Implication of Renewable Energy in Sustainable Development in India: Future Strategy

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Abstract: Renewable energy (RE) can play an important role in Sustainable Development in India. India is a growing economy, and it would need an assured supply of 3–4 times than the whole energy consumed today. This research paper discussed about RE sources, drivers, challenges and policies. It can be concluded from review of literature and other information provided in paper that RE have a huge potential in India and with latest technologies use it can fulfill India’s energy demand in future. Quality of life can be improved with the help of RE. It is predictable that large number of domestic jobs can be created in future in green energy and RE. The study found that RE can reduce environment pollution issues, carbon emission and scarcity of nonrenewable energy sources. RE has a positive relation with economic growth, job creation and welfare. This paper recommends some suggestions for strategic policy in sustainable energy sources.

1. Introduction
The power requirements will always be on the rise and the power generation capacity will also be increasing year on year to meet the demands of power. It is wise to build capacities in a sustainable way so that the unfavorable climatic changes can be mitigated drastically. Energy is the key factor in any country for industrialization, Urbanization and economic growth [1]. It affects many development issues like economic, livelihoods & agricultural productivity. Energy is required for many functions like healthcare, lighting, manufacturing and running many electronic or digital items. It is expected that green energy requirement by 2022 will be 175GW [2]. In green energy government is promoting FDI and allowed in RE recreation or circulation almost 100 % FDI. Solar energy as an alternative source would help us to leave a clean, safe and healthier world for our future generations. In next four years RE sector growth is expected up to US $ 80 billion. In country non renewable sources like coal, oil etc is used for its energy demand fulfillment or consumption [3, 4]. In India energy issue can be solved by sustainable energy sources like solar energy, biomass or geothermal. It is expected that nowadays RE is contributing more than half energy execution in different sources [5]. Sustainable development is a big challenge for any country nowadays. Electronic vehicles are a buzz word nowadays because of its ecofriendly nature approach.
These days’ consumers are also very much aware about green products and day by day green products or RE products demand is increasing. In automobile industry trends like e-vehicle is prevalent now days and future growth in this category is expected [6]. Government is promoting nowadays emission free products and they are providing essential guidelines and standards to manufacturers to minimize environment pollution. Nowadays corporate sector is working sustainable resources model and they are...
trying to use in their processes more and more RE or green energy techniques or equipment’s. Well-structured strategy is required for country like India to gain sustainability in business processes and household consumption of energy [7]. Green energy is solution for many challenges like global warming, environmental issues or increasing demand of fossil fuels. Government need to invest more and more in RE initiatives so that in future we can improve better uplifting in economic and social development [8].

2. Review of Literature

2.1 RE sustainability issues
Sustainable energy as, “a full of life synchronization between the even handed accessibility of energy-intensive goods and services to people and protection of the earth for next generations” [2]. Pachar S [3] mentioned in their study that in sustainability source of energy solar and wind energy are contributing more and more now days. Hydro energy India need to focus because this is not contributing significantly. In green energy India is growing fast. Government is taking many initiatives to improve energy supply. In energy supply initiatives Bio mass energy can play a important role. For any country sustainable development energy supply is important aspect. India is having geographical advantage which can be good in sustainable development model. Green energy is now only solution for carbon emission. Traditional energy sources cannot help to meet future demand of industry and household so India needs more initiatives and strategic planning to fulfill future demand of energy. Only solution to improve environment and industry need is RE or green energy [3]. Hák et al [9] focused mainly on The Sustainable Development Goals (SDGs) of India, which mainly focused on energy supply and green energy issues. Sustainable energy is dynamic harmony between people need and supply which can help in future generations need fulfilment. Nowadays Government is more concerned for country future need fulfilment. Recently launched SDGs main goals for India is to help in climate change. To provide sustainable resources to future generations [9].

2.2 Economic Development & RE connection
For any country development and sustainability, green energy can be the best strategy. This can help in development and need fulfilment. Millennium Development Goals also includes issues like climate change, renewable energy and modelling [5]. Edenhofer et al. [10] discussed that RE sources are accessible everywhere rather than tradition sources of energy. Economy can get benefit by improving supply of RE and reducing import of petrol and coal. Human development, economic productivity and country economic performance majorly dependent on energy supply. Green energy has constructive impact on development as well. RE can provide many new job opportunities it is expected that RE contributed 2.3 million jobs Worldwide. Financially viable development and energy use a have positive association and it can contribute globally in per capita income increase also.

2.3 RE role in climate change or Energy security
Twidell & Weir [11] discussed that industry pollution or emission of green house gases can be solved by using RE. It is natural resource and available all time and best solution for environment protection. Biodiversity of any country should not affected by energy supply. Every country facing issues related with environment pollution or global warming because use of traditional energy sources use like coal and petroleum. Considered RE technologies as clean sources of energy [12]. Future economic and social needs can be fulfilled by it and it can also make our environment pollution free. Renewable energy technologies are better solution for reducing global warming and greenhouse gas emission. So adopting renewable or green energy policy is best strategy to overcome the challenges related with environmental factors. Renewable energy technologies will improve energy supplies [13]. Fossil fuel energy should be replaced with green energy sources which consist solar energy, Hydropower, ocean energy (tide and wave), geothermal energy and wind [7].
3. **Methodology of the Study**

This research paper looks for study the Significance of RE in Sustainable Development in India and its potential in future strategic sustainable development. To achieve the objective peer reviewed journals have been analysed and reviewed and data have been taken from many authenticated government sources. This study is result of review of secondary sources like research paper or government report on RE or green energy or web policy documents etc. The present paper is an effort, to identify and discuss renewable energy status and potential in India. To be specific research paper has following objectives:

(a) To know the RE future Scope in India  
(b) To discuss the benefits of RE in India  
(c) The paper also analyses regulatory framework, issues concerned with renewable sources  
(d) To recommend suggestions to improve RE contribution in county growth & environment pollution control.

4. **Renewable Energy Sources and Technology**

In India (MNRE) Ministry of New and Renewable Energy is authorised body for RE in different areas like electricity, manufacturing and transportation etc. This department is involved in energy activities like R & D, certification or equipments standardization. The MNRE contains the all activities of green energy production. The government is working on special plans to set up an indigenous manufacturing capacity grid till 2022. In RE 75 % contribution is from wind program which is fastest contributing [9]. Government is working on many incubation schemes to set up enterprise in green energy

![Type of RES](image)

5. **Projections**

Figure 2 shows the status of renewable energy solar power capacity in India. Solar energy can contribute a major part in energy need fulfillment and it is available almost in every state of India. Thus there is a strong need of better policies related with energy development which can help India to fulfilling energy need. Indian Ministry has started many training programmes to fulfill human resource requirements in renewable area.

A country demand for energy is directly proportionate to its population and India is ranked second, of the most populous country. By the end of 2021, the capacity addition in the utility scale is expected to be at 47,000 MW and the rooftop capacity is expected to reach 12,500 MW. This in turn translates to reduction of carbon dioxide which would have otherwise resulted in the emission of 87,000 KT of carbon dioxide from the coal plants [14].
Table: 1 year wise and technology wise capacity additional targets to 2022 (Grid connected RE only)

| Year     | Rooftop Solar (GW) | Ground-Mounted Solar (GW) | Solar (GW) | Wind (GW) | Small Hydro (GW) | Biomass (GW) | Total (GW) |
|----------|---------------------|----------------------------|------------|-----------|------------------|--------------|------------|
| 2015-16  | 0.2                 | 1.8                        | 2          | 3.2       | 0.14             | 0            | 5.3        |
| 2016-17  | 4.8                 | 7.2                        | 12         | 3.6       | 0.14             | 0.9          | 16.7       |
| 2017-18  | 5                   | 10                         | 15         | 4.1       | 0.14             | 0.9          | 20.2       |
| 2018-19  | 6                   | 16                         | 4.7        | 0.14      | 0.9              | 21.0         |
| 2019-20  | 7                   | 10                         | 17         | 5.4       | 0.14             | 0.9          | 23.5       |
| 2020-21  | 8                   | 9.5                        | 17.5       | 6.1       | 0.14             | 0.9          | 24.7       |
| 2021-22  | 9                   | 8.5                        | 17.5       | 8.9       | 0.14             | 0.9          | 27.5       |
| Total    | 40                  | 60                         | 100        | 50.8      | 9.98             | 173          |            |

Table 1 represents a brief data about 7 years targets in energy sector by Niti Aayog in sectors like solar energy, wind energy, Hydro energy and biomass energy. Above table data represent that in India green energy is continuously increasing 27.5 GB in 2022. Major contributor in energy is solar and wind. These sources are sustainable and can contribute more significantly is country’s energy demand. Least contributor in energy is Hydro sector in India. Biomass energy have full potential to meet future energy demand [2].

Figure 3. Projections in reduction in Co2 emission (in KT)
Figure: 3 shows Projections in reduction in Co2 emission year wise. It is showing a trend that year wise as solar energy use is increasing carbon dioxide emission will also decrease. The power requirements will always be on the rise and the power generation capacity will also be increasing year on year to meet the demands of ever-increasing power. It is wise to build capacities in a sustainable way so that the unfavorable climatic changes can be mitigated drastically. Hence it could be concluded that usage of solar energy as an alternative source would help us to leave a clean, safe and healthier world for our future generations [15].

6. Renewable Energy contribution in sustainable development

Green energy or renewable energy most important feature is that it is accessible in abundant supply. It is unlimited. RE sources are natural and sustainable that have no harmful impact on nature. RE can be used in household and industrial functioning [16].

- Eco friendly environment: Green energy sources and technologies are clean source of energy than conventional energy technologies.
- Sustainable Source of Energy: Solar energy, thermal energy, winds energy and ocean energy all can be created by natural sources which are available vast quantity rather than nonrenewable sources which are finite and will sometime be depleted.
- Employment opportunity: Government is investing lots of funds on green energy R&D and infrastructure facilities which will create many jobs for people.
- Improved healthy life: green energy uses natural resources for energy making process like solar, thermal or ocean, which does not create any health issues or air pollution. Renewable energy is very clean energy which can save even cost health as well.

7. Recommendations for future renewable strategy for India

Renewable energy is best solution for environment protection and sustainable development. Best renewable source like Solar and wind energy are getting popularity nowadays. But it has also certain limitation exists such as: seasonal disparity as most RE resources are affected by seasons. So strategic planning with technological innovation is required. In main challenge lack of information to access the green energy comes [17]. So by the help of technology these shortcomings can be improved. Government should make Strategic future policy to make renewable energy plan successful. Main challenge include lack of infrastructure support, no financial viability and stringent regulatory approval by removing all these hurdles green energy for sustainability can be promoted [18].

8. Conclusion

In today’s era there is a dire need of green energy or RE where challenges like environment pollution, carbon emission or health issues are increasing day by day. Every country is now working to develop technology based on RE to meet future energy demand. In this paper many issues have been discussed related with India’s future possibilities of green and RE. India can be a hub of green energy supply if India will work on a strong strategy base plan. India can be self reliant in energy demand and supply by using proper geographical advantage in energy supply sources. Government should mandate for insurance companies to make better policy to invest in RE sector. The government should focus on Innovative latest techniques use in energy sector. Thus, to conclude it can be said that looking at the present situation, a self-sufficient better energy scheme in nation like India is vital for future growth & require fulfillment in energy consumption. RE sector can help to meet environment challenges and creating new ventures and job in green energy area.

9. Future Scope

Study can be done on issues like carbon emission or environment pollution solution by green energy or RE. More studies can be done like applications of RE and Innovation in green energy and their impact on people.RE have a huge potential to meet energy future need and it is a sustainable source so study
can be done to develop a sustainable model on RE sources contribution in meeting energy future demand.

This research paper is prepared based on secondary data and limited data sources have been referred. RE or green energy is having vast potential for future of world so more and more primary data based research should be needed in this area. Government need to address implementation and supervision of green energy issue and model seriously in industry or household.

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