru National Solar Mission (JNNSM) (NAPCC).

Keywords- Decision Support System, Renewable Energy, Policies, Generation

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1. INTRODUCTION

"Energy is the golden thread that links economic growth, greater social equity and a world-building environment." Compatible, cost-effective, and consistent power systems are vital to global prosperity, as power sector growth is linked to a nation's overall growth, economic stability, and environmental sustainability. The energies sector is one of the most fundamental components of economic advancement since the availability of adequate energy resources depends on the economic activities from production to transport goods. A World Bank study shows that nations with inefficient and unsuitable energy systems can reduce their potential by up to 1-2 percent each year due to a lack of electricity and the inefficient use of energy resources. It is obvious from the fact that over 80% of the world's population exists in developing countries, but only 40% of total global energy is consumed in these countries, which shows that energy consumption is directly linked to economic stability and a country's development [1]. But maximizing energy production is not the only solution, as conventional energy resources are overused as a key factor in today's fiscal, ecological, and development issues. Non-renewable energies, such as oil, coal, petroleum and so on, have, although a significant contribution to the growth of economy and national development, also become the main cause of serious environmental and health concerns. Present energy generation and use are not sustainable and at both national and global level are intimidating the environment [2].

According to a report, almost 60% of the total greenhouse gas emissions come from the power sector, the energy arrangements that include supply, conversion, distribution and use are the primary contributors to environmental concerns. Carbon emissions from burning of fossil fuel and the industries represented about 78% of the overall increase in emissions between 1970 and 2010. Indeed, after China and the USA, India ranks third in terms of global carbon contributors. Around 32.5 gigatons of carbon dioxide were released world-wide in 2017, of which China is responsible for 9 gigatons, 5 gigatons in the United States and India about 2 gigatons in carbon dioxide [3]. There are limited additional conventional sources and insufficient to meet current global energy requirements. Energy demand on the global level increased by 2 percent in 2017, of which over 40% were Chinese and Indian. Moreover, China and India accounted for around 70 per cent of the overall increase of demand as energy demand increased by 3 per cent in the same year. Around 3 trillion people worldwide are still bio-energy dependent (mostly wood) for household use, including cooking food and heating. In India, approximately 66% of the population has no access

to modern energy services and about 25% have no clean cooking installations [4]. It contains 30% of the world's poorest people, and around 304 million people worldwide without access to electricity come from India. The International Energy Agency estimated that modern and efficient energy services should be provided to an additional 700 million persons by 2015 if the MDG poverty reduction objective is to be achieved. An efficient energy arrangement is therefore needed, which can expand access and strengthen the conditions for the deprived billions in this field to modern energy services [5].

2. DECISION SUPPORT SYSTEM FOR ENERGY-EFFICIENT TECHNOLOGY

The deregulation of energy systems and the establishment of targets such as the EU (20-20-20) ("Literature review and background") increase the importance of optimisation of energy systems. These changes in turn increase the exposure of different agents to new risks that motivate new regulations and policies. For example, emission trading schemes, renewable energy subsidies and/or efficient generation subsidies or requirements for efficiency, for example building labeling. The motivations for this new situation are several post-industrial issues, such as global warming, global economy, and scarcity of resources and awareness of sustainability. Despite the globalization mentioned above, global changes usually have to be addressed at the regional or local level [12]. Therefore, energy supplies and fuel producers, but worldwide, have enough electricity to meet local market needs, e.g. for a given city. In addition, final energy users have their own need which depends on shop-level decisions. Comfort, safety and accessibility are challenges for building-level decision-makers who, regardless of their global, regional or local scope, must handle limited budgets and regulations. New Technologies and rehabilitation options are also available and are continuously evolving and are expanding to include decision-makers, operators, consultants, designers and data managers in order to address key concerns of stakeholders. External stakeholders, like politicians or the media, can also be involved. Taking into account the intricacy of the emerging problem, the present paper develops a DSS for optimal strategic building infrastructure planning and operations. While stakeholders usually have several or even conflicting goals, they can all have a tailor-made dialog with the DSS, but consistent with the different interfaces and output reports. This dialog comprises the DSS through its design capabilities. Special attention shall be paid to the development of new stochastic dynamic optimisation models that include strategic and operating variables ex ante. The model developed in this paper has shifting time horizons which are defined by time stoppages generated by potential events and dialog of the stakeholders. This integrated environment provides the necessary communication between stakeholders.

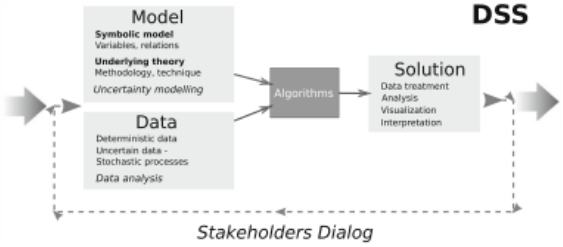

Fig. 1 Decision support system (DSS) framework diagram

The purpose of this dialog is twofold as illustrated in Fig. 1: the dialog between stakeholders and the DSS, on the one hand, and between stakeholders, probably with various motivations and objectives, on the other. There is self-contained dialog between stakeholders and the DSS. The dialog between stakeholders (internal and external) may be held at any stage in decision-making, and user communication is essential to the accuracy of the inputs. This dialog can therefore provide the decision-maker with exogenous feedback [14]. Moreover, as decision-making is an iterative process, the results can provide the DSS structure with endogenous feedback through the stopping of time times and moving time horizons.

With regard to DSSs, this term is normally defined in more or less detail as "an information system to support decision-making," and its use is often misused in the field of computer science and management. Therefore, a DSS could be claimed by any information system. However, to capture the preferred analytical approach more specific limits are required. The model plays a key role in a DSS under this paradigm. The model and the data form the basis for decision-making. The proposed DSS can therefore also prepare the data in a model-appropriate manner. Once the model has been defined and the data available, adequate algorithms are applied. Decisions taken by the DSS include interpretation and analysis irrespective of their category (descriptive, normative, or prescribed) and are likely to require post-data analysis. A new approach for the optimal planning and operation of a building infrastructure through dialog with stakeholders is provided in the development framework for DSS-based decision making. The proposed use of readable human and machine formats by using algebraic modeling languages (AMLs) enhances the dialog between interested parties mentioned in this section. On the other hand, the reproducible research approach adopted in Leisch 2002 allows for consistent updates to be recorded and tracked over time and for stakeholders, consistent with all components of the DSS, to be provided with a sort of balance scorecard. In addition, the results obtained are reproducible for one of the actors, increasing the efficiency and quality of communication processes in multi-agent, multi-disciplinary and changing environments. Finally, it must be noted that this Framework has

been successfully implemented through the EnRiMa project (Public Buildings Energy Efficiency and Risk Management). EnRiMa is a research project of the seventh Framework Program (FP7), with overall aim of developing a DSS for energy-efficient building operators and public spaces.

3. EVOLUTION OF RENEWABLE ENERGY

Although renewables are often thought to be a new energy source, we have used these natural sources for a long time and for a number of purposes, such as heating, transport, lighting etc. The main part of the energy obtained from renewables alone was generated before the coal deposits around the time of the Industrial Revolution in the mid–19th century. In most of human history, we tend to use organic materials such as wood, grass, and moose and to fuel our homes and ranches, we have the tendency to burn. In the traditional use of biomass, the ancient use of renewable energies was found almost untrusted 800,000 years ago. Only a few hundred thousand years later, sometimes between 200,000 and 400,000 years ago, fire biomass became common.

From a single angle, the invention and use of fire could be a history of civilisation and of the use of renewable energies. Another example is the use of renewable energy, which has focused the trade for some 6,000 years in human history, in animals for the production of ploughes and water, wind, in crushing grain windmills. Already in the 1860s and 1870s, there were concerns that no fossil fuels would be developed and that a better source would be needed. Some people conjectured of renewable sources such as solar and pushed for technological development during the industrial revolution even since it was at its height that coal mining was at its peak. In the 1950s, the idea of peak oil sparked a new push for renewables. The environmentalists have consistently been concerned that the population will increase further in oil consumption, which is a limited source of electricity generation, in addition to the adequate access to these resources.

In the 1970's environmentalists encouraged renewable sources of energy to be used both for fossil fuels and for the reduction of oil dependencies, and the first wind turbines to generate electricity appeared. Renewable sources are not only technical, but inevitable because of the rising Green Movement, the advance of conservational sciences, and the drive to combat Greenhouse Gas. In the 1990s insufficiency in the oil-rich world led to oil-price uncertainty, which was a further problem for energy security worldwide. The term energy security combines the word energy and security. The energy security agenda of the 21st century has therefore been important and the nations continually thrive to ensure the security of energy through the use of unconventional energy sources. By increasing renewable energy deployment in the country, the Ministry of New and Renewed Energy ensures energy security and energy equity. The Ministry also has the various programs that focus on the country's expansion of renewable energy. In order to facilitate renewable energy growth in industry, the transport sector, heating and cooking facilities in urban and rural areas, the Ministry is responsible. For the better use of renewables the focus was mainly on a mixture of financial incentives, more advantageous tariffs and good market strategies and other positive actions, such as compliance with absolute renewable energy procurement commitments in various legislation and policies. Monetary funds are also available for research, information and advertising and other support programmes. The overall development of renewable energy in the nation has been comparatively low despite numerous favorable policies and strategies. However, despite the slow growth of the renewable energy sector there are other aspects that can improve the renewable energy situation in the North in the near future because of factors including carbon emission targets and assurances at the global level, likely rises of the oil crisis in the coming years, improved access to electricity in villages or rural areas. In other study, renewable energies in India are growing from ancient times to now.

4. BENEFITS OF RENEWABLE ENERGY UTILIZATION

Renewable energy use benefits from sustainable development, energy security, stability in the economy, carbon emission avoidance and health benefits. Figure 2 shows five key advantages to be achieved by using renewable energy sources.

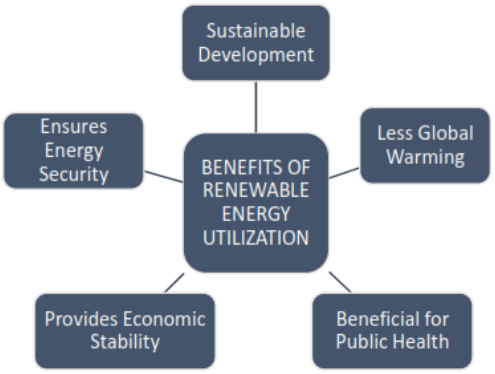

Figure 2 Benefits of Renewable Energy Utilization

i. Sustainable Development:

Renewables are filled or replaced naturally, as the main advantage of renewables. More accurately, even after constant use of this alternative power source is abundant and will remain so. It will take decades to replenish what we already have used, or sooner, for fossil fuels to disappear. The use of renewable energy sources promotes and never ends sustainable growth.

ii. Less global warming:

In 2017, total CO2 emissions of 32.5 gigatons were generated in the world, with China leading with 9 Gigatons of CO2 emissions from the US and India leading with 5 Gigatons and 2 Gigatons of CO2 emissions. Almost 50% of the world's CO2 emissions originated in the power sector, which is India after China and the USA's third biggest contributor. Without changing how we harvest and utilize energy, there is no way to protect the climate. Renewables are friendly to the environment and are the most effective method to combat pollution and climate change.

iii. Ensures Energy Security:

The world today faces a burden of affordable and accessible energy supply, in order to meet rising energy demands. At the global level energy demand rose by about 2% in 2017 and demand for power grew significantly around 3% worldwide. Energy security concerns include insecurity in energy production countries, mistreatment and inadequate supplies of energy. Through investment in renewable energy sources the threats and problems faced by the power sector today can be avoided.

Transiting from conventional resources to renewables provides two-fold benefits-

a) Minimizing carbon emissions and avoiding climate change impacts

b) Ensuring energy security and energy efficiency by providing energy at an affordable price.

iv. Provides Economic Stability:

Renewable energy can supply affordable energy so that energy prices can be helpful. At the beginning, the establishment of renewable energy plants and amenities can require considerable funds, but their energy production costs are much lower and stable at the energy prices. Moreover, expenses for renewable energy technology have decreased steadily and are expected to decrease further, affecting the price of renewable energies more directly. Since last year, renewables prices have been reduced considerably, reducing wind and solar energy prices by around Rs 2.5 per unit. This price is significantly lower than the average Rs 3.7 per unit price.

v. Beneficial for Public Health:

Conventional resource exploitation has adverse effects on human health. The use of sources by oil and coal processes creates excessive pollution and leads to various respiratory problems, neurological impairment, cardiac problems, cancer and many fatal illnesses. The toxic wastes in air and water which simply clean up energy technologies to pollute the air have such deleterious effect on health.

5. TYPES OF RENEWABLE ENERGY SOURCES

There are five major types of renewable energy sources namely, solar energy, Wind energy, Geo thermal energy, Hydro Power and Biomass Energy. Figure 3 shows the five types of renewable energy sources which have been discussed in detail.

Figure 3 Types of Renewable Energy Sources

i. Solar Energy:

Solar power is the transformation of energy, either by means of PV cells or the application of solar concentration or combination technologies, from sunlight into electricity. For a long time we have taken advantage of energy from the sun, though the solar electricity is the National Renewable Energy Laboratory that is used to keep homes and businesses warm, heat water or other power supplies. Solar cells that warm a lot are made of a silicone that mainly transforms solar power to electricity. The power consumed by sunshine on earth is about 1 trillion watts, a high level of about 15 trillion watts, both of which is present in the world as well as other next requirements. The average temperature ranges from 25°C 27.5°C per year, so Indian is located between the tropics of cancer and the equator. That means India has an enormous potential for the solar sector; from Calcutta to Madras, the regions with the most sunlight come from south to east.

ii. Wind:

Wind turbines convert the kinetic energy in the wind into mechanical energy. Wind energy is one of the cleanest and cheapest form of renewable energy i.e. why wind energy is deliberated as most favorable technology for power generation. India ranks at the fifth position at the global level as it has installed capacity of 32,400 MW as on 30 March, 2017.

iii. Biomass energy:

Biomass includes solid biomass, biogas, liquid biofuels, and municipal waste. The biomass has

always been a major source of energy for the nation as it accounts for around 30% of the total primary energy use and more than 72% of the population relies on it for satisfaction of their regular needs.

iv. Hydro power:

The production of power with the help of water has been in use from early times and currently most of the use majorly some or the other form of electricity generated from the water. The wave power and tidal power are the two major forms or hydropower through which energy is captured from the ocean waves and tides respectively. The hydro power energy is also considered to be the most promising and encouraging form of renewables that in the year 2015, the electricity generated from hydropower was almost 16% and generated around 69% of all renewables power.

6. CONCLUSION

Economic progress and the social welfare of the nations are mainly driven by the energy or energy sector. For the nation's economy to constantly grow, survival and growth of the power industry are essential. India is currently experiencing significant economic development while the evolving economy is at the same time thrilling with excess power installed. Every year the grid could be further strained by popular growth, economic growth and an increase in electricity demand. Increasing electrical capacity installed is therefore crucial. India has formidable challenges to meet its energy needs and to provide adequate, sustainable and competitively priced, energy of desired quality in various forms. In order to end poverty and meet its human development goals, India will need to sustain an 8 to 10% economic growth rate over the next 25 years. India needs, at a minimum to increase its supply of primary energy by 3 to 4 times and its supply of electricity by between 5 and 6 times its 2003-04 levels, to achieve a sustained growth rate of 8 percent through 2031-32 and to meet the lifeline energy needs of every individual. With 2003-04 as the basis, India's commercial supply should rise from 5.2% to 6.1% per year, while its overall primary energy supply should increase annually by 4.3% to 5.1%. The current capacity of around 1.60,000 MW needs to grow to almost 8,00,000 MW by 2031-32. Faced with the energy challenge, India's economic growth requirements and its efforts to raise the human level of development are of fundamental relevance253. Searching and adopting the other energy alternative on the market is therefore crucial. The best alternative for tackling energy and climate questions efficiently is the use of renewable energy.

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