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Impact of Policies & Regulations on Renewable Energy Future

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Abstract
Renewable energy is playing a pivotal role in meeting ever growing demand for electricity and at the same time addressing the issues related to global warming. Almost all countries are focusing on implementation of renewable energy sources . The renewable energy policies and regulations are not only being evolved and implemented at country level but also at global level through international organisations such as IRENA and think tanks such as International solar Alliance(ISA). The government of India's Ministry of New and Renewable Energy has taken the initiative and formulated a policy framework to promote & integrate Hybrid Energy Systems. International collaboration are also being promoted in the coming years, to make the world achieve net zero emissions by 2070. The government organisations are facilitating knowledge sharing between different pilot projects. The implementation of Smart Grids has their ability to facilitate the extended deployment of renewable energy and provide cost savings for all users along the energy value chain. One of the steps the Indian government took to make use of renewable energy sources in the country was to create off-grid power generation systems using solar PV panels. Numerous associations have recognized environmentally friendly renewable energy as an appropriate response to non-renewable energy consumption and environmental change. It has moved the energy industry toward eco-friendly and renewable energy frameworks in recent years.

Key Words: Renewable Energy, Policy, Regulations, Solar, Nuclear

1.0Introduction

The main objective of the Policy is to provide a framework for the promotion of large grid-connected wind-solar PV & nuclear power hybrid systems for optimal and efficient utilization of transmission infrastructure and land, reducing the variability in renewable power generation and achieving better grid stability. It is expected that more environmentally friendly power models and appropriate control frameworks will soon be available for the hybrid energy framework to meet the specific needs of various regions in the world (Shezan et al., 2016).The newly industrialized and developing countries are offering incentives to encourage investments in renewable energy (Steffen et al., 2018).It's worth exploring the possibility of cooperation, knowledge sharing & learning between different types of pilot projects of renewable energy as this would facilitate addressing common concerns and an intermediary entity can oversee such collaborative activities & open the doors for new developments (Naber et al., 2017). The policymakers should provide incentives for developing off-grid systems to cater to remote and inaccessible areas in rural areas (Goel, 2016).Therefore, to meet clean energy targets, there is a need to explore & establish processes to implement strategy by utilizing available resources thereby influencing an individual and/or collectively acting towards meeting clean energy objectives (Schulze et al., 2016).

2.0 Research Questions

The primary aim of this study is to understand the impact of policies and regulations on renewable energy future via the following questions:

a. Does Convenient renewable energy models and proper control systems are to be introduced for the hybrid energy system
b. Does Growing number of Renewable Energy support policies in newly industrialized and developing countries supports international collaboration
c. Does Experiments and knowledge sharing between different pilots improve the role of an intermediary organisation
d. Do Off-grid systems that are 'Grid ready' for remote areas being promoted

e. Is there a Mechanisms dealing with the process of strategy implementation is part of energy education

3.0 Research Objectives

As a solution to the above research questions, this study seeks to answer the following research objectives:
a. To understand some more convenient renewable energy models and proper control systems that can be introduced for the hybrid energy system applicable for the different areas of the world.
b. To understand the importance of being considered for the growing number of Renewable Energy support policies in newly industrialized and developing countries
c. Can further research be worthwhile to study how experiments cooperate, how knowledge sharing between different pilots can be improved, and what the role of an intermediary organisation can be in facilitating such exchanges of experiences.
d. How is the development of off-grid systems that are 'Grid ready' for rural and remote areas, and whether making by-laws for new buildings for grid connected as 'Rooftop ready' should be the suggested goals for the future
e. Should future research examine the specific mechanisms dealing with the process of strategy implementation by utilizing resources and influencing individual and/or collective action towards energy-related objectives

4.0 Scope of the study

Due to climate change, the importance of renewable energy in every nation's energy mix has increased over time. As a result, there is a push to replace fossil fuel-based power generation with renewable energy. The high initial costs associated with the installation of renewable energy technologies are one of the most significant obstacles to renewable energy. Even though renewable energy sources like solar and wind power save money in the long run, the costs of setting them up can be too much to bear at first. The decision makers in all the countries are formulating polices to the implementation of utility-scale renewable energy projects (typically those with a capacity of 10 megawatts or more). These polices can address the barriers related to Feed-in tariffs, renewable portfolio standards, transmission access, and other policies .

5.0 Literature Review

The greenhouse gas emissions are one of the major challenges faced by the world in recent times. The United Nations Organisation took the initiative to address the climate change and adopted a protocol called 'Kyoto Protocol' laying down a charter to reduce greenhouse gas emissions worldwide. It came into effect on 16th February 2005. Later an amendment was made and introduced on 8th December 2012 and is called as 'Doha Amendment'. So far 192 countries have accepted the Kyoto Protocol and subsequent Doha Amendment. India is also a signatory to the Kyoto Protocol and is committed to net carbon-zero emissions by 2070. The Central and State governments in India are promulgating policies and regulations to encourage Renewable Energy . India's need is financial development and to alleviate poverty. India's heavy reliance on Coal Fired Thermal Power Plants implies the significance of coal and thus the CO2 emissions decrease is certainly not a high priority in the near future. Nevertheless, the Ministry of Environment, Forest and Climate Change has adopted a long-term low-carbon development strategy. It intends to increase nuclear power capacity by three-fold by 2032. Environmental scientists are urging government policymakers to initiate policies and regulations promoting the addition of clean and renewable energy in the country's energy mix. This would help mitigate the impact of environmental damage being caused by emissions of gases caused by energy production using fossil fuel (Herman & Xiang, 2019).India has an abundance of sunlight and thus has a tremendous opportunity to take advantage of global trends in environmentally friendly power strategy plans in hastening of renewable energy development. The central government in India has initiated wide-ranging policies and regulatory incentives, including the Jawaharlal Nehru National Solar Mission (JNNSM), to encourage private sector investments in achieving an ambitious target of 500 GW of renewable energy installed capacity by 2030. The government is creating a strong positive environment such as renewable purchase commitments and renewable energy credit mechanisms to encourage private sector participation in the Solar & Wind Power Plants sector (Griffiths, 2017).Amjad Ali, Wuhua Li, Rashid Hussain, Xiangning He, Barry W. Williams, and Abdul Hameed Memon, (2017) are of the opinion that growing concern about energy security and environmental changes have made governments worldwide in taking substantial interest in increasing the renewable energy sources (RES) and distributed energy generation. The government is working out regulatory frameworks to

attract Distributed Energy Resources and Renewable Energy Target (RET) power to support effective microgrid implementation (Ali et al., 2017).

5.1 Hybrid Energy

The government of India's Ministry of New and Renewable Energy has taken the initiative and formulated a policy framework to promote Hybrid Energy. The main purpose of the policy is to promote large grid-connected solar PV and wind power hybrid systems. This system would reduce the variation in renewable power generation and optimise and improve the efficiency of utilization of the transmission network thus achieving better grid stability.

The Hybrid energy system combines different types of power generation resources, its storage and its consumption into one system that is managed by a central control module. It also optimizes its generation and consumption based on local requirements and local grid conditions. The present Hybrid Energy Storage System (HESS) can be classified into three broad categories such as

- Passive Hybrid Energy Storage System (HESS),
- Semiactive Hybrid Energy Storage System (HESS) and
- Full active Hybrid Energy Storage System (HESS).

It is expected that the Hybrid Energy Storage System (HESS) will eventually develop into a robust and reliable Hybrid Energy Storage System (HESS) in small-scale standalone microgrids, specifically for remote areas. It would also develop into an autonomous and intelligent medium to large-scale grid-connected micro-grids that are part of smart grid architecture (Jing et al., 2017).

The Nuclear Power Plants can also be operated in a Hybrid manner along with Solar and Wind Power plants. The flexibility of operating nuclear plants providing the baseload continuously help integrate larger shares of variable wind and solar resources and reduce fossil fuel consumption. This flexible operation would certainly increase the profitability of nuclear plants reducing variable O&M costs. It is expected that some more suitable renewable energy models and appropriate control systems will be introduced for the hybrid energy system applicable to the different areas of the world in the near future (Jenkins et al., 2018).

5.2 International Collaboration

International collaboration should be promoted in the coming years, to make the world achieve net zero emissions by 2070. This is particularly essential for making heavy industry and long-distance transport carbon-free as these sectors serve global markets. Their evolution to net zero carbon emissions involves the massive utilization of technologies that are still under development today. Their transformation to a net zero carbon emission industry cannot happen without a well-targeted effort in international collaboration.

The Indian government has taken the initiative to form an International Solar Alliance (ISA) . The alliance is an agreement-based inter-governmental organization. The primary goal of this alliance is to work for the efficient consumption of solar energy and reduce dependence on fossil fuels. As of now, 120 countries have signed the treaty. Most of the countries of this alliance are sunshine countries, lying either completely or partly between the Tropic of Cancer and the Tropic of Capricorn. The International Solar Alliance intends to mobilize more than USD 1000 Billion of investments by 2030 for the massive development of Solar Power Plants. International Solar Alliance's long-term goal is to scale up Solar Energy to an extent such that the cost of solar generation comes down drastically, making them economically viable. It also will be important to consider the growing number of RE-support policies in newly industrialized and developing countries. The developed countries like the USA and France still bank on Nuclear Power Plants to generate carbon-free electricity. Although the availability of cheap natural gas has led to a reduction in electricity prices, it has increased carbon emissions. Therefore it is essential to operate the existing Nuclear Power Plants to have an economical carbon-avoidance strategy compared to the social cost of carbon (Roth & Jaramillo, 2017).

It is observed that there is significant variation in the adoption of renewable energy technologies in various countries. The organisations such as the International Solar Alliance and the International Renewable Energy Agency can play a crucial role in solving the bottlenecks in climate change negotiations by framing renewable energy as business-friendly, creating a knowledge base for renewable energy in the countries that are lagging behind. This would on one hand limit the "downside risk of hurting cooperation efforts in other energy institutions" and, at the same time would focus on "more modest and achievable goals" (Atalay et al., 2016).

5.3 Size Of Project

The economies of scale in the case of the power generated by renewable energy sources are unique as compared to that produced using fossil fuel. The variation is primarily in three areas

- As the level of sunshine or intensity of wind is the same in a particular geographical area, the larger solar or wind power plants produce less costly power as compared to smaller size power plants.
- The areas with high quality and intensity of sun radiation or good wind speed produce the best generation which can then be transmitted to longer distances for users.
- The path to developing renewable energy rapidly is through a large-scale renewable energy power plant.

Traditionally, the power is delivered to a large number of customers through a power grid from a few central power generation stations. However, the introduction of large-scale renewable energy sources (e.g. wind and solar) into the grid has led to erratic production of electricity. To address these issues, a new idea of future generation electric power systems has evolved, namely the so-called 'smart grid'. The Smart Grid is a system that incorporates different kinds of operational and energy measures including smart meters, smart appliances, renewable energy resources, and energy efficiency resources". The smart grids have been able to address the size of projects by integrating of smaller power plants into the grid. The Smart grids are deemed to improve the electric power quality and reliability and help in the reduction of greenhouse gas emissions. The most important feature of Smart Grids is their ability to facilitate the extended deployment of renewable energy and provide cost savings for all users along the energy value chain. The government organisations are facilitating knowledge sharing between different pilot projects (Naber et al., 2017).

5.4 Off-Grid Systems

A typical off-grid system, as the name implies, operates independently of the main power grid for the supply of electricity to the consumers. It usually encompasses the solar panels, a battery bank, and an inverter. The solar panels utilise sun radiations to produce electricity which is in turn used to store electricity in a battery bank. The stored electricity in the battery bank which is 'Direct Current' (DC) electricity is then converted to an 'Alternating Current' (AC) electricity by using an inverter which is used to supply power to various equipment. Off-grid systems for power generation using Solar PV Panels are one of the first initiatives taken by the Government of India towards harnessing Renewable Energy Resources in the country. The purpose of Off-Grid Systems was to provide electricity where central grid power is not available. It covered applications such as Solar Street Lighting and homes lit by Solar Power. These were also used for pumps operating on solar power in the agricultural sector. The government of India had set up a 'National Solar Mission' in 2010 setting a target of generating two gigawatts of electricity using Solar Off Grid Systems. The project was implemented in three phases, with the main thrust towards the development of rural areas using renewable energy for Water Pumps for Irrigation and drinking water facilities. It is observed that the support of government organisations is required for off-grid systems to be sustained. The Off-grid systems need these supports for their implementation and as well as for them to be durable. In a Country like India, these two aspects tend to be low and therefore is challenging for the sustainability of off-grid PV systems. This, coupled with a lack of expertise such as a lack of skilled personnel leads to poor implementation such as the shadowing of solar panels because of wrong installation or the selection of wrong ancillary equipment. The implementation is further aggravated by the use of unapproved materials and the under sizing of plant capacity due to inaccurate power capacity estimations. The capacity building of Off-grid Systems needs to be prioritised as a long-term goal for increasing the sustainability of off-grid PV systems (Feron, 2016). The proposed objectives for the coming years should be the development of 'Grid ready' Off Grid Systems for deployment in rural and remote areas. There should also be by-laws for new buildings being constructed in urban areas to make them ready for setting up 'Rooftop' Solar Plants.

5.5 Energy Education

Environmentally friendly renewable energy has been acknowledged as a fitting response to environmental change and non-renewable energy source consumption by numerous organizations. It has moved the energy business towards renewable and ecologically friendly energy frameworks throughout in last many years. This expansion has furthermore increased the demand of experts for planning, designing, execution, operation and maintenance of various renewable energy frameworks. The vast majority working in this area are not thoroughly prepared or taught enough though some of them are not even mindful of supportability. Mike Schulze, Henrik Nehler, Mikael Ottosson and Patrik Thollander, (2016) conducted an extensive study on the

implementation of energy management in the industry. It was observed that there is a huge potential in reducing energy consumption and subsequently cost of the energy by educating the personnel in efficient energy management. The cost of energy was considered just an overhead rather than a cost by companies a few decades ago. However, the rising cost of energy forced the organisations to rethink about energy management due to the increase in energy prices. The energy management has five key elements

- Strategy/Planning,
- Implementation/Operation,
- Controlling,
- Organization And
- Culture

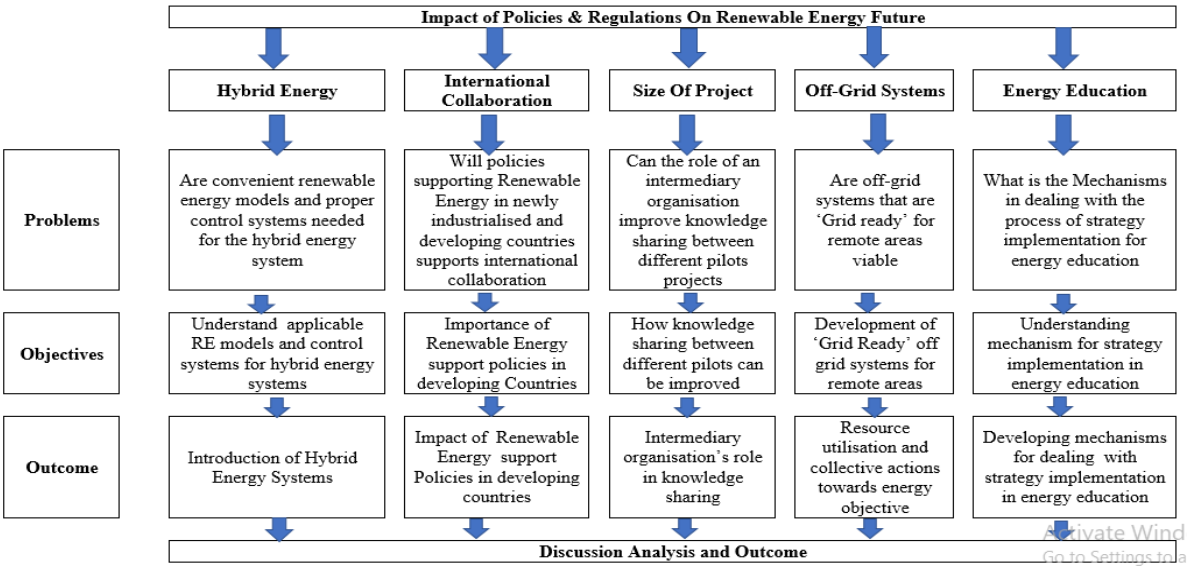
The companies need to have a written down long-term energy policy plan for the target-setting process on a company level and have a logical strategic risk management approach to minimize the exposure of the company's energy use. The companies implement this by setting up performance measurements by benchmarking their energy usage with contemporary industries. The key element in the successful implementation of the energy management system is to have an organisation structure in place for implementing it. The key elements of an energy management are to educate and train staff and motivate them through internal communication about the organisation's commitment towards energy management and usage of renewable energy sources (Schulze et al., 2016). The global contribution of Nuclear energy is over 11% after coal, gas and hydro energy resources. Developing economies, such as India, are now preferring to utilise nuclear energy to generate power to meet their higher power demand in comparison with other energy sources as this has much less greenhouse gas emission. There would be a need to educate the masses about the benefits of nuclear energy. For this purpose, regulatory structures should be implemented both at the centre level and state level (Roth & Jaramillo, 2017).

6.0 Research Methodology

Data for the research was gathered from various secondary data sources. The majority of the data was gathered by searching relevant indexed journals, industry reports, and reference books online. The existing core variables that were discovered through a thorough literature review are described in detail in the research methodology. A basic direct connection between five core variables — hybrid energy, international collaboration, size of project, off-grid systems and energy education and Policies & Regulations Impact On Renewable Energy Future — is established in the examination model.

7.0 Research Framework

From the literature review, a proposed research framework is developed as shown below.



7.1 Discussion, analysis and outcome

7.1.1 Hybrid Energy – Analysis of solutions and outcome

A hybrid energy system uses two or more fuels to power a generator or combines multiple energy generation and/or storage methods. In the process of moving away from economies based on fossil fuels, a useful strategy is a hybrid energy system. When used together tactically, these systems can provide synergistic advantages that maximise energy efficiency.

Policy makers have taken the initiative and formulated a policy framework to promote Hybrid Energy. The main purpose of the policy is to promote large grid-connected solar PV and wind power hybrid systems. This system would reduce the variation in renewable power generation and optimise and improve the efficiency of utilization of the transmission network thus achieving better grid stability.

7.1.2 International Collaboration – Analysis of solutions and outcomes

In order to achieve net zero emissions by 2070, international collaboration needs to be encouraged in the coming years. Because heavy industry and long-distance transportation serve global markets, this is especially important for eliminating carbon emissions. They are using a lot of technologies that are still being developed today to get to net zero carbon emissions. Without a well-targeted international collaboration effort, they cannot transition to a net zero carbon emission industry.

The International Solar Alliance (ISA) was initiated by the Indian government. The partnership is an understanding based between administrative association. This alliance's primary objective is to promote the efficient use of solar energy and lessen our reliance on fossil fuels. The treaty has been signed by 120 countries at this point.

(Roth & Jaramillo, 2017) had opinioned that the developed countries like the USA and France continue to rely on nuclear power plants for carbon-free electricity generation. Although the availability of cheap natural gas especially in the USA where ‘Shale Gas’ development is going on and has led to a reduction in electricity prices, it has increased carbon emissions. Therefore it is critical to operate the existing Nuclear Power Plants to have an inexpensive carbon-avoidance strategy compared to the social cost of carbon

7.1.3 Size Of Project – Analysis of solutions and outcomes

When compared to the power produced by fossil fuels, the economies of scale in the case of renewable energy sources are unique. There are three main areas of variation.

- As the degree of daylight or force of wind is same in a specific geological region, the bigger sun based, or wind power plants produce less expensive power when compared with smaller size power plants.
- The best generation is produced in locations with good wind speed or high sun radiation quality, allowing it to be transmitted to users over greater distances.
- A massive renewable energy power plant is the fastest way to develop renewable energy.

According to (Naber et al., 2017) , the development of Smart grids have led to improvement of the electric power quality and reliability. This has helped in the reduction of greenhouse gas emissions. The most important feature of Smart Grids is their ability to facilitate the extended deployment of renewable energy and provide cost savings for all users along the energy value chain.

7.1.4 Off-Grid Systems – Analysis of solutions and outcomes

As a sustainable alternative to conventional energy sources, off-grid solar systems are gaining popularity. Users can remain completely disconnected from the electrical grid thanks to these systems, which store the electricity generated by solar panels in batteries. Because users are not reliant on the electrical grid, they are able to generate their own electricity and control the energy they receive. This is especially helpful in rural areas where connecting to the grid can be difficult and expensive.

Off-grid solar systems are extremely eco-friendly and leave a significantly smaller carbon footprint when compared to conventional energy sources. These systems reduce greenhouse gas emissions and contribute to a greener planet by producing clean, renewable energy by harnessing the sun's power. Cost reduction Off-grid solar systems may require a larger initial investment than grid-tied systems, but they provide significant savings over the long term. The generated energy is free once the system is installed, lowering or eliminating monthly electricity costs. Government incentives can also help offset the cost of installation if eligible.

7.1.5 Energy Education – Analysis of solutions and outcomes

Numerous organizations have recognized environmentally friendly renewable energy as an appropriate response to environmental change and non-renewable energy consumption. In recent years, it has moved the energy industry toward renewable and environmentally friendly energy frameworks. The need for specialists in the planning, design, implementation, operation, and upkeep of various renewable energy frameworks has also grown as a result of this expansion. The majority of people working in this field are not adequately trained or prepared, and some are even unaware of supportability.

Mike Schulze, Henrik Nehler, Mikael Ottosson and Patrik Thollander, (2016) conducted a comprehensive assessment of the industry's energy management implementation. It was discovered that staff education in effective energy management has a significant potential to reduce energy consumption and, consequently, energy costs. The expense of energy was viewed as only an above instead of an expense by organizations years and years prior. However, the organizations were forced to reevaluate their energy management strategies as a result of the rising cost of energy.

8.0 Research Implications

The study's findings are based on qualitative research into policies and regulations and are supported by secondary research data. Policies and regulations for renewable energy will need to be identified using the research framework that was developed in the future. It likewise incorporates different answers for policies and regulations frameworks appropriate to environmentally friendly power sources from here on out. The study also emphasizes the public's perception of policies and regulations and their potential impact on other renewable energy sources.

Moving away from energy sources based on fossil fuels should be beneficial to policymakers and other stakeholders, according to the findings of the research. This study emphasizes the importance of developing favourable policies

9.0 Limitations and Scope for Future Research

The optional information utilised in the writing survey may not be precise on the grounds that they were gathered over an extensive period of time. Additionally, the research's accuracy is primarily determined by the data's accuracy, which may be biased.

There is a long way to go about the subject since there are a ton of neglected roads, like the improvement of existing policies and regulations frameworks, political elements, public insight, etc.

Future research can use primary data because secondary data are highly guarded and highly confidential. As a result, it's hard to get free access to the information. This demonstrates the significance of energy storage systems and their role in the future demand for renewable energy, despite the fact that very little research has been conducted in this area.

10.0 Conclusion

This research study has studied relevant papers and has justified it using secondary data. Given the understanding from existing literature, this article presents the research framework suggesting the role of policies & regulations on future renewable energy demand.

According to Amjad Ali, Wuhua Li, Rashid Hussain, Xiangning He, Barry W. Williams, and Abdul Hameed Memon, (2017) the energy security and environmental challenges and concerns have made governments globally to take keen interest in increasing the share of renewable energy sources (RES) and distributed energy generation in its energy mix.

Eventually the development of the Hybrid Energy Storage System (HESS) will lead to development of a robust and reliable Hybrid Energy Storage System (HESS) in small-scale standalone microgrids, specifically for isolated areas. It would also develop into an independent and smart medium to large-scale grid-connected micro-grids that are part of smart grid architecture (Jing et al., 2017)

The economies of scale in generation of electricity utilising renewable energy sources as compared to that of using fossil fuel sources into the grid has led to erratic production of electricity. This development has led to the development of ‘Smart Grids’. The Smart Grid incorporate different kinds of operational and energy

measures including smart meters, smart appliances, renewable energy resources, and energy efficiency resources. The smart grids have been able to address the size of projects by integrating of smaller power plants into the grid. Therefore, the results help to understand the factors found in the literature review

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