

Balancing Growth And Sustainability: Energy Security In The Indian Context

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Abstract: Energy security for India is related to economic growth, environmental sustainability, and global leadership objectives. India is the third-largest energy consumer in the world. The nation is expected to meet its increasing energy demands. India must drastically cut down its reliance on imports of fossil fuels. For example, the nation depends on the import of crude oil and natural gas. This paper examines India's energy security from various perspectives, including its energy mix, programs, infrastructure bottlenecks, and engagements with other countries. The paper, using definitions provided by the International Energy Agency (IEA), emphasizes the short-term and long-term aspects of energy security relevant to India. The country's primary energy consumption is still dominated by coal and oil, which is detrimental to the environment and damaging to the economy. India's energy scenario is impacted by factors such as energy poverty, sub-optimal infrastructure, and exorbitant prices of global fuels. To tackle these problems, India has taken various flagship initiatives, including the National Energy Policy, Ujjwala Yojana, the FAME India Scheme, and the National Hydrogen Mission, as well as announcing ambitious climate targets, such as reaching 500 GW of non-fossil fuel capacity by 2030 and achieving net-zero emissions by 2070. The report emphasizes the importance of diversifying, producing domestically, innovating, building infrastructure, and engaging in international diplomacy to ensure a resilient and inclusive energy strategy. With the help of sound policies, strategic investment, and international cooperation, India can create a sustainable energy future to power its growth.

Keywords: Energy Diplomacy, Energy Security, FAME, Policy Framework, Renewable Energy

1. Introduction:

According to the International Energy Agency (IEA), energy security is the uninterrupted availability of energy sources at an affordable price. It consists of long-term security, which includes timely investments aligned with economic development and environmental sustainability, and short-term security, which focuses on the system's ability to respond to sudden supply-demand imbalances instantly (Kamboj et al., 2022). Energy security is an important pillar of national development in the Indian context. Involves guaranteeing a dependable, inexpensive, and eco-friendly supply of energy to meet the rapidly expanding demand of the country's population.

India is the world's third-largest energy consumer, with projected annual energy demand growth of more than 3% until 2040 (Canton, 2021). As India aspires to become a global economic power, the increasing energy demand is driven by the creation of capacity and infrastructure, the provision of basic services, industrialization, employment generation,

and human capital development. India's energy landscape is under considerable stress. Almost 80% of the country's crude oil needs are met through imports, mostly from the OPEC countries, which hold together more than 60% of the world's crude oil reserves. India's dependence causes it to suffer from the world's oil price fluctuations and the oil cartels' monopolistic practices (Cergibozan, 2022).

Moreover, regulatory uncertainty, non-transparent gas pricing mechanisms, and geopolitical conflicts among India's key energy partners strain its energy security. For example, the Indo-USA nuclear deal as well as oil imports from the Middle East are critical to India's diversification strategy. Still, tensions between countries like the USA and Iran have forced India to cut down imports from Iran. Additionally, the country is strategically vulnerable due to its location and energy politics in the region. The operational failure of transnational gas pipelines like the Iran-Pakistan-India (IPI) and Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipelines and China's strategic pre-emptive moves through its One

Belt One Road initiative pose big risks to the energy supply routes of India.

In view of these challenges, attaining energy security will not only be an affordable matter, but an economical matter. India's energy strategy must be diversified and resilient, balancing dependence on imports and domestic production, with specific attention to domestic renewable resources, and finding a way through complex geopolitical dynamics.

2. Defining Energy Security in the Indian Context:

Energy security is the term used to refer to the ability of a country to supply energy at a level that meets the population's requirements, while also being affordable and sustainable on both environmental and social grounds. In India, energy security has transcended traditional concerns regarding supply sufficiency to a larger development concern. In other words, Planning Commission energy security in India is not only about reducing supply disruptions or price fluctuations but also about ensuring that all citizens have fair access to modern energy services. This is especially important in a country in which millions still endure without even clean cooking fuel or constant electricity. Understanding energy as an important enabler of economic growth, social equity and poverty alleviation, Indian policy initiatives have focused on linking energy access with the national development agenda (Bhaskar, 2013).

India has adopted a multifaceted approach to energy security to address its complex energy challenges. The Draft National Energy Policy by NITI Aayog (2017) emphasizes five key pillars:

- Diversifying energy sources
- Reducing import dependence
- Expanding access to energy for all citizens
- Ensuring energy efficiency, and
- Promoting low-carbon and renewable energy options. (NITI Aayog, 2017)

This is very important considering that India imports a lot of fossil fuels and has committed to addressing climate change under the Paris Agreement. The Jawaharlal Nehru National Solar

Mission promoted solar energy. The Pradhan Mantri Ujjwala Yojana expanded the use of liquefied petroleum gas (LPG). The programs like PAT (Perform, Achieve and Trade) promote energy efficiency by industries. These strategies jointly indicate India's approach on energy security.

It is not only considered a supply side issue but also viewed as a development issue linked with inclusive growth and environmental sustainability.

3. India's Current Energy Scenario:

India consumes more fossil fuel than any other country. Coal and oil are the main energy sources followed by natural gas. Coal comprises close to 44% of overall energy use fueled mainly through electricity and the sectors of industry, while oil accounts for almost 25% rail, being the dominant use of transport and industry (Uzair Ali et al., 2022). Even though India has enough coal, it often doesn't produce enough coal to meet rising demand because of inefficient mining practices, lack of adequate transport infrastructure and delays in environmental and land clearances among others. As a result of this, the country continues to import coal which adds to the burden of energy imports. The environmental degradation caused by coal-based energy generation, including air pollution and carbon emissions, is generating a policy push.

India's energy security and economy face considerable risks due to its dependence on imported crude oil and natural gas. About 85% of crude oil and 50% of natural gas in the world is imported, mainly from geopolitically fragile regions such as the Middle East (BP, 2023). India imports a large part of its goods. India depends on foreign countries for important goods like edible oils, electronics, chemicals and medicines. Also, though gas is cleaner than coal and oil, the infrastructure for storage, distribution and consumption of gas – pipelines, LNG terminals etc. are still underdeveloped in many parts of the country. India needs to offset its growing reliance on a single source for cleaner energy with the development of indigenous technologies to avoid vulnerabilities raised by the crisis reports, say researchers (Uzair Ali et al., 2022).

Table 1: India's Primary Energy Mix (2023):

Energy Source	Share in Primary Energy (2023)	Remarks
Coal	44%	Heavy dependence contributes to pollution
Oil	25%	Mostly imported; price-sensitive
Natural Gas	6%	Cleaner fuel; underutilized
Renewable Energy	20% (including hydro)	Rapid growth in solar and wind
Nuclear	2%	Limited but stable

(Source: Ministry of Power, 2023; BP Energy Outlook, 2023)

4. Major Challenges to Energy Security in India:

Energy security in India poses a complex challenge.

- I. **Import Dependence:** India's increasing import dependence, especially in oil and gas, is a fiscal burden. This also exposes the economy to geopolitical risks (IEA, 2021). Due to this reliance on these routes, India is susceptible to damage to their supplies, disruption of trade, and sanctions.
- II. **Infrastructure Deficiencies:** The ailing system of Transmission Networks and low Energy Storage capacity do not facilitate energy distribution and efficiency (TERI, 2022). This creates high transmission losses, frequent blackouts, and poor capability to integrate renewables into the grid.
- III. **Environmental Degradation:** Coal-based power generation causes severe air pollution and contributes heavily to carbon emissions. India disproportionate dependence on coal adds to toxicity-induced sickness. It also impacts climate change and India's international commitments.
- IV. **Energy Poverty:** Although there has been advancement in energy access in recent years, some remote areas and the countryside still lack access to energy. Many homes have still not accessed clean cooking fuel or cannot draw on a dependable supply of electricity.
- V. **Price Volatility:** The global volatility of crude prices puts pressure on the energy budget. When oil prices shoot up, inflation rises, trade deficit enlarges, and the overall economy destabilizes, especially in a developing economy like India.

5. Key Government Initiatives:

To tackle these issues, the Government of India has introduced several schemes and policies.

- **National Energy Policy (2017):** The National Energy Policy of the year 2017 includes energy efficiency, resilience, and access. We would like to attain energy independence by the year 2040 through diversification, a clean energy transition, and building infrastructure designed for the future, according to NITI Aayog (2017).
- **Ujjwala Yojana:** Ujjwala Yojana provides poor women with LPG connections at a highly subsidized price. Health outcomes, especially for women, have improved due to the reduction in indoor air pollution that comes from the use of conventional cooking fuels (Sharma et al., 2021).
- **FAME India Scheme:** FAME India Scheme promotes higher use of electric vehicles to cut down oil consumption. The plan also backs the infrastructure for charging, battery technology as well as solutions related to clean mobility ((Mittal, Garg, & Pareek, 2024).
- **International Solar Alliance (ISA):** The ability to use solar energy to improve the level of social, economic or industrial processes is ascribed as international solar alliances. According to ISA in 2023, it plans to leverage more than \$1 trillion in solar investment by 2030 and capacity-building in the Global South (Kanwat, 2024).
- **Strategic Petroleum Reserves (SPR):** The Strategic Petroleum Reserves (SPR) located at the sites of Mangalore, Vizag and Padur – serve as buffer stock that can prevent disruptions in supply. Strategic Petroleum Reserves (SPRs) includes underground storage facilities for

crude oil that permit the government of India to hold.

- **Hydrogen Mission (2021):** Promotes green hydrogen as the fuel of the future. The objective looks to make India an international hub for hydrogen production and export to support decarbonization of hard-to-abate sector (Priya, 2021).

6. Renewable Energy and Climate Goals:

India has emerged as a global front-runner in renewable energy deployment, aligning its energy strategy with both climate change goals and energy security imperatives. As part of its commitments under the Paris Agreement and domestic energy policies, India has set ambitious renewable energy targets for 2030 and beyond. The following table provides a comparative view of these long-term goals against the progress achieved so far.

Table 2: India's Energy Transition: 2030 Targets and 2024 Status:

Energy Type / Goal	Target by 2030	Current Status (2024)
Total Non-Fossil Fuel Capacity	500 GW	~170 GW (combined RE and nuclear)
Renewable Share in Energy Mix	50% of total electricity demand	~25–28%
Net-Zero Emissions	By 2070	Roadmap in progress
Solar Energy	~280–300 GW (est. contribution to 500 GW)	70+ GW
Wind Energy	~140 GW (est. contribution to 500 GW)	40 GW
Hydropower	Included in non-fossil fuel targets	47 GW (including small hydro)
Biomass and Others	Not specifically quantified	10+ GW

These figures in above table reflect India's strong push toward decarbonization and its strategic focus on becoming energy self-reliant while fulfilling its global climate commitments. India's renewable energy transition is progressing steadily, but significant scale-up is still needed to meet the 2030 targets. While solar energy remains the fastest-growing source with vast untapped potential, its continued expansion requires strong policy and investment support. Wind energy growth has been slower, hindered by land acquisition issues and regulatory bottlenecks. Hydropower remains stable and holds further potential, especially in the northern and northeastern regions. The success of India's net-zero ambition depends heavily on the development of green hydrogen, widespread adoption of electric vehicles (EVs), and deployment of carbon capture, utilization, and storage (CCUS) technologies. Additionally, biomass and other renewable sources play a vital role in rural electrification and effective waste management.

7. International Cooperation and Energy Diplomacy:

In recent years, India has bolstered energy diplomacy to secure energy supply chains while improving strategic autonomy. India has sought to expand its energy resource and technology access through diversified partnerships with major global players such as the USA, Russia, UAE, Central Asian countries, among others. Through their bilateral and multilateral engagements, countries not only avoid the over-dependence risk on a particular region but also promote the exchange of best practices, joint ventures and investment at upstream and downstream level of energy infrastructure.

India's status as an associate of the International Energy Agency (IEA) will enable it to engage with advanced economies on issues of global energy governance, energy transitions and emergency response.

Apart from their bilateral relationship India took part in multilateral forums like the BRICS Energy Cooperation Platform and G20 Energy Dialogues to make a case for affordable, clean and sustainable energy access for the Global South.

India is encouraging cross-border electricity trade through the proposed SAARC electricity grid at the regional level. Further, India is a forerunner in the effort called One Sun One World One Grid (OSOWOG). OSOWOG wants to connect solar power circuits in different countries to enable the transmission of energy anywhere and using anywhere. The diplomatic and regional initiatives, as well as grid projects, will help ensure energy security while establishing India as a key player in the global clean energy future.

8. Way Forward: Strengthening India's Energy Security:

India should follow a multi-pronged strategy for sustainable energy security.

- **Diversification-** India is looking to boost the renewable portion of its energy mix with greater use of solar and wind power, along with nuclear and green hydrogen. In the long run, it will lessen our dependence on fossil fuels.
- **Domestic Production-** Encouraging domestic exploration of oil and gas and biofuels and coal gasification can help our dependence on import cuts. That too strengthens energy self-sufficiency and economic resilience.
- **Efficiency Improvement-** Optimizing consumption through smart grids and energy-saving appliances helps improve energy efficiency. It also lowers costs and minimizes environmental impact.
- **Infrastructure Development-** To modernize India's electricity sector, investments in storage systems, power transmission and electric vehicle charging network is necessary. Power systems upgrades will support renewable integration and clean mobility.
- **Technology and Innovation-** Advanced battery tech, hydrogen storage and AI scaling up can change energy management. Sustainability gains impetus and competitiveness by innovation in India
- **Inclusive Access-** Access to reliable electricity and clean cooking solutions is a form of social equity. It also helps improve health, education and livelihoods
- **Policy Coherence-** The energy strategies of India should be harmonized with other

environmental and industrial policies for effective governance. Simpler rules and better teamwork will make things happen faster.

9. Conclusion:

India's growing economy needs energy. It also committed to climate change and also gearing up for geopolitics. India, the world's third largest energy consumer, needs dependable, affordable and sustainable energy for its growing industrial base, infrastructure projects and a rapidly urbanising population. Nonetheless, it involves dealing with a high import dependence, global price volatility of fuels and pollution too. A shift from fossil fuels to a wider energy mix that is also cleaner is not only important for reducing vulnerability to economic shocks, but it is also essential for asserting India's global leadership as a 'responsible' power aligned with the Paris Agreement and UN SDGs.

For long-term energy security, India must fasten the adoption of strategic interventions across several dimensions. Some of these include boosting domestic availability by going for oil and gas exploration as well as bio-CNG, ethanol and other alternative fuels; scaling of renewable energy capacity for attaining the 500 GW non fossil fuels target by 2030; investing in energy efficiency by way of smart grids and advanced appliances; and developing robust infrastructure with a focus on energy storage and EV charging networks. Battery technologies, AI-enabled energy systems, green hydrogen, carbon capture, and other technologies and innovations will matter. Another area that must be given equal priority is access to inclusive energy especially in rural and remote areas with expansion of clean cooking and decentralized solar systems.

Moreover, India's proactive engagement in energy diplomacy has been recognized at global level as the country collaborates with the U.S., Russia, UAE, and Central Asia. India's participation in the International Energy Agency and leadership in initiatives like the International Solar Alliance and OSOWOG will help secure energy resources. Through coherent governance frameworks aligning the domestic energy policies with broader environmental and industrial strategies, policy stability and implementation efficiency can be achieved. India can show the world that energy

security and sustainability can go hand in hand. And in finding a balance between its developmental imperatives and ecological security, it can emerge as a resilient and self-reliant energy future.

References:

1. Aayog, N. I. T. I. (2017). Draft national energy policy. NITI Aayog.
2. Bhaskar, B. (2013). Energy security and economic development in India: A holistic approach. The Energy and Resources Institute (TERI).
3. Canton, H. (2021). International Energy Agency—IEA. In The Europa Directory of International Organizations 2021 (pp. 684–686). Routledge.
4. Cergibozan, R. (2022). Renewable energy sources as a solution for energy security risk: Empirical evidence from OECD countries. *Renewable Energy*, 183, 617–626. <https://doi.org/10.1016/j.renene.2021.11.127>
5. International Energy Agency. (2021). India energy outlook 2021. <https://www.iea.org/reports/india-energy-outlook-2021>
6. Kanwat, Y. (2024). India's climate diplomacy: A soft power approach influencing South Africa's renewable energy policies through International Solar Alliance post-2017. SSRN. <https://doi.org/10.2139/ssrn.5128112>
7. Kamboj, P., Malyan, A., Kaur, H., Jain, H., & Chaturvedi, V. (2022). India transport energy outlook. Council on Energy, Environment and Water.
8. Mittal, G., Garg, A., & Pareek, K. (2024). A review of the technologies, challenges and policies implications of electric vehicles and their future development in India. *Energy Storage*, 6(1), e562. <https://doi.org/10.1002/est2.562>
9. NITI Aayog. (2017). Draft national energy policy. https://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf
10. Priya, L. (2021). India's National Hydrogen Mission and prospects for cooperation with GCC.
11. Sharma, S., Moerenhout, T., Aklin, M., & Bajaj, K. (2021). How to target LPG subsidies in India [Technical report]. International Institute for Sustainable Development (IISD).
12. Uzair Ali, M., Gong, Z., Ali, M. U., Asmi, F., & Muhammad, R. (2022). CO₂ emission, economic development, fossil fuel consumption and population density in India, Pakistan and Bangladesh: A panel investigation. *International Journal of Finance & Economics*, 27(1), 18–31. <https://doi.org/10.1002/ijfe.2167>