

Sustainable Development Goal 7 in India: Evaluating Progress in Affordable and Clean Energy Access

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Abstract

This article analyses India's progress toward Sustainable Development Goal 7, focusing on affordable and clean energy access. India has achieved near-universal household electrification, a significant milestone driven by initiatives like the SAUBHAGYA scheme. Substantial advancements are also observed in clean cooking fuel access, with the national average for LPG & PNG connections at 91%, contributing to an overall SDG 7 Index Score of 96. The study details various government schemes supporting this energy transition, including those for renewable energy deployment, energy efficiency, and electric mobility. Despite these successes, persistent regional disparities in clean cooking fuel access and ongoing energy poverty are observed. It emphasizes the need for further research to understand how policies can ensure truly equitable, qualitative, and reliable energy access for all diverse populations in India, moving beyond basic connectivity. The analysis primarily relies on secondary data from official government reports, such as the NITI Aayog SDG India Index Report 2023-24.

Keywords: SDG 7 India, energy access, renewable energy, regional disparities

1. Introduction

Access to affordable, reliable, sustainable, and modern energy is widely acknowledged by the international community as a fundamental prerequisite for fostering socio-economic development and effectively mitigating climate change. This principle is formally enshrined within Sustainable Development Goal (SDG) 7 of the United Nations' 2030 Agenda for Sustainable Development (NITI Aayog, 2021). SDG 7 aims to ensure universal access to energy services, substantially increase the share of renewable energy in the global energy mix, and double the rate of improvement in energy efficiency by 2030 (NITI Aayog, 2024). For a rapidly developing nation like India, with its vast population and growing energy demands, achieving these targets is not merely an international obligation but a critical imperative for inclusive growth and environmental sustainability (Srikantaswamy & Rangappa, 2024).

India stands at a pivotal juncture in its energy transition, aiming to balance its developmental aspirations with its commitment to a greener future. India has achieved notable progress in broadening energy access, evidenced by the near-universal electrification of households and enhanced availability of clean cooking fuels, particularly through expanded Liquefied Petroleum Gas (LPG) and Piped Natural Gas (PNG) connections (Pelz et al., 2020). Furthermore, India has demonstrated remarkable progress in enhancing its clean energy capacity, reaching 40% of electric installed capacity from non-fossil fuel sources well ahead of

its 2030 target and experiencing a substantial increase in solar power capacity (NITI Aayog, 2024). These efforts reflect a strong policy push towards renewable energy deployment and energy efficiency (Xu et al., 2024).

Despite these achievements, the journey towards fully realizing SDG 7 is fraught with challenges. India faces the complex task of meeting an ever-growing energy demand while reducing its reliance on fossil fuels, which currently contribute to rising CO₂ emissions and present energy security concerns (Bhandari et al., 2025). Ensuring 24x7 reliable power for all, addressing regional disparities in energy access and quality, and tackling energy poverty, particularly in rural and marginalized communities, remain critical areas of focus (Aditya et al., 2023; Ray, 2021; Yawale et al., 2023). The transition also necessitates substantial financial investment, technological innovation, and robust policy frameworks that balance stability with flexibility to adapt to evolving conditions (Abhyankar et al., 2023; Anjanappa, 2025).

This research undertakes a comprehensive analysis of India's progress toward achieving SDG-7. It explores the key initiatives and policy measures adopted by the government, assesses the current status of affordable and clean energy access across the nation, and evaluates the socio-economic and environmental impacts of these initiatives. By examining both the successes and the challenges, this study aims to offer a comprehensive understanding of India's pathway to a sustainable energy future.

2. Literature Review

2.1 Studies on SDG 7 in the American Continent

In North America, countries like the US, Canada, and Mexico are continuously developing renewable energy infrastructure, leading to some market integration (Azarpour et al., 2022). However, they are facing significant hurdles, including unsustainable consumption patterns, climate change impacts, and a continued reliance on fossil fuels. For example, the US faces issues with unsustainable agricultural systems and insufficient financial contributions to international development cooperation related to these goals (Sálvia et al., 2018). Limiting fossil fuel use, diversifying energy matrices, decentralizing energy generation, maximizing energy efficiency, minimizing generation costs etc. are the main challenges for achieving SDG 7 in these countries (Lup et al., 2023).

South American and Latin American countries exhibit leadership in renewable energy, historically driven by hydroelectric power, though there is a growing shift towards non-conventional sources such as solar, biomass, and wind (Borja-Patiño et al., 2023). Nations across South America are actively developing solar photovoltaic and concentrated solar power facilities, with some aiming for carbon neutrality by 2050 (Cacciuttolo et al., 2024). Despite these efforts, many countries, such as Ecuador and Mexico, still show dependence on oil and natural gas and need to intensify their transition efforts (Barragán-Ocaña et al., 2025). Literature also points to difficulties in governing for sustainable regional development and expresses apprehension that the "energy transition" concept is sometimes misused, focusing on extensive renewable energy expansion rather than achieving an equitable transformation of energy systems (Balanzó et al., 2020; Lázaro et al., 2025).

2.2 Studies on SDG 7 in European Union (EU) Countries

The EU monitors progress using indicators such as primary and final energy consumption, energy productivity, share of renewable energy, and energy import dependency. Countries like Finland, Denmark, Bulgaria, Portugal, and Sweden have demonstrated notable success in SDG 7 implementation (Verma & Kandpal, 2021). The EU successfully met its 2020 target of 20% renewable energy in total consumption, although targets for final and primary energy consumption were missed (Gontkovičová & Spišáková, 2023).

Despite these achievements, challenges remain. Highly developed states often face issues of excessive energy consumption (Fura & Skrzypek, 2025). Energy poverty is a significant concern, affecting over 50 million households in the EU, a problem whose definition and scale differ from those in developing countries (Tundys et al., 2021). Policy uncertainties and rising CO₂ emissions are also observed in some nations, like France, despite an increased share of renewable energy solutions (Xue et al., 2021). The concept of sustainable development, including access to stable, sustainable, and modern energy at affordable prices, is a fundamental objective enshrined in EU policy (Tutak et al., 2021).

2.3 Studies on Sustainable Development Goal 7 in India

Recent research concerning SDG 7 in India reveals the nation's considerable advancements alongside the ongoing complexities in securing universal availability of economical, dependable, environmentally sound, and contemporary energy resources. Dey et al. (2022); Joseph & Balachandra (2021) discuss India's ongoing energy transition, emphasizing the increasing role of renewable sources like solar and wind in its energy mix. Abhyankar et al. (2023) suggests pathways for India to achieve near-complete energy independence by 2047 through aggressive deployment of clean technologies. Mahato (2025) points out that India's progress, while substantial, must overcome significant hurdles, including grid integration challenges for renewables and ensuring equitable access across diverse socio-economic strata.

Yawale et al. (2023) point out energy poverty and regional disparities, particularly in rural and marginalized communities, where the quality and reliability of electricity supply need improvement, despite near-universal access. Shahbaz et al. (2020) emphasize the necessity for comprehensive policy frameworks that integrate climate action, energy consumption, and economic growth patterns to ensure a truly sustainable and equitable energy future for India.

3. Research Gap

In spite of noted success towards SDG-7 globally, there exists scattered energy poverty and significant regional disparities in energy access and quality. Therefore, further research is needed to understand how current policies and initiatives are addressing these deeper issues, moving beyond basic connectivity to ensure a truly equitable and sustainable energy transition for all of India's diverse populations. This will provide a detailed assessment of India's "Progress in Affordable and Clean Energy Access."

4. Research Objectives

The objectives of this study are:

- i. To assess the current state of quality, reliability, and equity in affordable and clean energy access across diverse regions of India.
- ii. To examine the effectiveness and adaptability of policy frameworks and governance mechanisms in promoting sustainable and equitable energy transitions in India.

5. Research Methodology

A descriptive and analytical research design has been used in this study. The research primarily relies on secondary data, drawing information from authoritative sources like publications from NITI Aayog along with other pertinent ministries involved in promoting sustainable and clean energy.

Data related to indicators and performance metrics directly relevant to SDG 7 across India's states and union territories has been collected. To analyse this data, qualitative content analysis has been utilized. This approach helps in the extraction and synthesis of critical information regarding Government schemes, existing policy frameworks, and reported outcomes related to clean energy access and sustainability.

6. Results and Discussion

6.1 SDG-7 Target

Table 1 shows India's 2030 targets for SDG 7. These include achieving 100% household electrification and ensuring 100% access to LPG and PNG connections.

S. No.	Indicators	Target
1	Percentage of households electrified	100
2	Percentage of LPG and PNG connections against number of households	100

Source: NITI Aayog SDG Report 2023-24

6.2 Raw data on performance of States & UTs

Table 2 highlights raw data on progress of various states and UTs towards SDG 7 as per NITI Aayog SDG Report 2023-24.

S. No.	States/UTs	Percentage of households electrified	Percentage of LPG & PNG connections against number of households
1	Andhra Pradesh	100	103.56
2	Arunachal Pradesh	100	78.82

3	Assam	100	108.17
4	Bihar	100	84.32
5	Chhattisgarh	100	89.21
6	Goa	100	141.92
7	Gujarat	100	98.29
8	Haryana	100	132.36
9	Himachal Pradesh	100	114.17
10	Jharkhand	100	74.97
11	Karnataka	100	116.39
12	Kerala	100	100.18
13	Madhya Pradesh	100	91.73
14	Maharashtra	100	116.84
15	Manipur	100	90.12
16	Meghalaya	100	68.61
17	Mizoram	100	114.03
18	Nagaland	100	58.6
19	Odisha	100	86.43
20	Punjab	100	142.6
21	Rajasthan	100	114.74
22	Sikkim	100	86.24
23	Tamil Nadu	100	102.94
24	Telangana	100	118.49
25	Tripura	100	78.37
26	Uttar Pradesh	100	107.37
27	Uttarakhand	100	119.94

28	West Bengal	100	107.78
29	Andaman and Nicobar Islands	100	136.84
30	Chandigarh	100	115.37
31	Dadra and Nagar Haveli and Daman and Diu	100	59.98
32	Delhi	100	147.05
33	Jammu and Kashmir	100	122.28
34	Ladakh	100	154.37
35	Lakshadweep	100	85.74
36	Puducherry	100	105.06
	India	100	96.35
	Target	100	100

Source: NITI Aayog SDG Report 2023-24

India has achieved 100% household electrification across all States and Union Territories, a significant milestone aligning with its goal for universal energy access.

However, the picture for clean cooking fuel access shows disparities. While the national average stands at 96.35%, just short of the 100% target, performance varies greatly. UTs like Ladakh (154.37%) and Delhi (147.05%) have exceeded the target, demonstrating robust penetration. Conversely, states such as Nagaland (58.6%) and Meghalaya (68.61%) significantly lag behind, underscoring persistent regional disparities in energy access and quality. This gap indicates that while connections are expanding, ensuring equitable and sustained access to clean cooking fuels, particularly in rural and marginalized communities, remains a crucial challenge for India's complete SDG 7 achievement.

6.3 Index score on performance of States & UTs

Table 3 shows index score of progress of various states and UTs towards SDG 7 as per NITI Aayog SDG Report 2023-24.

S. No.	States/UTs	Score on households electrified	Score on LPG & PNG connections	SDG 7 Index Score

			against number of households	
1	Andhra Pradesh	100	100	100
2	Assam	100	100	100
3	Goa	100	100	100
4	Haryana	100	100	100
5	Himachal Pradesh	100	100	100
6	Karnataka	100	100	100
7	Kerala	100	100	100
8	Maharashtra	100	100	100
9	Mizoram	100	100	100
10	Punjab	100	100	100
11	Rajasthan	100	100	100
12	Tamil Nadu	100	100	100
13	Telangana	100	100	100
14	Uttar Pradesh	100	100	100
15	Uttarakhand	100	100	100
16	West Bengal	100	100	100
17	Gujarat	100	96	98
18	Madhya Pradesh	100	80	90
19	Manipur	100	76	88
20	Chhattisgarh	100	74	87
21	Odisha	100	67	84
22	Sikkim	100	67	83
23	Bihar	100	62	81
24	Arunachal Pradesh	100	49	74

25	Tripura	100	48	74
26	Jharkhand	100	40	70
27	Meghalaya	100	24	62
28	Nagaland	100	0	50
29	Andaman and Nicobar Islands	100	100	100
30	Chandigarh	100	100	100
31	Delhi	100	100	100
32	Jammu and Kashmir	100	100	100
33	Ladakh	100	100	100
34	Puducherry	100	100	100
35	Lakshadweep	100	66	83
36	Dadra and Nagar Haveli and Daman and Diu	100	3	52
	India	100	91	96
	Target	100	100	100
Source: NITI Aayog SDG Report 2023-24				

It can be seen that India has achieved 100% household electrification across all States and Union Territories, earning a perfect score in this indicator. This is a significant milestone for SDG 7.

However, the overall SDG 7 Index Score for India is 96, with the "Percentage of LPG & PNG connections" scoring 91. While many States and UTs, such as Andhra Pradesh, Goa, Haryana, and Delhi, achieved a perfect 100 across all indicators, substantial regional disparities persist.

Regions like Nagaland (0 score on LPG/PNG, overall- 50 SDG 7 Index) and Dadra and Nagar Haveli and Daman and Diu (3 score on LPG/PNG, overall- 52 SDG 7 Index) show significant shortfalls in clean cooking fuel access. This stark contrast highlights the "persistent energy poverty and significant regional disparities" underscoring the ongoing challenge for equitable energy transition in India.

6.4 Key Government Initiatives towards SDG-7

A brief overview of the government schemes which has enabled India to achieve overall score of 96 has been presented in Table 4.

Table 4: Key Programmes/Initiatives of Government of India	
S. No.	Name
1	“SAUBHAGYA scheme”
2	“PM Ujjwala Scheme”
3	“Unnat Jyoti by Affordable LED for All (UJALA)”
4	“PM-KUSUM Scheme”
5	“Green Energy Corridors (GEC)”
6	“Bio-Energy Programme”
7	“National Green Hydrogen Mission”
8	“Deen Dayal Upadhyaya Gram Jyoti Yojana”
9	“National Solar Mission”
10	“Faster Adoption and Manufacturing of Electric Vehicles (FAME) Scheme”
11	“PM Surya Ghar Muft Bijli Yojana”
12	“Electric Mobility Promotion Scheme (EMPS)”
13	“Rooftop Solar Programme”
Source: NITI Aayog SDG Report 2023-24	

The schemes are briefly summarised below:

- i. “SAUBHAGYA scheme”: Pradhan Mantri Sahaj Bijli Har Ghar Yojna – Saubhagya focuses on providing electricity connections to all households and ensuring last-mile connectivity in India. The persistent efforts under this scheme have led to the achievement of 100 percent household electrification across the country, aligning with SDG target 7.1 for universal access to affordable, reliable, and modern energy services (NITI Aayog, 2024).
- ii. “PM Ujjwala Scheme”: This scheme aims to enhance access to clean cooking fuels for deprived households. It supports the expansion of LPG and PNG connections across the nation, contributing to the goal of universal clean cooking fuel access.
- iii. “Unnat Jyoti by Affordable LED for All”: UJALA promotes energy efficiency by distributing low-cost LED bulbs. This initiative has significantly contributed to

- reducing carbon emissions, with India saving approximately 38.6 MtCO₂ by December 2020 by switching to LED bulbs, demonstrating its impact on sustainable energy practices (NITI Aayog, 2024).
- iv. “PM-KUSUM Scheme”: This program supports farmers by promoting the use of solar energy, primarily through the installation of solar pumps for irrigation and grid-connected solar power plants. It aims to reduce farmers' dependence on diesel and electricity, contributing to both energy security and sustainable agriculture.
 - v. “Green Energy Corridors”: The Green Energy Corridors initiative is an important initiative for integrating renewable energy into the national grid. It involves developing the necessary transmission infrastructure to transmit power from renewable energy-rich areas to demand centres, thereby facilitating a larger share of renewable energy in the overall energy mix.
 - vi. “Bio-Energy Programme”: This program focuses on utilizing various biomass resources to generate energy. It aims to harness India's vast biomass potential to meet energy demands, diversify the energy mix, and contribute to waste management and environmental sustainability.
 - vii. “National Green Hydrogen Mission”: This ambitious mission aims to position India as a global hub for Green Hydrogen production. It targets a significant production capacity, enhancing India's energy security, and supporting the transition to a sustainable energy economy.
 - viii. “Deen Dayal Upadhyaya Gram Jyoti Yojana”: This scheme has been instrumental in rural electrification, focusing on providing electricity access to rural households and improving the quality and reliability of power supply in rural areas.
 - ix. “National Solar Mission”: A cornerstone of India's renewable energy strategy, this mission has significantly boosted the country's solar power capacity. India's solar power capacity increased substantially in the past decade, contributing to the nation's goal of achieving 40% of its electric installed capacity from non-fossil fuel sources ahead of schedule (NITI Aayog, 2024).
 - x. “Faster Adoption and Manufacturing of Electric Vehicles Scheme”: The FAME scheme promotes the adoption of electric vehicles by offering fiscal incentives to buyers and supporting the development of charging infrastructure. Its goal is to accelerate the shift towards cleaner transportation and reduce fossil fuel dependency.
 - xi. “PM Surya Ghar Muft Bijli Yojana”: This scheme encourages the installation of rooftop solar panels on residential buildings. It aims to provide free electricity to households, promote decentralized solar power generation, and reduce household electricity bills, thereby fostering energy self-sufficiency.
 - xii. “Electric Mobility Promotion Scheme”: The EMPS focuses on accelerating the deployment and adoption of electric vehicles in India. It aims to create a supportive ecosystem for electric mobility through various promotional activities and incentives, contributing to cleaner air and reduced emissions.

- xiii. “Rooftop Solar Programme”: This program supports the installation of solar panels on the rooftops of residential, commercial, and industrial buildings. It promotes decentralized renewable energy generation, helping consumers become prosumers and contributing to India's climate change mitigation efforts.

7. Conclusion and Limitation

7.1 Conclusion

India has achieved remarkable progress in ensuring 100% household electrification across all its States and Union Territories, a significant milestone in fulfilling SDG 7. This achievement is largely attributable to strategic government initiatives such as the SAUBHAGYA scheme. Furthermore, India has made considerable strides in expanding clean cooking fuel access through schemes like PM Ujjwala, reaching a national average of 91% LPG & PNG connections and an overall SDG 7 Index Score of 96. These efforts, coupled with ambitious programs in renewable energy (e.g., National Solar Mission, PM-KUSUM) and energy efficiency, demonstrate a strong policy commitment to a sustainable energy future.

7.2 Limitation

Despite these successes, a critical limitation remains in addressing the persistent regional disparities and energy poverty within clean cooking fuel access. As highlighted in the research gap, this study acknowledges that further research is needed to move beyond basic connectivity and fully understand how policies are ensuring truly equitable, qualitative, and reliable energy access for all diverse populations in India. The document primarily relies on secondary data from official government reports, such as the NITI Aayog SDG India Index Report 2023-24. Despite its usefulness in assessing macro-scale development, this reliance on secondary data may limit a more in-depth qualitative understanding of the localized obstacles, behavioural dynamics, and socioeconomic factors that contribute to apparent discrepancies at the micro level.

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