



## Empowering sustainable development goal 7 for energy resources and India's G20 presidency

Sonali Sardar<sup>1</sup>, Priyajit Ray<sup>2</sup>

<sup>1</sup> UGC-JRF, Research Scholar, Department of Commerce, University of Calcutta, Kolkata, West Bengal, India

<sup>2</sup> Assistant Professor, Department of Commerce, Raja Peary Mohan College, Uttarpara, Hooghly, West Bengal, India

### Abstract

In 2021, the Government of India disclosed that the capacity of renewable energy has been increased by 250% from the year 2014 to 2021, and its targeted renewable energy is valued at 900GW, which mainly comes from various renewable energy sources, including solar ranks (750GW), Wind energy (102 GW), Bioenergy (25Gw), and small hydro (25GW). India ranks fifth position in the world on installed renewable energy capacity. Sustainable development is being implemented by properly utilising sustainable energy resources and also by assuring the availability of affordable, reliable, sustainable, and modern energy for society. The Sustainable Development Goals (SDGs) are mainly associated with extensive lists of goals and targets that discusses the social, economic and environmental parameters to boost our society. Energy resources can play a significant role in achieving sustainable development goals in India. Therefore, this paper primarily investigates the performance of the U.N. Sustainable Development Goal 7, along with a discussion on the trend of production capacity of clean fuels, electricity and renewable energy resources. This study also discusses the significance of India's G20 presidency working group meeting about energy resources. The paper finds India's performance in meeting Goal 7 of SDG targets is entirely satisfactory and on the other hand, producing clean fuels, electricity, and energy are also occasionally remarkable. India has implemented various agendas and policies to meet those targets and boost these sectors overtime during the G20 summit. To the best of the author's knowledge, the paper is the first to assess the performance of SDG 7 in light of India's presidency. The study might enrich the existing literature and provide direction for further research.

**Keywords:** Goal 7 of SDGs, India's G20 presidency, Renewable energy, sustainable development

### Introduction

In 2021, the Government of India disclosed that the capacity of renewable energy has been increased by 250% from 2014 to 2021, and targeted renewable energy is valued at 900GW, which mainly comes from various renewable energy sources, including solar energy(750GW), Wind energy (102 GW), Bioenergy (25Gw), and small hydro (25GW). India ensures the fifth position in the world concerning installed renewable energy capacity. Due to increased economic growth from various sectors, such as genuine estate and transport, electricity consumption is estimated to increase by 15,280TWh in 2040 from 4926 TWh in 2012. In 2020, India achieved fourth, fifth, and fourth ranks in wind, solar and renewable power, respectively. In 2023, India has a 532.42GW installed capacity of renewable energy sources, including biomass, waste to energy, and waste to power. India has only achieved the pre-estimated target of the Paris Agreement out of all G20 countries. And India has been on track to achieve the best One Earth, One Family, and One Future through its scientific and innovative and strategies (Garg et al. 2023) <sup>[3]</sup>.

Seventeen sustainable development goals (SDGs) and 169 targets are associated with sustainable development under the 2030 agenda. The SDGs are mainly related to extensive lists of goals and targets that discuss social, economic, and environmental parameters to boost society. The focus of sustainable development goals and G20 has shifted from financial crises to a more comprehensive environmental and socioeconomic agenda (Roy, 2024) <sup>[10]</sup>. Nowadays, people are very much required to have easy Access to sustainable energy in their daily activities; goal 7 of SDG mainly elaborates on the importance of sustainable and reliable to all the goals sustainable development. Sustainable

development goals try to stop profit shifting, base erosion, and competitive devaluation (Yoganandham 2023) <sup>[12]</sup>. The goal primarily focused on ensuring technologies on cooking and access to clean fuels, boosting efficiency on energy, enhancing the proper utilization of renewable energy sources, as well as promoting modern and sustainable energy use. Renewable energy resources involve hydro energy, wind power, solar energy, and other renewable energy that is reliable and clean for society. The role of technology is also crucial in facilitating transformation and promoting inclusivity in relation to digital public infrastructure and sustainability (Kumar, 2024) <sup>[6]</sup>.

The targets incorporated as a part of the Goal 7 of the SDGs 2030 Agenda are as follows: -

1. By 2030, assure universal availability of affordable, reliable and sustainable energy services.
2. By 2030, enhance the share of renewable energy in the global energy mix.
3. By 2030, the global rate of development in energy efficiency will be enhanced.

This paper also discusses the performance of some critical targets of goal 7 of SDG, including Access to clean fuels and technologies for cooking, Access to electricity in rural and urban areas, the Energy intensity level of primary energy, and Renewable Energy Consumption. In India, the performance of SDG7 has been entirely satisfactory over time. India's government always tries to achieve all the targets formulated under sustainable development goals to develop society, designed many policies, conducted various meetings and took critical initiatives to implement the targeted plan under SDG 7. The G20 Energy Transition

Working Group Meeting and some vital initiatives are in India. Recently, India's G20 presidency have been conducted in Goa from 19 to 20 July 2023 under the fourth energy transitions working group meeting to identify and perform best practices policies and take innovative approaches which mainly promote and support an inclusive energy transition. The aim is to build a cooperative pathway for fulfilling sustainable and rational growth while indicating the challenges efficiently incorporated with energy transition.

### Literature Review

Elavarasan et al. (2020) <sup>[2]</sup> pointed out that Tamil Nadu, Gujarat and Karnataka are the states that quickly adopted renewable energy generation in India, while globally, countries like America, China, Germany and Sweden are leading by rapidly increasing their renewable energy capacity while fixing deadlines and framing policies to achieve its target and goals. As per the study, each state has framed its renewable energy policies based on its physical and geological landscapes to promote suitable renewable energy around the globe.

Dey et al. (2022) <sup>[1]</sup> identified that the strategy for renewable energy for sustainable development is one of the critical parameters for growth, and such energy benefits health and the environment. As per the study, renewable energy sources will be approximately 49% of the total electricity by the year 2040 such that more than 66% of the solar energy cost will be cut. Furthermore, renewable sources of energy have the opportunity to develop our country by providing employment generation in the backward areas. In contrast, the Indian Government wants to develop a 'green city' with renewable energy within every state of the country.

Gautam (2022) <sup>[4]</sup> suggested that India should utilize the G20 summit to raise discussions on issues like India-China border tensions, the war in Ukraine, promoting peace and cooperation worldwide, and deteriorating US-China relations. The researcher also suggested that the Indian policy makers should popularize an inclusive approach with the help of human-centric and pragmatic solutions at the G20 summit, and, therefore, contribution and influence to different global affairs in the recent era is essential through the G20 forum.

Katoch et al. (2022) <sup>[5]</sup> asked to formulate various energy regulations that target the deprived sections of the society. The study also pointed out that solar energy services and small hydro plant strategies for rural areas are a great way to help marginalized communities access clean, affordable energy services at all times. The study also pointed out that the SDG 7 can be achieved by effectively delivering reforms and planning through affordable and clean energy.

Pandey and Shukla (2023) <sup>[9]</sup> said that the G20 platform is essential in the modern era that provides new avenues for our economy. The research study focused on G20, which promotes sustainable and inclusive growth that provides access to technological advancements, which also strengthens the global trade. As studied, the Indian objective for G20 is to promote solar energy for a sustainable future of the Indian economy.

Singh (2023) <sup>[11]</sup> highlighted that the G20 structure consists of mainly three significant aspects, i.e. the Sherpa Track, which is concentrated on socioeconomic like education,

agriculture, employment, trade and tourism; the Finance Track, which deals with monetary and fiscal issues like global economy, and financial inclusion; initiatives that focused on women empowerment, research, and space industry.

### Research Gap

Based on the above extensive review of literature, it has been found by the researchers that there is a lack of a concrete study in the concerned area for gaining in-depth knowledge regarding the empowerment of Sustainable Development Goal 7 for Energy Resources and also related to India's G20 Presidency. Considering this as a vital area of study, especially in the current scenario, and also the current research having a considerable socioeconomic significance for the economy and beyond, the researchers choose to continue the study to fulfil the research gap through the defined research objectives by conducting analytical and explorative research work.

### Research Question

1. How do various energy resources in India align with Sustainable Development Goal 7 (SDG7)?
2. What are the trends in the production of different energy resources in India?
3. What initiatives and policy agendas has India proposed or implemented during its G20 presidency to facilitate the transition towards sustainable energy resources, and what are the anticipated impacts on India's energy sector and progress towards SDG 7?

### Research Objectives

1. To analyse the performance of energy resources in India as per Sustainable Development Goal (SDG)
2. To analyse the production trend of energy resources in India.
3. To discuss the agenda of India's G20 presidency to amplify the transition of energy resources in India.

### Research Methodology

Secondary data was used for the study. The data has been collected from various sources, including website of the World Bank, the Ministry of Petroleum & Natural Gas & Central Electricity Authority, G20 India, and the International Renewable Energy Agency (IRENA) journal. For the current research work, the researchers have collected specified data from the World Bank database from the year 2015 to 2016, and furthermore, data was collected from the Ministry of Petroleum & Natural Gas & Central Electricity Authority from the year 2013-2014 to 2020-2021. The study period for the data, which is collected from the IRENA database, is from the year 2013 to 2022. Based on the data collected from various sources, analysis has been done for the current study such that its objectives can be fulfilled. Conclusion has also been drawn by the researchers based on the findings of the research work which can be beneficial for the future researchers adding strength to the existing literatures.

### Analysis of the Study

Based on the objectives and importance of the study, analysis has been conducted by researchers.

**Objectives: 1****Table 1:** Performance of Affordable and clean Energy (SDGs :7) in India

SDGs :7 Indicators	2015	2016	2017	2018	2019	2020
Access to clean fuels and technologies for cooking (% of population)	48.2	51.4	55.8	59.8	63.9	67.9
Access to electricity (% of population)	88.0	89.2	92.1	95.7	97.3	99.0
Access to electricity, rural (% of rural population)	83.4	84.8	88.8	93.9	96.0	98.5
Access to electricity, Urban ((% of urban population)	97.5	98.2	98.8	99.1	99.7	100
Energy intensity level of primary energy (MJ/2017 PPP GDP)	4.8	4.5	4.5	4.4	4.3	-
Renewable Energy Consumption (% of total final energy Consumption)	33.4	33.0	32.4	32.8	32.9	-

Source: World Bank

The data presented in Table 1 illustrates the advancements made by India in attaining Sustainable Development Goal 7 (SDG 7), which pertains to the provision of affordable and clean energy. The time frame considered for this analysis spans six years, commencing in 2015 and concluding in 2020. The Sustainable Development Goal (SDG) seeks to ensure universal Access to affordable, reliable, sustainable, and modern energy while encouraging the adoption of clean energy sources and enhancing energy efficiency. India's advancements in these domains are evaluated through diverse metrics, encompassing the availability of clean cooking fuels and technologies, Access to electricity, rural electrification, and urban electricity accessibility. The nation has experienced consistent advancements in these domains, characterized by an increase in the adoption of clean

cooking methods and the expansion of electricity access in rural areas. India has witnessed an improvement in its energy intensity level of primary energy, which signifies an enhancement in energy efficiency. The nation's dedication to renewable energy sources is apparent, as a substantial proportion of its overall energy consumption is derived from renewable sources. In general, Table 1 underscores the notable advancements made by India in attaining Sustainable Development Goal 7, as well as its dedication to sustainable and environmentally friendly energy alternatives.

**Objective 2: The production trend of energy resources in India****Table 2:** The Production Trend of Energy Resources in India

Year	Production of Clean fuels			Production of Electricity
	LPG (in Million Tonnes)	Natural Gas (In petajoules)	Biogas (MW)	Electricity (In petajoules)
2013-2014	10.03	1363.87	7	844.54
2014-2015	9.84	1296.48	9	860.07
2015-2016	10.57	1242.24	11	808.46
2016-2017	11.33	1228.66	12	870.63
2017-2018	12.38	1257.65	14	958.71
2018-2019	12.79	1266.28	14	1078.07
2019-2020	12.82	1201.22	14	1226.08
2020-2021	12.07	1104.47	14	1226.07

Source: Ministry of Petroleum & Natural Gas & Central Electricity Authority

Table 2 presents a comprehensive overview of the production trends of energy resources in India, spanning the period from 2013-2014 to 2020-2021. This initiative's primary focus is producing clean fuels, specifically liquefied petroleum gas (LPG), natural gas, and electricity. The production of liquefied petroleum gas (LPG) exhibited stability, whereas a slight decline was observed in natural gas production. The electricity production in India witnessed a notable rise, escalating from 844.54 petajoules from 2013 to 2014 to 1226.07 petajoules in 2020-2021. This upward trend signifies the endeavours undertaken to address

the surging electricity requirements and enhance the overall quality of life. The production of biogas has exhibited a steady upward trend, with a notable rise from 7 MW during the period of 2013-2014 to 14 MW in 2020-2021, thereby exemplifying India's steadfast dedication to the adoption of environmentally sustainable energy alternatives. The trends above play a pivotal role in ensuring India's energy security, fostering economic growth, and promoting sustainable energy alternatives, aligning with domestic and global obligations.

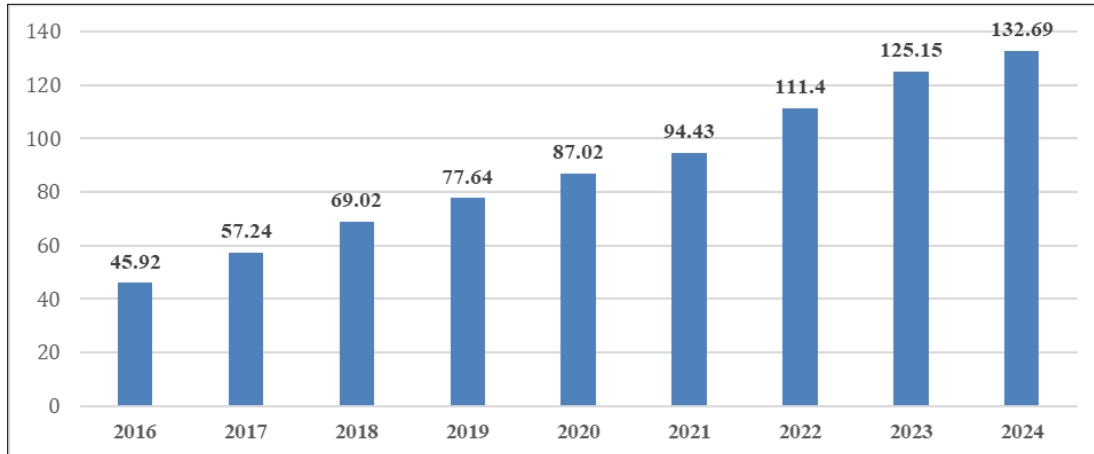
**Table 3:** Production Capacity of Renewable Energy

Year	Hydro Power (MW)	Wind Energy (GWH)	Solar Energy (MW)	Bio Energy (GWH)	Solid Biofuels and Renewable waste (MW)	Other Solid Biofuels (MW)
2013	44174	24640	1603	4182	4175	4070
2014	45406	27235	3776	5032	5023	4899
2015	47104	31873	5697	5480	5469	5332
2016	47622	36273	9982	8897	8885	8746
2017	49521	47670	18257	9418	9405	9258
2018	50102	55009	27485	10138	10124	9965
2019	50279	62689	35250	10226	10212	10046
2020	50763	63522	39432	10533	10518	10331
2021	51566	62272	49731	10592	10578	10361
2022	52005	-	63193	10670	10656	10395

Source: www.irena.org

Table 3 presents a comprehensive overview of India's renewable energy production capacity spanning 2013 to 2022. The table explicitly highlights the production capacity of various renewable energy sources, including hydropower, wind energy, solar energy, Bioenergy, solid biofuels, and other solid biofuels. The hydroelectric power capacity of the nation has exhibited a consistent growth trajectory, increasing from 44,174 MW in 2013 to 52,005 MW in 2022. Wind energy production has experienced notable growth, from 24,640 GWH in 2013 to 62,272 GWH in 2021. This upward trend suggests considerable investments in wind farms and advancements in related technologies. Solar energy capacity has experienced significant growth,

exhibiting an exponential increase from 1,603 MW in 2013 to 49,731 MW in 2021. The production of Bioenergy has exhibited fluctuations, albeit with an overall upward trend, rising from 4,182 GWH in 2013 to 10,670 GWH in 2022. Solid biofuels and renewable waste capacity have experienced notable growth, rising from 4,175 MW in 2013 to 10,656 MW in 2022. This upward trend can be attributed to India's emphasis on waste-to-energy initiatives and effectively utilizing solid biofuels. The consistent growth in renewable energy capacity indicates India's advancement towards a more environmentally friendly and sustainable energy framework.

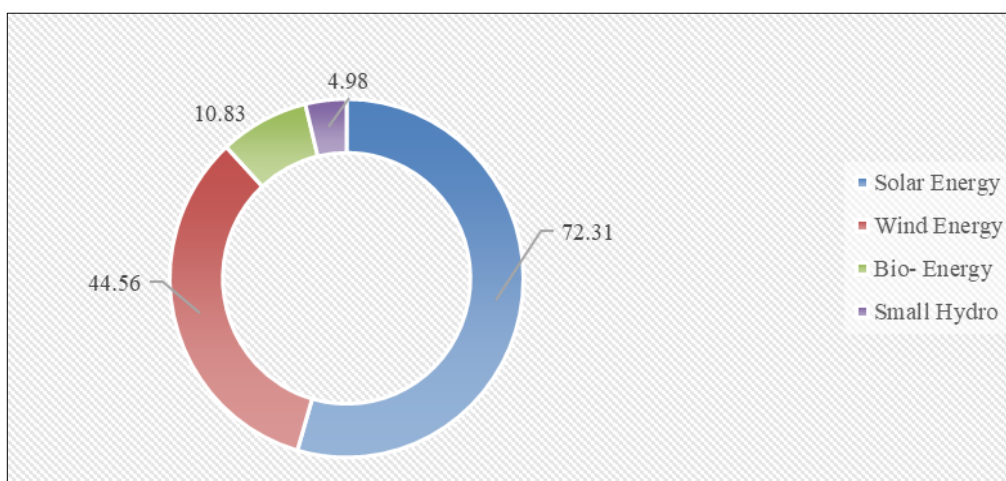


Source: Central Electricity Authority (CEA), International Renewable Energy Agency (IRENA), MNRE

Fig 1: Installed Renewable Energy Capacity (GW)

Figure 1 elucidates an essential outline of the installed capacity of renewable energy in India spanning from 2016 to 2024. The trend above comprehensively elaborates on India's significant growth in renewable energy production capacity from 2016 to 2024. India's installed renewable energy capacity has manifested a radical upliftment, from 45.92 GW in 2016 to 125.15 GW in 2023. This upward trend exhibits a substantial increase in renewable energy

production capacity in India compared to non-renewable energy during the study period from 2016 to 2023. In 2024, India's targeted installed renewable energy capacity is valued at 132.69 GW, and the country also plans to raise 450 GW of installed renewable energy capacity by 2023. So, India has been adopting several initiatives to elevate the country's sustainable development.



Source: Central Electricity Authority (CEA), International Renewable Energy Agency (IRENA), MNRE

Fig 2: Installed Renewable Capacity breakup (GW) In 2023

Based on the above figure it can be clearly observed that 72.31 GW of Solar energy has been used for the year 2023 alone whereas 44.56 GW of installed renewable capacity was from Wind energy. 10.83 GW of Bio energy has been

used for the year 2023 out of the total installed renewable capacity and Small Hydro contributed the least with 4.98 GW of renewable energy out of all sources of renewable energy for the year 2023.

So, from the figure it can concluded that the performance level of solar energy is quite satisfactory and is used largely in India compared to other sources of renewable energy to reduce the environmental hazards of our country.

**Objectives 3:** To discuss the agenda of India’s G20 presidency to amplify the transition of energy resources in India

**Table 4:** India’s G20 presidency amplify the transition of energy resources in India

Six significant dimensions for the Energy Transitions	<ol style="list-style-type: none"> <li>1. Identifying technology Gap for Energy Transitions</li> <li>2. Reasonable Financing for Energy Transitions</li> <li>3. Energy Security and divergence in supply chains.</li> <li>4. Adequate consumption, and industrial low-carbon transitions, Energy efficiency,</li> <li>5. The opportunity to gain access of Fuels.</li> <li>6. Universal availability of affordable and clean energy.</li> </ol>
Additional agendas	<ol style="list-style-type: none"> <li>1. Elaborating policies to enhance E-mobility,</li> <li>2. Developing Solar energy for fulfilling SDG 7 goals</li> <li>3. Enhancing knowledge and solutions with the help of accumulation in energy efficiency.</li> </ol>
Various remarkable side events	<ol style="list-style-type: none"> <li>1. Industry decarbonisation,</li> <li>2. Focus on the storage of battery</li> <li>3. Availability of energy</li> <li>4. Focus on green hydrogen</li> <li>5. Sustainable cooling</li> <li>6. Clean energy marine hubs</li> <li>7. Energy Expansion and introducing the innovative approach for Energy transition.</li> </ol>
Place of meeting, discussions and deliberations	Goa, Bengaluru, Gandhinagar, Mumbai

Table 4 presents a comprehensive analysis of India's strategy for enhancing the transition of energy resources throughout its tenure as the G20 presidency. The document delineates six critical focus areas for energy transitions, supplementary agendas and a range of noteworthy ancillary events, thereby highlighting India's dedication to tackling significant energy-related issues at national and international levels.

The G20 presidency of India emphasizes various significant domains of energy transitions. These encompass the bridging of technological disparities, the assurance of affordable financing, the promotion of energy efficiency, the encouragement of sustainable consumption, the exploration of cleaner fuel alternatives, and the facilitation of universal Access to clean energy. The nation's objective is to decrease emissions from the transportation sector while promoting the widespread adoption of electric vehicles. Additionally, it endeavours to foster solar energy utilization to attain Sustainable Development Goal 7. Moreover, its objective is to enhance understanding and propose resolutions by consolidating energy efficiency efforts. India has successfully coordinated various supplementary activities to address multiple energy-related subjects, encompassing industry decarbonization, battery storage, energy accessibility, green hydrogen, sustainable cooling, clean energy marine hubs, and fulfilling innovation requirements for energy transition. India's dedication to engaging various regions in deliberations regarding energy transition and capitalizing on its abundant cultural and economic diversity is apparent through its selection of prominent cities for convening meetings and discussions. Adopting a multifaceted approach towards energy transitions exemplifies India's commitment to assuming a leadership role in the global energy transition agenda.

**Conclusion**

It is essential to properly utilize green or renewable energy to overcome sensitive issues, including environmental solutions, health issues and carbon emissions. India has announced various schemes and policies to boost this sector and fulfil future energy demand. India is also working on achieving the effective target of SDG7, which mainly highlights clean fuel for cooking purposes, electricity accessibility, energy intensity and renewable energy. This paper analyses India's performance in fulfilling the specified target in SDG7. It also measured the capacity to produce clean fuels, access electricity in rural and urban areas, and the energy intensity level of primary and renewable energy consumption, mainly focusing on Goal 7 of SDG. This paper also elaborates on the importance of the G20 summit regarding energy transition and agendas in India. The paper concluded that India's performance in meeting Goal 7 of SDG targets is entirely satisfactory. On the other hand, producing clean fuels, electricity, and energy is also occasionally remarkable. India has implemented various agendas and policies to meet those targets and boost these sectors overtime during the G20 summit.

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