



---

## **Role of Solar Energy in Fulfilment of SDGs**

*Rupali Chourasiya*

Research Scholar, Department of Economics, Institute for Excellence in Higher Education, Yashoda Vihar Colony, Kolar Road, Bhopal- 462016, India

---

### **ABSTRACT:**

Nearly every significant opportunity and issue the world has today revolves around energy, including the elimination of poverty, gender equality, climate change adaptation, food security, health, and education, as well as sustainable cities, jobs, and transportation. However, the country is facing challenges such as energy scarcity, widespread poverty, and overpopulation. This article discusses the energy scenario of India and describes the role of Solar Energy to attain SDG-7 and other SDGs associated to it. The manuscript also aims to analyse the need and significance of the Solar Energy towards SDG-7, on which some questions arise such as what are the effects of Solar Energy on sustainable development of a country. Finally, the paper recommends some policy interventions to attain SDG-7 as early as possible. This study concludes that India is severely facing the problem of energy scarcity to maintain sustainable economic growth. It has been also observed that with the huge availability of renewable energy potential, there will not only solve the problem of energy poverty but also save huge expenditure on imports of fossil fuel and can increase the standard of living with concern of environment.

**Keyword:** Solar Energy; SDGs; Solar Energy for SDGs; SDG-7;

**JEL codes:** A130, I380, O210, Q420

---

### **1. Introduction**

Sustainable development depends on a safe and sustainable energy pathway, which we have not yet discovered. The rate of growth in energy consumption has been slowing. However, developing countries' industrialisation, agricultural advancement, and quickly expanding populations would require far more energy. Therefore, any realistic global energy projection must account for significantly higher primary energy use in developing nations. Any nation's socioeconomic development must take energy into consideration. There is a consistent need for high-quality energy services as a result of increasing economic activity, population growth, fast urbanisation, industrialisation, and rising living standards. Chronic power supply problems plagued many nations, while prior decades saw underfunding of the country's energy needs. There is a constant need for reliable sources of power in the commercial, industrial, and agricultural sectors. The massive influx of people into cities and the upcoming construction projects are driving up demand for electricity. The government is aware that a number of important components of development have been put on hold as a result of slow economic growth and energy scarcity. The government's top focus in recent years has been to give the people of the nation access to and security over energy.

#### **1.1 Solar Energy**

As it eliminates the majority of the drawbacks of the other sources of renewable energy, solar energy and solar rooftop technology are regarded as the finest. A benefit of the country's location is its geographic location. India is a country in the northern hemisphere, lying between latitudes 8°4'N and 37°6'N and longitudes 68°7'E and 97°25'E. The Tropic of Cancer (23°30'N) divides the nation roughly in half. The southern portion of the country, which makes up peninsular India, is in the tropical zone, whereas the northern half of the country is in the subtropical zone. With 300 days of sunshine per year and solar insolation of 4 to 7 kWh per square metre, India has a vast amount of solar energy that can be used to produce 5,000 trillion kilowatts of renewable energy (JNNAM phase 11, 2010). With bold aspirations to boost solar energy's contribution, the policy framework has undergone significant modifications over the last few years. The government's objective and target for sustainable energy have been accelerated through a number of programmes developed by the Ministry of New and Renewable Energy (MNRE) (Kunnath, 2019).

Heat and light are the two main manifestations of solar energy. Due to this, solar thermal and solar photovoltaic energy systems have been developed. Solar collectors, which are part of the solar thermal system, take in energy from the sun. The hot water is gathered in the storage tank before being distributed. Solar photovoltaic, on the other hand, transforms sunlight into electrical energy. The modules have many solar cell connections, and these modules are coupled together to form arrays that are connected to an inverter. Direct current (DC) power is generated, and an inverter transforms it into alternating current (AC). In India, the solar power industry is rapidly expanding as one of the most promising sources of energy.

To address climate change, environmental challenges, and achieve the SDGs at the national level, the National Action Plan on Climate Change (NAPCC) was established. Jawaharlal Nehru National Solar Mission was one of the NAPCC's eight missions (JNNSM). The Jawaharlal Nehru National Solar Mission (JNNSM) was founded by the Indian government in 2010 pursuant to a resolution dated 1 July 2015. The National Solar Mission's objectives

were to establish India as a world leader in solar energy and to develop policy recommendations for its urgent implementation throughout the nation. The ambitious goal of the Indian government is to increase the capacity of renewable energy to 175 GW by 2022, with 100 GW coming from solar power (MNRE, 2022). As a kind of renewable energy, solar power is a rapidly growing sector in India. As of 31 March 2022, the nation had 53.997 GW of installed solar capacity. A plan to establish at least one "green" city in each state, powered mostly by solar energy, was presented by Prime Minister Mr. Narendra Modi in December 2020. As of 2020, India had the fourth-largest installed capacity of renewable energy and placed fifth in solar power. India maintained its third-place position on the EY Renewable Energy Country Attractive Index in October 2021 (India Brand Equity Foundation, 2022).

### 1.2 Sustainable Development Goals

The Sustainable Development Goals (SDGs) confirm the course to be taken in order to provide people from all over the world with a better and more sustainable future. Global issues like poverty, inequality, climate change, environmental degradation, peace, and justice are addressed by the SDGs. After the publication of the Brundtland Report, which had significant economic, environmental, and social ramifications, sustainable development was for the first time taken into consideration as a guiding principle for economic development and was implemented into public policy (World Commission on Environment and Development, 1987).

Development that satisfies current demands without compromising the capacity of future generations to meet their own needs is referred to as sustainable development. The Brundtland Commission report or the World Commission on Environment and Development started the global discussion on sustainable development, which was continued at the Earth Summit, also known as the 1992 Rio Conference on Environment and Development (UNCED), as well as in other international gatherings. The declarations made at these conferences were not enforceable in court. However, it is important to recognise how they have influenced policy. The United Nations Framework Convention on Climate Change, the global accord that established member countries' legally bound carbon reduction objectives, was followed by the Kyoto Protocol (UNFCCC, 2022).

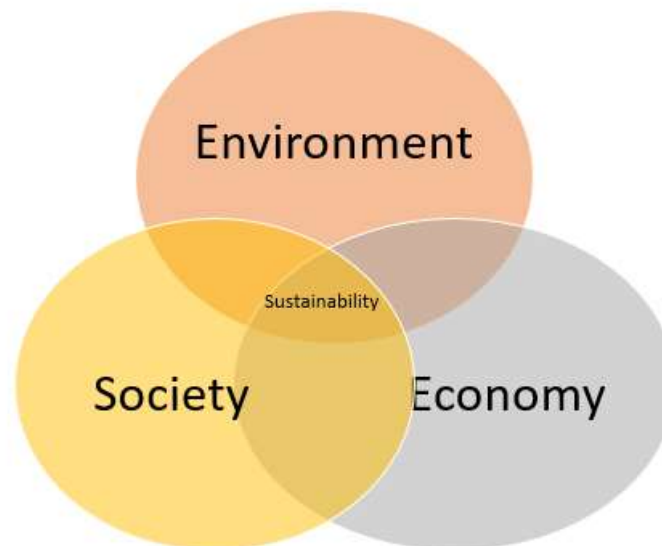


Figure 1- Sustainable Development based on triple bottom line methodology.

### 1.3 SDG – 7

This goal **Ensure access to affordable, reliable, sustainable and modern energy for all.**

This goal includes some predefined **targets** and their **Indicator** are:

**Target 7.1:** By 2030, ensure universal access to affordable, reliable and modern energy services

**Indicator 7.1.1** - Proportion of population with access to electricity

**Indicator 7.1.2** - Proportion of population with primary reliance on clean fuels and technology

**Target 7.2:** By 2030, increase substantially the share of renewable energy in the global energy mix

**Indicator 7.2.1** Renewable energy share in the total final energy consumption

**Target 7.3:** By 2030, double the global rate of improvement in energy efficiency

**Indicator 7.3.1** Energy intensity measured in terms of primary energy and GDP

**Target 7.a:** By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

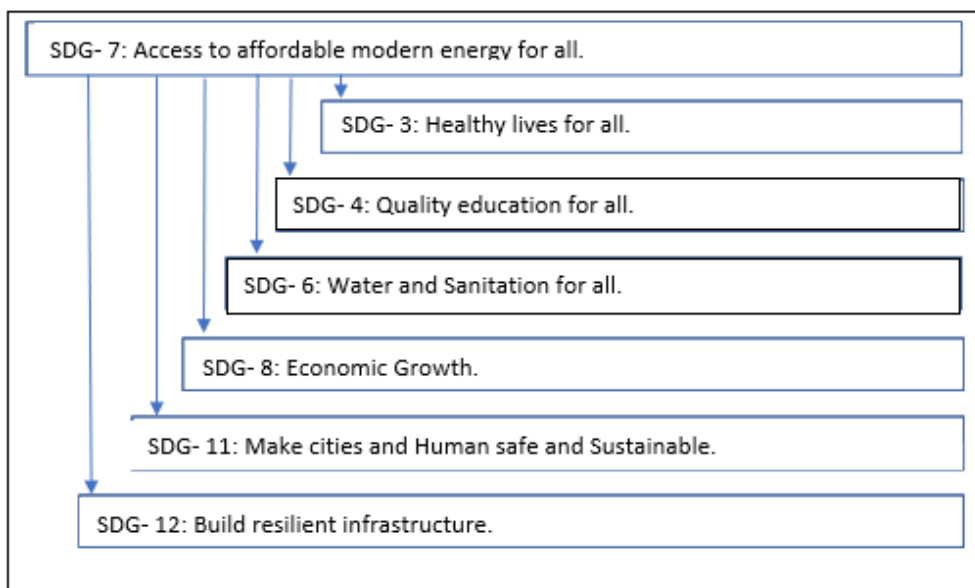
**Indicator 7.a.1** International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems

**Target 7.b:** By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support (United Nations Environment Programme, 2022)

**Indicator 7.b.1** Installed renewable energy-generating capacity in developing countries (in watts per capita)

**Linkage of SDG-7 with other SDGs** - All of the SDGs are connected. The elimination of poverty (SDG 1), gender equality (SDG 5), adaptation to climate change (SDG 13), food security (SDG 2), health (SDG 3), education (SDG 4), sustainable cities (SDG 11), employment (SDG 8) and transportation (SDG 9) are all largely dependent on energy (or SDG 7). Climate change mitigation (SDG 13) and SDG 7 are interconnected and mutually beneficial. Switching to renewable energy as a fuel source and improving end-use energy efficiency are the two main areas where governments need to concentrate in order to meet their pledges under the Paris Agreement.

**Figure 2- Linkage of SDG-7 with other SDGs.**



Source: (Katekar V.P., 2020)

## 2. Literature Overview

The usage of natural resources has increased recently as a result of the rising scarcity of conventional energy sources like coal, petroleum, and natural gases, which are also contributing to environmental and climatic changes. In order to make up for the lack of electrical energy, solar energy is essential and challenges the renewable sector faces (Patil & Memon, 2022).

The literature on grassroots innovation is used to study community-led solar energy initiatives in India. The community energy movement in India is explained in this essay using the concept of "grassroots innovations for sustainability." The report offers three excellent case studies of community energy initiatives that operate off the grid. Case studies are in line with social justice issues including participation, fair benefit allocation, and acknowledgment of marginalised communities. Projects address issues of social justice and energy poverty, including community involvement, benefits distribution that is fair, and underrepresented communities' representation. The results of this study demonstrate that grassroots technological breakthroughs and sustainable development are compatible with one another (Joshi & Yenneti, 2020). In India, using renewable energy is primarily done to advance economic growth, increase energy security, increase access to electricity, and slow down climate change. The government has created liberal rules, programmes, and an atmosphere to entice international investment and quickly advance the nation in the renewable energy sector. Over the coming years, it is projected that the domestic job market would benefit greatly from the growth of the renewable energy sector (Majid, 2020). Providing a needy family with a home equipped with solar panels is a financially sound and environmentally responsible initiative. The economist John Maynard Keynes makes the supposition that everyone will eventually pass away. Future resources that support sustainable development must be taken into account by the government. The government's modernization plans have no regard for next generations. India could achieve its energy needs, but it could also create energy instability, lose precious foreign exchange reserves, and contribute to environmental deterioration if it does not more effectively utilise the valuable and readily available renewable energy potential. Although not all countries with natural resources are developed, those who have used them to their advantage have experienced progress and growth (Sudan, 2019).

Commercial and industrial consumers must have access to renewable energy sources as well, which is why the author has suggested policies for the efficient implementation of Open Access as well as some significant amendments to other regulations to remove barriers to the expansion of the rooftop solar market. The privatisation of distribution businesses would be the most crucial structural change to pass in the long run for this competitive energy source to develop as it should. In order for this to happen, the carriage and content industries must first be separated, allowing for competition in the retail supply sector and ensuring that the full cost of electricity is revealed, leading to increased efficiency and competitiveness on a whole (Sood, 2021). There are two primary investors; the first is identified as having a moral imperative to use environmentally friendly procedures and processes, whilst the other is only motivated by financial gain. The companies that operate out of these environmentally friendly commercial buildings will be recognised as socially responsible creators of safer products and procedures and businesses that support sustainable practises. Government policy and intervention is vital in the early stages of technological adoption for a more extensive use of the technology. Renewable energy adoption will foster a learning environment that simulates real-world issues, offer benefits to society and the environment, support curriculum in renewable energy and sustainability, and help students develop good attitudes toward renewable energy (Kunnath, 2019).

### 3. Objectives

Lack of access to electricity in developing nations forces rural residents to continue using kerosene, agricultural waste, charcoal, and animal dung for cooking and lighting, predisposing them to risks to both their population and economy. This would require sustainable and alternative energy sources, such as low- or no-pollution renewable energy. There is a great chance to utilise solar energy due to its abundance of sunshine. It would make educational and livelihood activities possible at night in rural areas, reduce the time-consuming task of gathering firewood by women, and help prevent environmental degradation by preventing the use of forest wood for fuel. Overall, RE would lessen rural poverty, raise food production, reduce air pollution, and improve the quality of life for rural women, men, and children.

The key aim of the study is to analyse the need and significance of the Solar Energy towards SDG-7, on which some questions arise which are become objectives of this study are:

- i. To analyse the effect of Solar Energy in Sustainable Development.
- ii. To identify the role of Solar Energy in SDG-7.

### 4. Methodology

With a target of 175 GW installed capacity as a contribution of RE by 2022, India now has one of the greatest renewable energy capacity expansion programmes in the world, with solar accounting for 100 GW. Figure shows the year-over-year rise in India's solar energy targets.

*Table 1-Year-wise targets (in MW)*

Category	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Total
<b>Rooftop Solar</b>	200	4,800	5,000	6,000	7,000	8,000	9,000	40,000
<b>Ground mounded</b>	1,800	7,200	10,000	10,000	10,000	9,500	8,500	57,000
<b>Total</b>	2,000	12,000	15,000	16,000	17,000	17,500	17,500	97,000

Source: (MNRE, 2022)



*Figure 2- Year-wise Solar targets (in MW).*

**SDG- 7 Index State/UT wise performance score(0 to100) –**

Colour Indication on table:

Blue- Achiever (100)

Green- Front Runner (65 - 99)

Yellow- Performer (50 - 64)

Red- Aspirant (0 - 49)

S.N.	States/ UTs	SDG - 7 Score		
		2018	2019	2020
1	Andaman and Nicobar Islands	56	73	100
2	Andhra Pradesh	76	86	100
3	Arunachal Pradesh	44	74	85
4	Assam	18	70	98
5	Bihar	67	62	78
6	Chandigarh	96	84	100
7	Chhattisgarh	36	56	78
8	Dadra and Nagar Haveli	73	80	71
9	Daman and Diu	84	81	71
10	Delhi	51	96	100
11	Goa	61	95	100
12	Gujarat	67	75	94
13	Haryana	50	77	100
14	Himachal Pradesh	62	64	100
15	Jammu & Kashmir	58	76	100
16	Jharkhand	20	50	77
17	Karnataka	77	86	100
18	Kerala	60	70	100
19	Ladakh			100
20	Lakshadweep	60	43	83
21	Madhya Pradesh	58	62	86
22	Maharashtra	69	82	100
23	Manipur	39	72	96
24	Meghalaya	11	52	50
25	Mizoram	78	81	100
26	Nagaland	45	70	69
27	Odisha	23	50	80
28	Puducherry	61	97	98
29	Punjab	61	89	100
30	Rajasthan	63	61	100
31	Sikkim	47	97	100
32	Tamil Nadu	89	90	100
33	Telangana		93	100
34	Tripura	32	56	83
35	Uttar Pradesh	23	63	100
36	Uttarakhand	55	78	100
37	West Bengal	40	58	98

Source: SDG India Index (NITI Aayog , 2021)

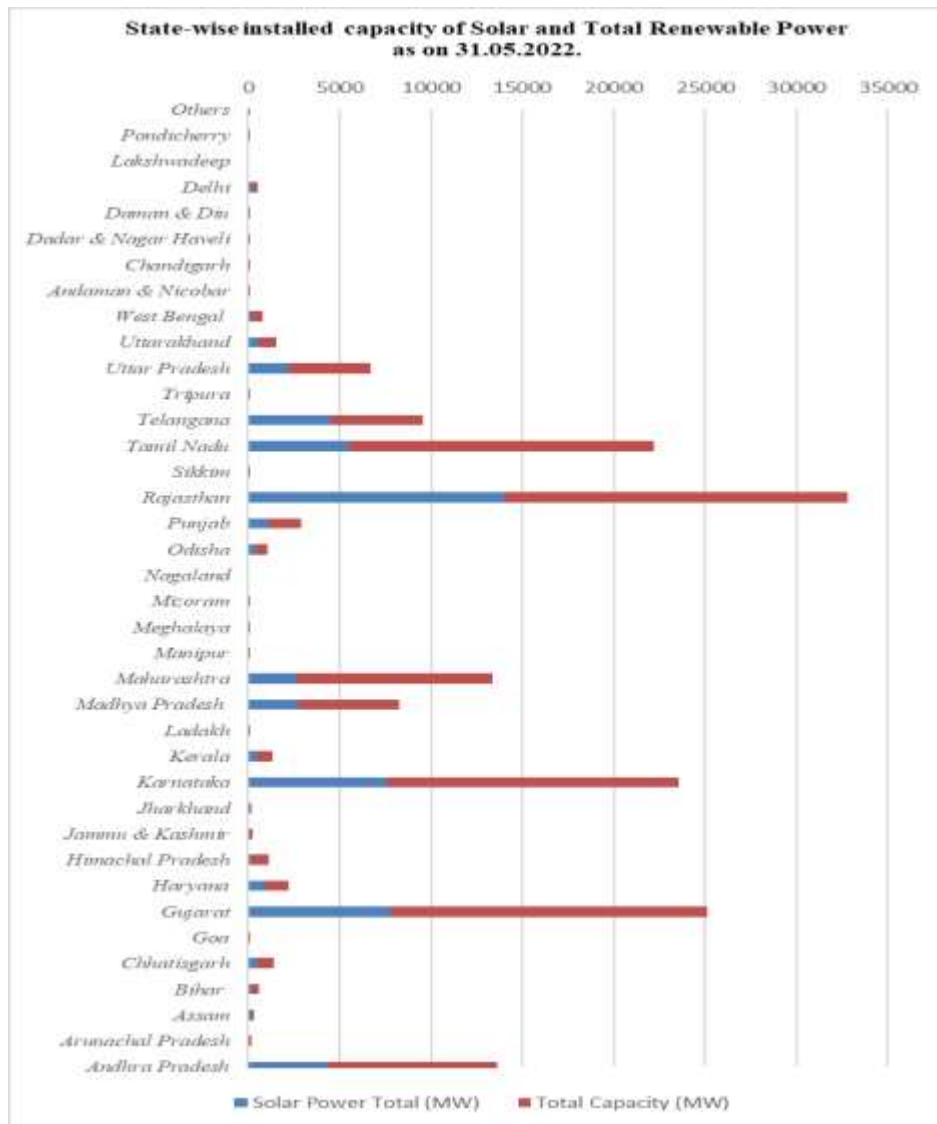
Table 2- SDG- 7 Index State/UT wise performance score.

Utilizing information on sustainable development objectives and the goal of realising solar potential, it is possible to observe the role of solar energy in the sustainable growth of the economy. NITI Aayog's state and UTs specific sustainable development goals index and MNRE's data on solar potential are used in this study to determine the importance of solar energy in sustainable development.

According to table 1 total target for Solar energy in rooftop and ground mounded Solar of 97,000 MW till 2020-21. Now, the target for installed capacity is 40 GW and overall, of 100 GW include off-grid applications 830373 street lighting, 1723479 home light, 7948219 solar lantern, 286830 Solar pumps and 216407.67 KW Stand Alone Power Plants (MNRE, 2022).

According to table 2 of State/UTs wise SDG -7 Performance score and figure 4 of State/UTs wise Solar Potential on comparing these two materials we can analyse active role of Solar Energy in performance of particular SDG -7 performance score. The top performer states in SDG- 7 have specialised potential of Solar Energy usability.

Total target Solar capacity of India is 56,951.33 MW with Rajasthan state have highest total Solar capacity of 14,062.52 MW. Later on, other better performer states are Gujrat with 7,78.72 MW, Karnataka with 7,597.92 MW, Tamil Nadu with 5,572 MW, Telangana with 4,553.66 MW, Madhya Pradesh with 2,745.88 MW, Maharashtra with 2,668.89 MW, Uttar Pradesh with 2244.56, Punjab with 1,112.96 MW and other states/UTs also initiated for grow sustainably.



Source: (MNRE, 2022)

Figure 3-State-wise installed capacity of Solar and Total Renewable Power.

According to figures from the World Economic Forum, the nation will have the second-largest population in the world in 2022, with more than 1.417 billion people, set to become the world's most populous country by the end of the decade, overtaking China, rise to 1.515 billion in 2030 (World Economic

Forum, 2022). The International Energy Agency (IEA) also notes that India's per capita energy consumption is one-third of the global average, which may point to a long-term increase in energy demand as the nation continues on its path of economic development.

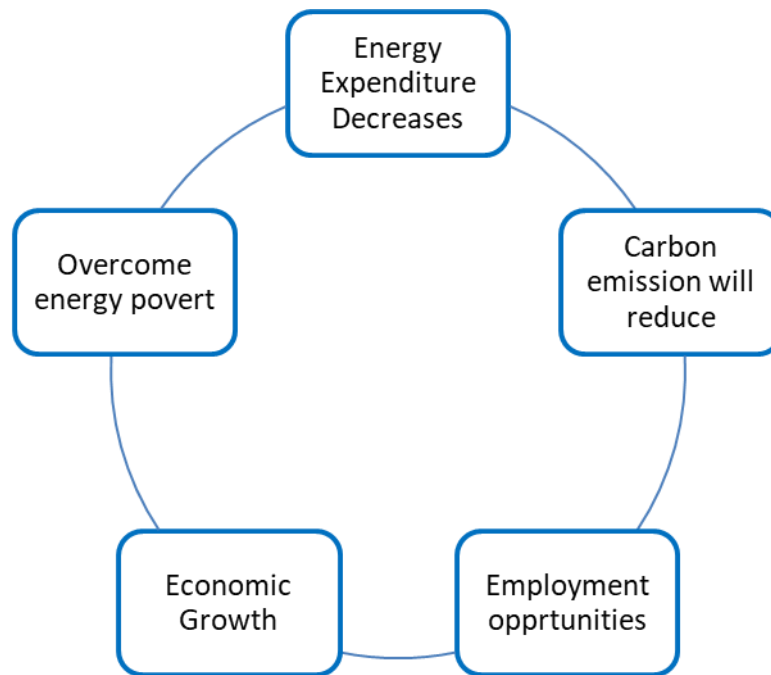


Figure 4- Effects of Solar Energy for Sustainable Development.

Since solar energy is the most lucrative and environmentally benign form of electricity, it is crucial for maintaining the environment. It is the use of solar energy's radiant energy. The most popular methods for creating drinkable water are solar distillation and disinfection. Additionally, it provides energy for drying, pasteurisation, and cooking. Solar energy is a useful tool for preserving the environment through a variety of methods, including solar thermal, solar lighting, agriculture, horticulture, and architecture and urban planning. Though compared to traditional energy sources, solar power offers a clean, environmentally friendly, and limitless source of energy, it is not necessarily a green energy source because there are unavoidable possible environmental and socioeconomic effects. A solar power plant's size and effects might change as it goes through different phases including construction, operation, and decommissioning. Environmental Impact Assessment (EIA) regulation 2006 does not apply to solar photovoltaic projects in India, and its requirements do not require environmental clearance for such projects (Gawande & Chaudhry, 2019).

## 5. Result and Discussion

17 Sustainable Development Goals (SDGs) must be accomplished by 2030. The objectives span a number of crucial areas, including energy access, gender equality, health, and education. The goals are lofty and receive various levels of support from governments. Sustainable clean energy for all is made possible in large part by solar energy. Environmental and sustainability issues must be taken into consideration when producing energy. Fossil fuels and gas have traditionally been used in the generation of energy. Even if these activities provide more energy, they also have an impact on the environment, which causes global warming. As a result, the quality of life in the locations where these activities take place may be poor (Ash, 2022).

The possibility of lowering carbon emissions spurs the economic growth of renewable energy. India must stop using energy derived from fossil fuels in order to control climate change. The findings show that economic development's CO<sub>2</sub> emissions are negatively impacted by economic growth. However, the future trend line is positively impacted by economic expansion, national carbon emissions are rising, and renewable energy consumption is declining. Energy is crucial to the global economy, and communities' socioeconomic resilience will be impacted by the shift to more sustainable energy sources.

### Elements of Sustainability of Solar Energy

- Abundant enough, more than capable of meeting the demand for electricity around the globe.
- Non-polluting, reliable, and clean source of energy
- Economically feasibility
- Environmentally friendly
- Use as Heating cooling and ventilation
- Non consumptive source
- Save energy and other resources

- Security and distribution
- Uses in agriculture and horticulture
- Beneficial for Architecture and urban planning
- Solar disinfection and distillation
- Solar lighting and Water heating

Despite the clear advantages, a number of things have kept renewable energy from becoming the norm. First, there is no comprehensive national policy or legal framework for renewable energy in India. Power markets have been constrained as a result of the majority of our financially troubled power distribution firms, which are also the major consumers of electricity, refraining from purchasing expensive power. RE is more impacted by these high prices than other conventional power sources or infrastructure. There are some specific disadvantages are:

- Existing rules and programmes for Solar promotion, which vary between governments, constrain strategic intent.
- Lack of willing and credit-worthy buyers of RE-based electricity
- In combination with other economic considerations, market risks have resulted in high interest rates, ranging from 10% to 14% annually.
- Non-payment by customers or operations-backing-down by grid operators.
- Unplanned and unfacilitated project development environment.
- Dilution
- Expensive source
- Location preference
- Insufficient and obsolete grid operations and infrastructure
- Solar energy is only usable throughout the day and is most effective when the sun is shining.

From the analysis of the data presented in this study it is found that there is an active role of Solar Energy usability in performance of particular SDG -7.

---

## 6. Need and Significance

More energy, less carbon dioxide might be summed up as the main dilemma facing the world today. Global security is seriously threatened by the twin issues of environmental contamination and the depletion of non-renewable energy sources. Energy and climate change are two important issues that have recently taken centre stage in discussions about the nature of economic growth and human welfare. The ecological threat posed by the climate change brought on by the emission of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases (GHGs) extends to all parts of the planet.

The need for mechanical energy for irrigation is among the most significant energy-related needs. Pump efficiency might be significantly increased by giving farmers and equipment manufacturers the right incentives, as well as by doing good extension work. Wind turbines and traditional internal combustion engines powered by biogas made from local biomass wastes can also be used to power irrigation pumps. Agriculture products can be preserved using solar dryers and solar coolers. It is important to encourage these unconventional sources, especially in places with few energy resources.

---

## 7. Conclusion

Solar renewable energy has a promising future in India, as it is increasingly used as a substitute for conventional energy sources and aids in the social and economic advancement of the nation. The adoption of solar energy still faces a number of obstacles, but we can work to reduce these obstacles so that society's perspective on turning green can change. Information technology will play a significant part in this (Patil & Memon, 2022). The cost of a good or service is heavily influenced by energy, and sustainable development offers blooming economic potential since it creates greater opportunities and provides environmentally conscious 'green consumers' with sensible and sustainable products.

### 7.1 Recommendation

According to the International Energy Agency, policies should be created to enhance market efficiency, remove all barriers, provide predictable and transparent mechanisms to maintain investor confidence, and provide incentives that fluctuate over time depending on the maturity of the renewable energy source under consideration. The creation and maintenance of a national solar policy is a difficult task.

To overcome the barriers of Solar Energy development

1. Encouraging consumer-friendly government legislation.
2. Increasing customer awareness.
3. Offering a solution for issues with large-scale installation including land availability, long-range transmission, and other things.



4. Provide energy security literacy to all and Government-sponsored educational initiatives have raised the calibre of ongoing research into renewable energy sources (Tiwari & Chourasiya, 2022).
5. Solar renewable energy employment prospects in India.
6. Using creative marketing techniques are all important.
7. Conduct in-depth study on the strategies used by various nations to establish markets for solar energy.
8. Rooftop generation is a promising area for solar energy plans and programmes that may push the limits of solar energy capacity while also advancing India's transition to a green energy economy.

In order to address climate change issues, solar energy technologies are being encouraged. This is the best solution to the long-standing sustainability issue. However, a number of socio-economic, technological, and environmental obstacles continue to prevent widespread use of solar energy. India is a formidable rival for the top spot in the global energy industry because of its tropical environment, sizable market, alluring government incentives, and wealth of institutions for education and research. This research found the positive role and huge impact of use of Solar Energy on sustainable development of an economy.

### **Acknowledgement**

Here, I thank the entire environment that helped me to conduct this research by developing a systematic presentation of the knowledge using a combined analysis of online and offline sources for people and materials. I want to firstly express my deep gratitude to my supervisor, Prof. Manish Sharma, for his continuous contribution in helping me to complete my study work with perseverance, motivation and enthusiasm. I would also like to express my sincere appreciation and debt of thanks to my parents, relatives, and friends for their constant help and encouragement.

### **ORCID**

Rupali Chourasiya <https://orcid.org/0000-0003-3087-4879>

### **References**

1. Aktamis, H. (March 2011). Determining energy saving behavior and energy awareness of secondary school students according to socio-demographic characteristics. *Educational Research and Reviews* Vol. 6(3), 243-250.
2. Ash, A. (2022). Role of Solar Energy in achieving SDGs. Retrieved from Dynamic SLR: <https://www.dynamicslr.com/role-of-solar-energy-in-achieving-sdgs/>
3. Ayyoub, S. A., & Radaydeh, N. M. (April 2021). The Knowledge of People About the Use of Renewable Energy and Environmental Awareness in Their Area, Irbid Governorate as a Case Study. *International Journal of Sustainable Development and Planning*, 365-371.
4. B, S. A., Priya, V., V., Kavitha, S., & Gayathri, R. (2020). Awareness on Renewable Energy among General Population- A Survey. *European Journal of Molecular & Clinical Medicine*, 2824-2841.
5. Balaji, A. (2021). *Climate Change: A review of the Rural Electrification Policies and Barriers to adopting Renewable Energy in Rural India*. The Peninsula Foundation.
6. Balzan Alzate, D., López Sánchez, J., Blessent, D., Raymond, J., Dezayes, C., Portela, J. P., . . . Borgne, T. L. (2021). An online survey to explore the awareness and acceptance of geothermal energy among an educated segment of the population in five European and American countries. *Geotherm Energy*, 21.
7. Buragohain, T. (August 2012). Impact of Solar Energy in Rural Development in India . *International Journal of Environmental Science and Development*, Vol. 3, No. 4., 334-338.
8. Climate Policy Info Hub. (2022, May). Social Acceptance of Renewable Energy. Retrieved from Climate Policy Info Hub Scientific Knowledge for Decision-Makers: <https://climatepolicyinfohub.eu/social-acceptance-renewable-energy>
9. Department of Sustainable Development of the General Secretariat of the Organization of American States with the expert advice of IT Power Group. (March 2013). *Sustainable Energy Action Plan*. Antigua & Barbuda: Department of Sustainable Development, American States.
10. Deshmukh, V. V., & Rajput, P. (2016). Implementation of renewable energy (solar) for rural development. *Journal of Chemical and Pharmaceutical Research*, 130-135.
11. Ellabban, O., Abu-Rub, H., & Blaabjerg, F. (November 2014). Renewable energy resources: Current status, future prospects and their enabling technology. *Renewable and Sustainable Energy Reviews*, 748-764.
12. Ganesan, K., Jain, A., & Urpelainen, J. (2017, January). Rural electrification in India needs an upgrade. Retrieved from Qrius: <https://qrius.com/rural-electrification-india-needs-upgrade/>
13. Gawande, A., & Chaudhry, P. (2019). Environmental and Social impacts of Solar Energy: A View Point with reference to India. *Jharkhand*

Journal of Development and Management Studies.

14. Gill, B., Gupta, A., & Palit, D. (2019). Rural Electrification impact on Distribution Companies in India. The Energy and Resources Institute.
15. Girouard, N., & Elianna Konialis, C. T. (2011). OECD Green Growth Studies.
16. Government of Canada. (2022, May). About Renewable Energy. Retrieved from Government of Canada: <https://www.nrcan.gc.ca/our-natural-resources/energy-sources-distribution/renewable-energy/about-renewable-energy/7295>
17. Green Growth Knowledge Partnership. (2022, May). Overview. Retrieved from Green Growth Knowledge Partnership: <https://www.greengrowthknowledge.org/about-us>
18. India Brand Equity Foundation. (2022). Indian Renewable Energy Industry Analysis. Retrieved from Renewable Energy Industry Report: <https://www.ibef.org/industry/renewable-energy-presentation>
19. Indian Institute of Forest Management . (2017). Assessment of Energy Status & Opportunities for the Use of Renewable Energy in Forest Villages of Madhya Pradesh: Enabling a Paradigm Shift in Carbon Balance. Bhopal Madhya Pradesh: Madhya Pradesh Climate Change Knowledge Portal. Retrieved from <http://www.climatechange.mp.gov.in/en/knowledge-bank/skmccc-knowledge-resources/project-report-assessment-energy-status-opportunities-use>
20. Johns Hopkins School of Advanced International Studies. (2021, July). Renewable Energy vs Sustainable Energy: What's the Difference? Retrieved from Johns Hopkins School of Advanced International Studies: <https://energy.sais.jhu.edu/articles/renewable-energy-vs-sustainable-energy/>
21. Joshi, G. D., & Yenneti, K. (2020). Community solar energy initiatives in India: A pathway for addressing energy poverty and sustainability? Energy and Buildings.
22. Katekar V.P., D. S. (2020). Assessment and Way Forward for Bangladesh on SDG-7: Affordable and Clean Energy. International Energy Journal, 421-438.
23. Khambalkar, V. P., Katkhede, S. S., Dahatonde, S., Korpe, N. D., & Nage, S. M. (July 2010). Renewable energy: An assessment on public awareness . International Journal of Ambient Energy, 133-142.
24. Kumar, M. (2020). Social, Economic, and Environmental Impacts of Renewable Energy Resources. In K. E. Okedu, Wind Solar Hybrid Renewable Energy System. IntechOpen.
25. Kunnath, S. (2019). An Analysis Of The Impact Of Renewable Energy On Organization Performance And Sustainability. Jain University.
26. Lu, Y., Khan, Z. A., Alvarez-Alvarado, M. S., Zhang, Y., Huang, Z., & Imran, M. (June 2020). A Critical Review of Sustainable Energy Policies for the Promotion of Renewable Energy Sources. Sustainability, 02-30.
27. Madhya Pradesh Urja Vikas Nigam Limited. (2021, November 21). M.P Urja Saksharta Abhiyan (USHA). Retrieved from Department of New and Renewable Energy: <http://usha.mp.gov.in/mission-objective>
28. Majid, K. J. (2020). Renewable energy for sustainable development in India: current status, future prospects, challenges, employment, and investment opportunities. Energy, Sustainability and Society.
29. Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. Cogent Social Sciences, 1-21.
30. Ministry of new and renewable energy. (2022). PM-KUSUM (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan) Scheme. Retrieved from Government of India: <https://www.india.gov.in/spotlight/pm-kusum-pradhan-mantri-kisan-urja-suraksha-evam-utthaan-mahabhiyan-scheme#:~:text=PM-KUSUM%20%28Pradhan%20Mantri%20Kisan%20Urja%20Suraksha%20evam%20Utthaan,as%20part%20of%20Intended%20Nationally%20Determined%20Contribut>
31. Mishra, S. (2016). Renewable Energy Awareness and Education in India. Current Sustainable Renewable Energy Report, 72-79.
32. MNRE. (2022). SOLAR ENERGY. Retrieved from MNRE: <https://mnre.gov.in/solar/current-status/>
33. MNRE. (2022). Solar Energy . Retrieved from <https://mnre.gov.in/solar/current-status/>
34. Morgil, I., Secken, N., Yucel, A. S., Oskay, O. O., Yavuz, S., & Ural, E. (January 2006). Developing A Renewable Energy Awareness Scale For Pre-service Chemistry Teachers . Turkish Online Journal of Distance Education.
35. Munene, M. B., Odongo, J. O., & Nyambane, A. (July 2019). Energy Efficiency in Kenya: Public Awareness, Strategies, Challenges and Opportunities. Rabat - Morocco: Heinrich-Böll-Stiftung.
36. Nhalur, S., Josey, A., & Mandal, M. (November 2018). From 'Connections for All' to 'Power for All' Rural Electrification in India. Economic and Political Weekly (EPW).
37. NITI Aayog . (2021). NITI Aayog Releases SDG India Index and Dashboard 2020-21. Retrieved from NITI Aayog :

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1723952>

38. Niti Aayog & Rocky Mountain Institute. (2020). Towards a clean energy economy Post-COVID-19 Opportunities for India's Energy and mobility sectors. Green Stimulus and Recovery Series.
39. Owusu, P. A., & Asumadu-Sarkodie, S. (2016). A review of renewable energy sources, sustainability issues and climate change mitigation. *Cogent Engineering*, 1-14.
40. Patil, S., & Memon, S. (2022). Solar Renewable Energy for Sustainable Development in India: Current Status, Future Prospects, Challenges, Employment. *International Journal of Advanced Research in Science, Communication and Technology (IJAR SCT)*.
41. Samar, E. K., & Sharma, D. D. (2016, May). Renewable Energy for Rural India. *Dream 2047*, pp. 27-29.
42. Sood, G. (2021). Effectiveness of Solar Energy Policy Framework in India Towards Sustainable Growth. Symbiosis International University.
43. Staggs, C. J. (2019, May). Rural Electrification in India: Problems, Progress, and The Power of Citizen's Media. Retrieved from merican Indian Foundation: <https://aif.org/rural-electrification-in-india-problems-progress-and-the-power-of-citizens-media/>
44. Sudan, P. (2019). Non conventional energy and sustainable development in kanyakumari district. Manonmaniam Sundaranar University.
45. Tiwari, A., & Chourasiya, R. (2022). UShA for Rural Development : ACritical Analysis. *International Journal of Research and Analytical Reviews*, 392-407.
46. Trading Economics. (2022, May 06). India-Rural Population. Retrieved from Trading Economics: [https://tradingeconomics.com/india/rural-population-percent-of-total-population-wb-data.html#:~:text=Rural%20population%20\(%25%20of%20total,compiled%20from%20officially%20recognized%20sources.](https://tradingeconomics.com/india/rural-population-percent-of-total-population-wb-data.html#:~:text=Rural%20population%20(%25%20of%20total,compiled%20from%20officially%20recognized%20sources.)
47. UNFCCC. (2022, Octobar). What is a Kyoto Protocol? Retrieved from UNFCCC Process: [https://unfccc.int/kyoto\\_protocol#:~:text=In%20short%2C%20the%20Kyoto%20Protocol,accordance%20with%20agreed%20individual%20targets.](https://unfccc.int/kyoto_protocol#:~:text=In%20short%2C%20the%20Kyoto%20Protocol,accordance%20with%20agreed%20individual%20targets.)
48. United Nations Environment Programme. (2022). Goal 7: Affordable and clean energy. Retrieved from United Nations Environment Programme: <https://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-7>
49. United Nations Environment Programme. (2022, May). Renewable Energy. Retrieved from United Nations Environment Programme: <https://www.unep.org/explore-topics/energy/what-we-do/renewable-energy>
50. World Bank organization. (2020, July). Energy. Retrieved from The World Bank: <https://www.worldbank.org/en/topic/energy/overview#1>
51. World Commission on Environment and Development. (1987). Report of the World Commission on Environment and Development: Our Common Future. Oslo: World Commission on Environment and Development. Retrieved from Report of the World Commission on Environment and: <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>
52. World Economic Forum. (2022). These will be the world's most populous countries by 2030. Retrieved from World Economic Forum: <https://www.weforum.org/agenda/2022/08/world-population-countries-india-china-2030/>
53. Zakaria, S. U., Basri, S., Kamarudin, S. K., & Majid, N. A. (2018). Public Awareness Analysis on Renewable Energy in Malaysia. *International Conference on Sustainable Energy and Green Technology 2018*. IOP Publishing.
54. Zyadin, A. (December 2015). Prospects for renewable energy education (REE) inelevating youth energy and environmental awareness in Jordan. Joensuu: Finnish Society of Forest Sciences.