



India's Energy Security Challenges Amidst the West Asian Crisis and the Way Forward

Vikash Ranjan, Sushil Kumar and
Pranshu Priyadarshi Birthal



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Abstract: This paper assesses India's energy security challenges in the context of geopolitical disruptions in West Asia and changing global energy markets. It identifies significant risks associated with dependence on imported crude oil and natural gas, stressing the importance of strategic petroleum reserves and diversifying the supply. The expansion of renewable and nuclear energy is crucial, alongside addressing the emerging vulnerabilities associated with critical minerals and clean energy technologies. The analysis highlights macroeconomic impacts, including trade balance, inflation, fiscal pressures, and fertilizer costs. The paper strongly argues for an integrated energy security framework that prioritizes diversified sourcing, strategic reserves, rapid transition to domestic clean energy, reliable supply chain partnerships, and continuous improvements in energy efficiency.

Keywords: Energy Security; India; West Asia; Crude Oil; LNG; Renewable Energy; Strategic Petroleum Reserves; Critical Minerals

1. Introduction

The ongoing Russia-Ukraine conflict and the recent West Asian crisis have exposed vulnerabilities in global energy supply chains, raising concerns about the reliability, affordability, and sustainability of energy security. The immediate impact of these crises was a sharp rise in energy prices (Figure 1). For example, following the West Asian crisis in late February 2026, Brent crude oil prices rose from about US \$72 per barrel to a peak of US \$138 per barrel in April 2026,¹ Liquefied Natural Gas (LNG) prices rose from US \$9.84 per Metric Million British Thermal Unit (MMBTU) to US \$12.29 per MMBTU² in the same period, underscoring the exposure of energy-importing economies to geopolitical supply chain disruptions (EIA, 2026a).

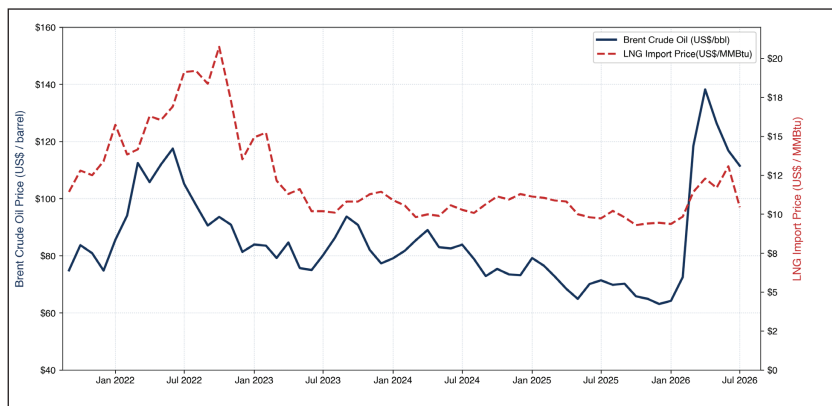
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**Figure 1: Brent crude oil and LNG import prices:
September 2021-July 2026**



Source: GoI, 2026a

For economies like India, which are heavily dependent on imported energy, the challenge is twofold: to secure reliable and affordable supplies of conventional fuels in the short and medium term while simultaneously building resilient domestic clean energy systems and value chains for the longer term (IEA, 2025). These challenges become more pronounced as India advances towards the goal of Viksit Bharat by 2047. Rapid economic growth, urbanization, industrialization, infrastructure expansion, rising household incomes, increasing mobility, and the growing electrification of transport and other end uses are expected to significantly increase the country's energy requirements. Energy security therefore requires a carefully managed transition: diversifying sources and routes for oil, gas, and other essential fuels; strengthening strategic reserves; accelerating domestic renewable and nuclear energy capacity; expanding transmission and energy storage infrastructure; and developing domestic capabilities in critical minerals and clean energy technologies.

Higher energy prices rapidly transmit across the economy through multiple channels, eroding household purchasing power, raising transportation and production costs, and intensifying inflationary and fiscal pressures. For an energy-importing countries such as India, an increase in international crude oil and natural gas prices directly raises

the import bill and increases the cost of fuel, electricity, freight, fertilizer, and other energy-intensive inputs. These higher input and logistics costs subsequently pass through manufacturing, agriculture, and services, and ultimately to consumer prices.

Geopolitical uncertainty can amplify energy price shocks through financial and foreign exchange markets. Increased global risk tends to increase exchange rate volatility, strengthen demand for the US dollar, widen sovereign and corporate borrowing spreads, and weaken capital flows to emerging economies. The depreciation of the rupee further increases the domestic currency cost of dollar-denominated crude oil, LNG, fertilizers, and other imported commodities, reinforcing interaction between energy prices and exchange rate pressures. At the same time, a larger energy import bill can widen trade and current-account deficits and increase demand for foreign exchange. When the government seeks to cushion households and producers from sharp price increases through tax adjustments, subsidies or other fiscal measures, the price shocks also extend to public finances.

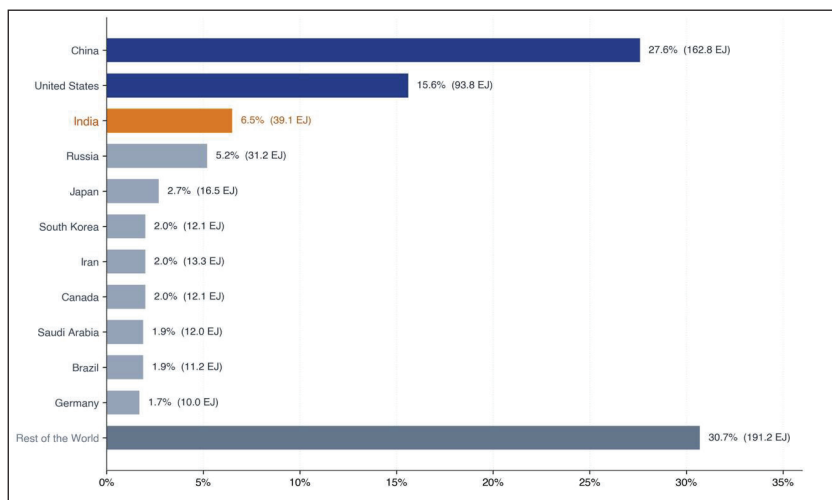
For India, energy security is therefore not merely a question of ensuring physical availability of fuels; it is an important component of macroeconomic stability and resilience to external shocks. This paper aims to explore India's energy security challenges in this backdrop, by identifying the growing needs, extent of disruptions, macroeconomic impact of these crises, challenges associated with renewable energy transition, and suggest the way forward.

2. India's Energy Imperatives

India's energy demand is expanding rapidly, reflecting the scale and pace of its economic and structural transformation. India is already the world's third-largest energy consumer, after China and the United States, accounting for approximately 7 per cent of global primary energy consumption (Figure 2). Yet, its per capita energy consumption remains considerably lower than that of developed countries, suggesting huge scope for further growth. According to the International Energy Agency (IEA), India is expected to be one of the largest contributors to the increase in global energy demand through 2035, making the country

increasingly important in shaping the future trajectory of global energy markets (IEA, 2025).

Figure 2: Share of global primary energy consumption, 2025 (%)



Source: Energy Institute, 2026.

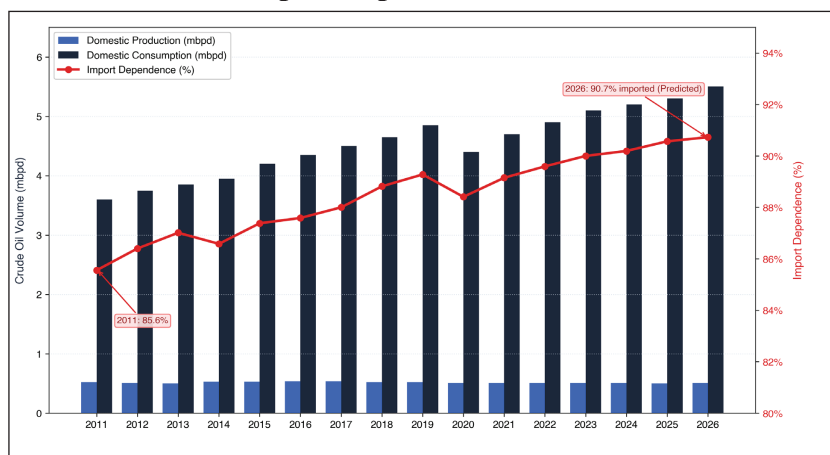
The composition of this additional energy demand is as important as its magnitude. India currently remains dependent on fossil fuels for more than three-fourths of its primary energy supply and is a net importer of major fossil fuels, while simultaneously developing one of the world's fastest-growing renewable-energy programmes. Meeting rapidly increasing demand predominantly through imported fossil fuels would increase exposure to international price volatility, geopolitical disruptions and maritime chokepoints, besides increasing the energy import bill. Conversely, meeting a progressively larger share of incremental demand through domestic renewable energy, nuclear power, and other low-carbon sources could simultaneously strengthen energy security and advance India's climate objectives. India's energy challenge is therefore not simply to produce and procure more energy, but to ensure that the rapidly expanding energy system becomes more diversified, affordable, reliable,

and resilient while progressively reducing its dependence on imported fuels (IEA, 2025).

2.1 Crude Oil

India is the world's third-largest oil consumer, after the United States and China, but domestic production meets only around 10-11 per cent of its requirements (Figure 3). Oil accounts for approximately one-quarter of the primary energy supply and is predominantly used in transport, leaving the economy highly exposed to international crude prices and supply disruptions (IEA, 2025).

Figure 3: India's crude oil production, consumption and import dependence, 2011–2026



Source: Energy Institute, 2026, and EIA, 2026d.

The Strait of Hormuz crisis has highlighted India's exposure to strategic maritime chokepoints. Before the crisis, about 45 per cent of India's crude oil imports transited through the Strait of Hormuz.³ The vulnerability was considerably greater for Liquefied Petroleum Gas (LPG): India imports around 60 per cent of its total LPG consumption,⁴ and about 90 per cent of these imports were routed through the Strait, implying that roughly 54 per cent of India's total LPG consumption was dependent on this single maritime passage. India is also dependent on imports for roughly

half of its natural gas requirements, and an estimated 55-60 per cent of LNG imports passed through the Strait before the disruption. Thus, a prolonged disruption of the Strait could simultaneously affect crude oil, cooking gas, and natural gas supplies, with implications for transport, households, industry, power generation, and fertilizer production. This demonstrates that India's energy vulnerability arises not only from high import dependence but also from the geographical concentration of these imports along a few critical maritime routes.

The crisis underscores that energy security depends not only on the diversification of suppliers but also on the diversification of transport routes and storage arrangements. India has already broadened its crude oil sourcing beyond the Gulf, with imports increasingly coming from Russia, the United States, Latin America, and Africa. However, supplier diversification alone cannot fully eliminate chokepoint risk when a significant proportion of imports continues to move through geographically concentrated maritime routes. Greater sourcing from producers outside the Gulf, stronger energy partnerships with countries whose export terminals lie beyond the Strait of Hormuz, and the development of alternative logistical and maritime arrangements can reduce concentration risk. To address this, India has systematically broadened its crude sourcing beyond the Gulf region. India now sources crude oil from more than 40 countries. The Gulf's share of India's crude basket has been declining steadily.

Russia is currently India's largest crude oil supplier, approximately two million barrels per day (mbpd). Russian crude gained prominence in India's import basket after Western sanctions following the start of 2022 Russia-Ukraine conflict. India continues to purchase Russian crude oil, primarily Urals, a medium-sour grade, by ensuring compliance through non-sanctioned sellers, vessels, insurance, and payment routes. While the United States and Europe have imposed sweeping sanctions on Russia, Russian oil itself has never been directly sanctioned, although the United States has more recently targeted specific entities such as Rosneft and Lukoil, as well as certain vessels and financial channels.

2.1.1 Effects of the Strait of Hormuz Crisis

In the wake of the Strait of Hormuz crisis, trade networks have been rerouted. For instance, India imported a record 2.25 mbpd of oil from Russia in March,⁵ increasing the country's share in total Indian imports to about 50 per cent. The United Arab Emirates (UAE) emerged as the second-largest crude supplier in May,⁶ followed by Venezuela, Saudi Arabia, and the United States. Indian refiners have increased their purchases of affordable heavy crude from South America. Additionally, the lifting of sanctions on Venezuela has enabled an increased flow of crude.

At the global level, Atlantic Basin crude oil exports heading to East of Suez markets increased by approximately 3.5 mbpd since February 2026 (IEA, 2026a), with notable gains from the United States, Brazil, Canada, and Venezuela. In tune with this, India has been diversifying its import basket from these countries. Nigeria, Angola, Guyana, and Mexico contribute to the further diversification of crude grades. New trade flows are progressively contributing to the reduction of regional supply imbalances, with the global crude deficit in the second and third quarters of 2026 estimated at approximately 4.5 million barrels per day (IEA, 2026a).

2.1.2 Strategic Petroleum Reserves (SPRs)

Strategic petroleum reserves provide an essential buffer between external supply disruptions and the domestic economy. This concept was pioneered by the US following the 1973 OPEC oil embargo, and the US currently holds approximately 413.3 million barrels in government stocks (EIA, 2026d), separate from its commercial inventory. China holds the world's largest SPR, at approximately 1.4 billion barrels (EIA, 2026b).

India entered the strategic petroleum reserve business relatively late. India's existing strategic petroleum reserves hold about 5.33 million metric tonnes (MMT) of crude oil, while commercial inventories maintained by oil companies provide an additional buffer. Expanding these reserves, together with geographically diversified storage facilities and stronger emergency-response arrangements, would provide greater

flexibility during prolonged disruptions. India's first SPR was approved in 2004 but did not become fully functional until 2019. India currently operates three SPR facilities: Visakhapatnam in Andhra Pradesh with 1.33 MMT capacity, Mangalore in Karnataka with 1.5 MMT capacity, and Padur in Karnataka with 2.5 MMT capacity. Public sector oil companies maintain additional commercial stocks equivalent to approximately 64.5 days of consumption, giving India a combined buffer of roughly 74 days of crude oil and fuel storage (GoI, 2026b).

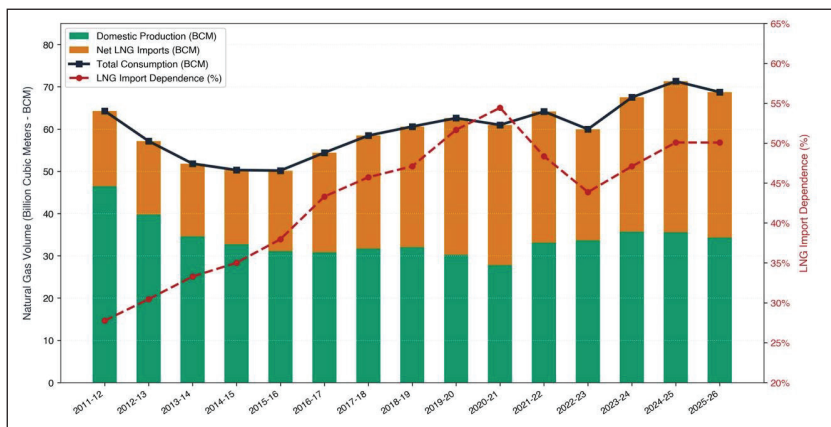
This coverage, while meaningful, falls short of the 90 days that the IEA recommends as a minimum buffer. India is actively expanding its SPR network. New facilities are under development at Chandikhol (4 MMT) in Odisha, and the Padur facility in Karnataka is being expanded (2.5 MMT), which will allow the site to hold 5 MMT of crude storage. Large salt caverns in Rajasthan are being considered potential storage sites.

In May 2026, the India Strategic Petroleum Reserve Limited (ISPRL) signed a landmark agreement with the Abu Dhabi National Oil Company (ADNOC). Under this agreement, the ADNOC will store up to 30 million barrels of crude oil in Indian facilities (GoI, 2026c). Additionally, both sides agreed to explore the storage of crude oil at Fujairah, UAE, as part of India's strategic reserve architecture, an innovative offshore reserve arrangement that diversifies storage geography and reduces vulnerability to domestic disruptions (GoI, 2026c).

2.2 LNG and LPG

India has emerged as one of the world's largest markets for LNG, ranking as the fourth-largest LNG importer globally, after China, Japan, and South Korea (EIA, 2025). Currently, imports meet 46-50% of India's natural gas requirements, reflecting the widening gap between domestic production and rapidly growing consumption, with India also ranking among the top three countries globally in natural gas demand growth. Demand is being driven by the expanding use of gas in fertilizers, city gas distribution, transport, refining, petrochemicals, and other industries.

Figure 4: India's natural gas production and consumption, 2011–2026, in Billion Cubic Metres (BCM)



Source: GoI, 2026n

India is deepening its LNG partnerships, particularly with the UAE. In May 2026, while ISPRL signed a contract with ADNOC; other Indian companies such as, Indian Oil Corporation Limited (IOCL), Gas Authority of India Limited (GAIL), and Hindustan Petroleum Corporation Limited (HPCL), also entered into long-term LNG supply contracts with ADNOC Gas, totalling 4.5 million metric tonnes per annum (MMTPA). This makes India the largest LNG buyer of ADNOC Gas. The UAE is also India's largest source of LPG, meeting nearly 40 per cent of India's LPG requirements. IOCL and ADNOC Gas have also signed agreements for long-term LPG supply.⁷

India can explore sourcing competitively priced American LNG. Despite higher global LNG prices due to reduced Hormuz flows, the spread between low US domestic prices and high international prices makes US LNG commercially attractive to Indian buyers. It is to be mentioned here that natural gas production in the US has remained high, with marketed output at approximately 121.8 billion cubic feet per day (EIA, 2026d). In addition, the building of new US LNG export capacity at Golden Pass LNG's Train 1 and Corpus Christi Stage 3 (EIA, 2026c) has created opportunities for India to source competitively priced American LNG.

2.3 Coal

Coal remains the largest component of India's energy system, contributing approximately 46 per cent of the primary energy supply (IEA, 2023) and nearly three-fourths of electricity generation (IEA, 2023). This makes India one of the ten least decarbonized electric power systems in the world. India is the second-largest coal consumer globally, behind China. Despite holding one of the world's largest coal reserves, estimated at 401 billion tonnes, plus 47 billion tonnes of lignite (GoI, 2026d), India remains a significant coal importer. India imports approximately 19 per cent of its coal requirements (GoI, 2026m), as 93.3 per cent of its domestic production consists of non-coking coal (GoI, 2025a), which is unsuitable for steelmaking and other industrial processes that require metallurgical-grade coking coal.

Coal-fired power plants in India are also inefficient, losing approximately two-thirds of their energy inputs as waste heat. Coal use is responsible for approximately 70 per cent of India's greenhouse gas emissions.

Recognizing both the economic importance and environmental impact of coal, the government approved a RS 375-billion (approx US\$ 3.95 billion) scheme to boost coal gasification (GoI, 2026d), converting domestic coal into synthetic gas for use in power generation, fertilizer production, and petrochemical applications. The initiative targets the gasification of approximately 75 MMTof coal annually, which is expected to attract around three trillion rupees in investment. State-run NTPC plans to produce 5-10 million tonnes per annum of synthetic gas over the next 3-4 years. By channelling domestic coal into cleaner uses and reducing dependence on imported LNG, urea, ammonia, and methanol, this programme represents a pragmatic bridge between India's fossil fuel inheritance and its long-term transition goals.

3. Macroeconomic Implications of Energy Insecurity

3.1 Trade Deficit and Currency Pressures

India's oil imports amounted to approximately US\$ 134.7 billion in 2025-26. India paid 14.7 per cent more in May 2026 for its crude imports compared to April 2026 and more than 22 per cent higher for LNG,

widening the trade deficit. A higher energy import bill increases the demand for foreign exchange, exerting downward pressure on the rupee and forex reserves at a time when capital inflows are already constrained by tighter global financial conditions.^{8,9,10,11}

3.2 Fiscal and Inflationary Pressures

Higher energy prices complicate India's fiscal consolidation efforts. India's fiscal deficit is currently estimated at around 4.6 per cent of GDP, reflecting mounting expenditure pressures and revenue uncertainties. Meanwhile, the country's debt-to-GDP ratio remains above 56 per cent, making any energy-induced fiscal slippage particularly relevant for long-term debt sustainability. The inflationary impact of higher energy costs is magnified by the substantial weight of fuel and power in the Wholesale Price Index (WPI), accounting for approximately 13.15 per cent of the basket (GoI, 2026i). Rising fuel prices feed through transportation, manufacturing, agriculture, and ultimately consumer prices, generating broad-based cost pressures across the economy. With year-on-year WPI inflation reportedly reaching 8.3 per cent in April 2026, policymakers face the difficult challenge of balancing inflation control with fiscal consolidation and growth objectives.^{12,13,14,15}

3.3 Food Security Linkages

Natural gas remains the principal feedstock for fertilizer production, and rising gas prices are increasing India's fertilizer subsidy burden, which is expected to reach twice the budgeted target of Rs1.71 lakh crore (About US\$ 17.9 billion) in 2026-27 due to the upside risk from gas price spikes (GoI, 2026h). The Strait of Hormuz handles more than a third of global urea exports, and disruptions there led to higher production costs, local transport costs, and retail food prices across Asia. Although global food supplies and stocks are relatively stable, the ongoing rise in fertilizer costs is affecting farmers' planting and input decisions, potentially leading to reduced crop yields in the upcoming harvest season. Farmers are confronted with a challenging decision: either apply less fertilizer and accept lower yields or incur higher costs and achieve lower earnings. Even slight reductions in fertilizer use can lead to substantial yield decrease.¹⁶

4. The Expanding Definition of Energy Security

The meaning of energy security has broadened over the past five decades. Historically, it has been synonymous with oil security, ensuring an uninterrupted fuel supply and protecting economies from price shocks. Today, energy security is at the intersection of geopolitics, trade, technology, climate policy, maritime security, critical minerals, industrial strategy, and economic resilience. Modern energy security is therefore not merely about access to fuel; it is increasingly about resilience, strategic capability, and trusted partnerships.

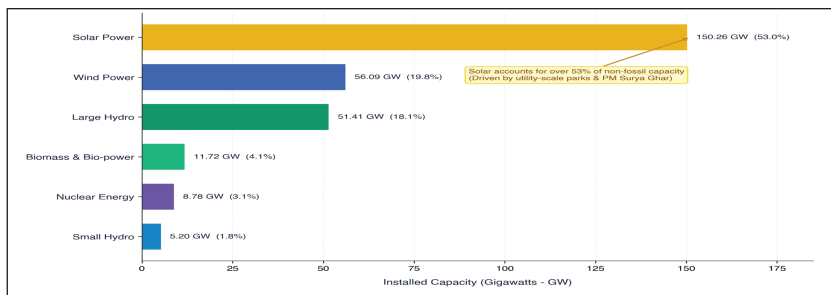
Global energy flows continue to depend heavily on strategic maritime corridors: the Strait of Hormuz, Bab-el-Mandeb, Suez Canal, and Strait of Malacca. Any disruption to these routes rapidly transmits across freight costs, insurance premiums, and global energy prices. Beyond physical supply risks, energy markets are increasingly shaped by economic sanctions, export controls, strategic embargoes, infrastructure attacks, and the use of energy as a direct instrument of geopolitical leverage. Oil and gas market stability is also strongly influenced by OPEC+ production decisions, West Asian geopolitics, and LNG expansion from Qatar and the United States.

In this backdrop, India is rapidly expanding domestic renewable energy as a longer-term strategy to reduce its exposure to imported fossil fuels and geopolitical disruptions.

5. India's Renewable Energy Transition

Alongside efforts to secure and diversify conventional energy supplies, by March 2026, India's installed renewable energy capacity, including large hydropower, had reached about 275 Gigawatt (GW), led by solar and wind. (GoI, 2026e).

Figure 5: India's installed non-fossil electricity capacity in GW by source: March 2026



Source: GoI, 2026o and GoI, n.d.

This represents an important structural shift in India's power system. The country has already crossed the 50 per cent non-fossil share in installed electricity capacity, while further expansion of solar, wind, hydro, nuclear power and storage will be critical to meeting rising electricity demand with lower import exposure. (GoI, 2026e).

5.1 Solar Energy

India possesses some of the world's largest solar energy resources, with most regions receiving between 4 and 7 kWh/m² of solar radiation per day (GoI, 2026j). As a result, solar power has become the country's largest source of installed renewable capacity and is expected to account for the largest share of future renewable energy capacity additions. Growth has been driven by the rapid expansion of utility-scale solar parks, rooftop solar installations, and agricultural solar projects. By March 2026, India's installed solar capacity had reached 150.26 GW (GoI, 2026j). Government initiatives such as the PM Surya Ghar Muft Bijli Yojana and the PM-KUSUM (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan) are flagship schemes by the government to promote solar energy.

India's technical potential for land-based utility-scale and distributed solar generation is estimated at around 748 GW (GoI, 2026j). In addition, given the country's extensive network of reservoirs and water bodies, floating solar has the potential to contribute about 102 GW of exploitable

solar capacity. A recent TERI study substantially revised India's solar potential upward to 10,830 GW-nearly 15 times the earlier government estimate of 748 GW. The estimate includes 4,909 GW from barren lands, 4,177 GW from agri-voltaics, 960 GW from rooftops, 100 GW from floating solar, and 684 GW from infrastructure such as railways and highways (Mazumdar & Malik, 2025).

5.2 Wind Energy

Wind energy remains the largest untapped renewable energy source in India. The installed wind power capacity reached approximately 56.09 GW by March 2026 (GoI, 2026e). Advances in turbine technology, particularly the deployment of taller turbines with higher hub heights, have significantly increased the estimates of India's exploitable wind resources. Earlier assessments at a 100-meter hub height estimated the onshore wind potential at approximately 302 GW. Updated evaluations based on 150-meter hub heights, more representative of modern wind turbine designs, have revised this estimate upward to approximately 1,163 GW (GoI, 2023).

India's most economically viable wind resources are concentrated in Gujarat, Tamil Nadu, Karnataka, Maharashtra, and Rajasthan. With technological advances, supportive policies, and expanding transmission infrastructure, their deployment is expected to accelerate.

5.3 Hydropower

Hydropower provides a flexible source of electricity that supports grid stability and balances fluctuations in solar and wind generation. The large hydropower capacity is 51.41 GW (GoI, 2026e), compared with an estimated technical potential of approximately 133 GW. The majority of the remaining untapped potential is concentrated in the Himalayan River basins, particularly in Arunachal Pradesh, Himachal Pradesh, and Uttarakhand.

Small hydropower installations account for approximately 5.2 GW of capacity against an estimated potential of about 22 GW (GoI, 2026l). Run-of-river and micro-hydro projects, especially in mountainous and remote regions, provide valuable opportunities for community-scale

electrification, energy access, and local resilience, while minimizing the environmental impacts associated with large reservoir-based projects.

5.4 Green Hydrogen

Green hydrogen occupies a distinct place in India's energy strategy, as its potential depends on renewable electricity, electrolyzer capacity, water availability and industrial demand. Although commercial deployment remains nascent, the National Green Hydrogen Mission targets 5 million tonnes of annual production by 2030, aiming to reduce dependence on grey hydrogen in fertilizers, refining, and other heavy industries.

5.5 Biofuels and Biogas

In India, the ethanol blending program is advancing, with a target of moving from the current E20 standard toward E30 and eventually higher blends. While several companies have demonstrated the commercial viability of flex-fuel vehicles capable of running on blends of up to 85-100 per cent ethanol, feedstock availability-from sugarcane, maize, and other sources-remains a constraint at the scale needed for mass adoption.¹⁷

Biogas from agricultural waste offers a complementary pathway with multiple co-benefits. It can be compressed into compressed biogas (CBG) for use as a clean transport fuel or blended with CNG to reduce the demand for natural gas. The fermentation process involved in biogas generation can simultaneously produce organic manure. India has huge bovine population producing approximately 1.27 billion tonnes of dung annually. If the entire dung is converted into bio-CNG, country's dependence on LNG imports becomes almost negligible, and for fertilisers reduced to half (Kumar and Birthal 2025). In a report on Economics of Electricity Generation Using Cattle Dung, the authors have found that it is profitable to utilize the cattle dung for electricity generation, the capital-output ratio being 2.2 and payback period being 4 years. Besides electricity generation the plant also provides bio-manure. It also checks water pollution and emission of green house gases (Chaudhary and Goyal, 2014). Recognizing this the government has strengthened GOBARdhan scheme, the National Circular Bioenergy Scheme, which will establish Compressed Biogas as a major pillar of

India's future energy mix. It will also attract private investment in commercial biogas production.

5.6 Nuclear Energy

Nuclear energy is India's most significant source of reliable, low-carbon, baseload power. India currently operates 24 nuclear reactors across seven sites, generating approximately 8.78 GW of power, with seven more under construction. The government targets 22.38 GW of nuclear capacity by 2031–32, about tripling the current installed capacity. (GoI, 2026k, GoI, n.d.)

Beyond near-term expansion, India is developing technology to utilize its abundant thorium resources. This has the potential to contribute immensely to India's energy security, given that India holds one of the world's largest thorium deposits.

The rise of small modular reactors (SMRs) offers further possibilities for the expansion of nuclear power. SMRs require less than one-tenth of a hectare of land, can be installed in remote or space-limited areas, and are designed for modular expansion without the cost and schedule overruns that have historically plagued large nuclear projects. At an estimated cost of approximately RS 4 (approx US\$0.042) per kWh (Kant, n.d.), SMRs can contribute to industrial process heat and be integrated with renewable energy systems to manage intermittency.

5.7 Challenges in the Renewable Energy Transition

With approximately 274.68 GW of installed renewable energy capacity at the end of March 2026 (GoI, 2026e), including large hydropower, India has harnessed less than 14 per cent of its estimated technical potential in solar, wind, and hydro resources, which together exceed 2,109 GW.¹⁸ This untapped capacity represents not only an underutilized natural resource but also a significant economic and strategic opportunity. Achieving the national target of 500 GW of non-fossil fuel capacity by 2030, alongside the ambition of the Green Hydrogen Mission, will require accelerated capital mobilization, greater policy certainty, and substantial investments in grid modernization.

The intermittent nature of solar and wind power remains a major technical and infrastructural challenge. Even in hybrid configurations,

solar photovoltaic and wind projects typically operate at capacity utilisation factors of 20-35 per cent, compared with more than 80 per cent for coal- and natural gas-based thermal power plants (CII & EY, 2024).

To sustain the annual addition of more than 50 GW of renewable energy capacity, which is needed to meet the rising electricity demand through clean energy, India must streamline land acquisition procedures, accelerate transmission infrastructure development, strengthen grid connectivity, and reduce project commissioning delays.

In parallel, energy storage deployment is essential to ensure grid reliability as the share of variable renewable energy increases. India is projected to require more than 60 GW of energy storage capacity by 2030, including approximately 42 GW from battery energy storage systems (BESS) (Bertagnini, 2026), to maintain grid stability and support the integration of renewable energy sources.

6. The Emerging Energy Security Framework

6.1 Critical Minerals and Technology Dependence

Minerals are essential for clean energy technologies, including solar panels, wind turbines, electric vehicle batteries, and electrolyzers, which rely on lithium, cobalt, nickel, copper, graphite, and rare earth elements. The global supply chains for these minerals are highly concentrated, with China leading the extraction, processing, and refining of most of them. India faces the risk of substituting its fossil fuel import dependence with a reliance on critical mineral imports, a situation it must strategically avoid.

The geopolitics of critical minerals resembles that of oil in several important ways. Supply concentration, the possibility of strategic embargoes, and the leverage that control of key resources confers. The Government of India is beginning to address this through Production Linked Incentive (PLI) schemes for the domestic manufacturing of solar panels, lithium-ion batteries, and electrolyzers, as well as through strategic mineral partnerships pursued through Quad and bilateral negotiations.

Domestically, India is also intensifying efforts to identify and develop critical mineral resources, including potential deposits in the

northeastern states, which are considered geologically prospective for several strategically important minerals. The Geological Survey of India has conducted 43 exploration projects between FY 2022-25 in the northeastern states (GoI, 2024) to explore critical minerals, such as vanadium, lithium, nickel, chromium, cobalt, rare earth elements, and other minerals. Accordingly, Arunachal Pradesh holds promising rare earth and cobalt deposits, Meghalaya has significant graphite and uranium reserves, Assam's sedimentary basins offer vanadium potential, and Nagaland and Manipur contain chromium and nickel-bearing geological formations¹⁹ (GoI, 2025a).

The development of these resources could have implications for both industrial policy and energy security. In the context of India's WTO disputes with China over clean energy manufacturing schemes, domestic critical mineral availability could dramatically strengthen India's "Make in India" ambitions by reducing its single greatest vulnerability—raw material import dependence, predominantly from China. A domestically anchored critical-mineral supply chain—from mineral extraction and processing in Northeast India to battery gigafactories and solar-module manufacturing—could strengthen the resource base of India's PLI schemes, reduce dependence on imported inputs, and support a more resilient and self-reliant clean-energy manufacturing ecosystem.

India is at the heart of the global clean energy transition. The Government of India is also pursuing energy and critical mineral partnerships through the India-Africa Forum, International Solar Alliance, and Global Biofuels Alliance. These initiatives give India a convening role in the broader global clean energy transition and an opportunity to shape international norms regarding green energy trade.

6.2 The Challenge of Green Protectionism

The global energy transition is increasingly shaped by industrial competition and climate-related trade measures, local-content rules, green standards, and clean-energy subsidies. Policies such as the US Inflation Reduction Act and the EU's Carbon Border Adjustment Mechanism (CBAM) risk disadvantaging developing economies. India must pursue decarbonization while safeguarding industrial competitiveness and

advocate for equitable global rules that prevent climate policy from becoming a form of protectionism.

China has recently filed two WTO complaints against India, targeting key government schemes, such as the PLI, for batteries, automobiles, EVs, and solar modules, all central pillars of India's 'Make in India' initiative. The WTO complaints contend that these schemes violate WTO rules because they incentivize domestic value addition, effectively favoring India-made components over Chinese imports. From India's perspective, these programs are framed as measures to build domestic capacity in highly concentrated clean-energy supply chains.²⁰

The future energy system will be shaped not only by who produces energy but also by who controls critical minerals, clean energy technologies, semiconductor ecosystems, battery manufacturing, hydrogen supply chains, and standard and certification regimes. Building indigenous clean energy supply chains through PLI schemes and vertical integration, from raw materials to end-use products, is therefore fundamental to both energy security.

7. Energy Diplomacy and Strategic Partnerships

India's energy security strategy has evolved beyond transactional procurement. It increasingly reflects comprehensive geopolitical engagement designed to build resilient and diversified energy ecosystems across fossil fuels, clean energy, critical minerals, and maritime connectivity.

7.1 UAE: A Comprehensive Energy Partnership

The UAE has emerged as India's most multifaceted energy partner. It is the fourth-largest source of crude oil (meeting nearly 11 per cent of India's requirement), the third-largest source of LNG, and the largest source of LPG (GoI, 2026p).

The 2018 agreement for ADNOC to store crude oil in India's Mangalore facility was the first partnership of its kind in India's SPR programme. The Government of India-UAE engagement in May 2026 substantially deepened this relationship. In addition to the expanded SPR collaboration and LNG and LPG supply agreements described above,

the two countries operationalized 'MAITRI' (Master Application for International Trade and Regulatory Interface), a virtual trade corridor connecting Indian and UAE ports, to improve maritime commerce efficiency.

India and the UAE also cooperate in the renewable energy sector. In a September 2024 agreement between MASDAR (also known as Abu Dhabi Future Energy Company, a state-owned renewable energy company) and the government of Rajasthan, a Memorandum of Understanding (MoU) was signed to set up solar, wind, and hybrid power projects of 60 GW capacity in the western districts of the state at a cost of Rs 3 trillion (approx US\$ 31.32 billion).²¹

Both countries are also examining the feasibility of electricity grid interconnections and collaborating through the Global Biofuels Alliance, which the UAE joined as an active founding member.

Indian companies have also invested over US\$1.2 billion in UAE upstream projects (GoI, 2026p). A consortium of ONGC Videsh Limited (OVL), Bharat PetroResources Limited (BPRL), and IOCL holds a 10 per cent stake in the Lower Zakum Block, and BPRL confirmed an oil discovery in Abu Dhabi's Onshore Block 1 in January 2026, the first such upstream discovery by Indian companies in the region (GoI, 2026p).

7.2 Oman: Strategic Gateway Beyond Hormuz

India's Free Trade Agreement with Oman also has an energy security dimension. Oman's geography gives it a potential role as an energy and logistics partner beyond the Strait of Hormuz, as much of Oman's coastline lies outside the Strait of Hormuz, and it can function as a trade and energy gateway even during periods of regional conflict or maritime disruption. This makes Oman vital for India's diversification strategies.

In 2025-26, India's imports from Oman totalled approximately US\$ 7.2 billion, consisting primarily of crude oil, LNG, and fertilisers. Indian exports to Oman amounted to approximately US\$ 4 billion, led by refined petroleum products, naphtha, iron and steel, machinery, and rice. The FTA between the two countries came into force on June 1, 2026 (GoI, 2026g), which would strengthen India's access to Oman's energy supplies, logistics infrastructure, petrochemical value chains,

and maritime connectivity, while reducing concentration risk in supply routes that pass through vulnerable chokepoints.²²

7.3 Netherlands: Green Hydrogen and Clean Energy Transition

India's energy diplomacy is not confined to fossil fuel. The May 2026 India-Netherlands engagement resulted in the launch of the India-Netherlands Roadmap on Green Hydrogen Development, a framework to support India's production, use, and export of green hydrogen while advancing its adoption in both countries. The two governments established a Joint Working Group on Renewable Energy under the existing MoU on Renewable Energy Cooperation with a broad mandate covering solar, green hydrogen, storage, and investment facilitation (GoI, 2026f).

The partnership encompasses a planned green hydrogen corridor between India and the Netherlands, cooperation on bio-energy, bio-chemicals, and circular feedstocks, and a 'Green and Digital Sea Corridor' aimed at creating an environmentally sustainable and economically efficient maritime link between the two countries, which would also facilitate India's green hydrogen exports to European markets. Academic cooperation has been formalized through a memorandum between the University of Groningen and 19 Indian Institutes of Technology, as well as a Doctoral Fellowship Program on Hydrogen between India's Department of Science and Technology and the University of Groningen²³ (GoI, 2026f).

7.4 Quad Indo-Pacific Energy Security Initiative

Through the Quad framework, the Government of India collaborates with Australia, Japan, and the United States to secure energy markets, diversify supply chains, and ensure the safety of maritime trade. Areas of cooperation include coordinated emergency response, strategic market analysis, technology cooperation, and support for vulnerable Indo-Pacific nations to enhance their energy resilience. This initiative reflects the growing recognition that energy security in the Indo-Pacific is a collective challenge that requires multilateral solutions.

7.5 Lessons from Global Experience

International experience provides useful lessons for strengthening India's energy security. Japan offers a particularly relevant example of managing energy security. Faced with near-total dependence on imported fossil fuels, Japan has diversified its energy mix across oil, LNG, coal, nuclear power, and renewables, while maintaining large strategic petroleum reserves, securing long-term supply contracts, and investing in overseas energy assets. Spain demonstrates another pathway, using the rapid expansion of solar and wind power, supported by grid integration and storage, to reduce dependence on imported fossil fuels. Brazil has strengthened energy security through the extensive development of sugarcane-based ethanol, widespread adoption of flex-fuel vehicles and biofuel blending, and complemented by domestic oil production and a largely renewable electricity system. These experiences show how countries can use their specific resource and technological advantages to reduce exposure to external energy shocks.

China provides an additional lesson in linking energy security with industrial policy. Sustained investment, manufacturing incentives and technological development have enabled it to expand solar, wind, hydropower, nuclear power, batteries and electric vehicles at an unprecedented scale, with renewables now contributing around 40 per cent of electricity generation. At the same time, China has developed strong domestic clean-energy manufacturing capabilities and secured access to overseas energy resources and critical minerals.

The broader lesson from these countries is that no single instrument can ensure energy security. For India, resilience requires a portfolio approach combining diversification of fuels, suppliers, and transport routes; adequate strategic reserves; expansion of domestic renewable, nuclear, and bioenergy resources; development of storage and grid infrastructure; domestic manufacturing and critical-mineral value chains; and strategic overseas energy and mineral investments. Together, these measures can reduce exposure to geopolitical and price shocks while supporting a more self-reliant and low-carbon energy system.

8. Policy Priorities

India's long-term energy security strategy should be based on six interconnected pillars, each addressing a distinct yet related challenge.

The first pillar is supply diversification. India should continue to expand its crude oil, LNG, critical mineral, and technology partnerships to reduce its excessive dependence on any single geography, chokepoint, or supplier. The progress already made in reducing the Gulf's share of the crude basket and developing partnerships across Africa, the Americas, and the Indo-Pacific should be systematically extended.

The second pillar is the strategic reserves. India should expand its SPR capacity toward a target of 90-100 days of crude consumption from the current 74 days. In addition, strategic reserves for critical minerals, such as lithium, cobalt, nickel, and rare earth elements, should be developed as an equivalent buffer for the clean energy supply chain.

The third pillar is the accelerated deployment of renewable energy. India should scale solar, wind, hydro, offshore wind, battery storage, and green hydrogen capacity while simultaneously strengthening domestic manufacturing capabilities to avoid replacing fossil fuel import dependence with technology-import dependence. Renewable capacity additions must exceed 50 GW per annum to keep pace with demand growth, which requires streamlined land acquisition, transmission planning, and grid integration frameworks.

The fourth pillar is the expansion of nuclear power. Nuclear energy offers reliable, dispatchable, low-carbon baseload generation that cannot be replicated by variable, renewable sources alone. Accelerating the implementation of the 'Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Act, 2025', expanding conventional nuclear capacity to 22.38 GW by 2031-32 (GoI, 2026k), and developing SMR capabilities and India's long-term thorium fuel cycle should all be prioritized.

The fifth pillar is trusted supply chain partnerships. India should forge and deepen partnerships with trusted nations for critical minerals, semiconductors, batteries, and clean energy technologies, leveraging the Quad and Indo-Pacific frameworks, the India-Africa Forum, and other bilateral FTAs as vehicles for building resilient, diversified supply chains.

The sixth pillar is domestic industrial capacity. PLI-based manufacturing, private sector participation, and indigenous innovation across the clean energy value chain should be expanded. Vertical integration from raw material production to end-use products is essential to achieve cost competitiveness and ensure that India's clean energy transition generates domestic economic value rather than simply substituting one form of import dependence for another.

These six pillars should be complemented by an energy-efficiency agenda. India's energy intensity has already fallen by 36 per cent between 2000 and 2023, and further efficiency improvements could reduce the final energy demand by approximately 20 per cent by 2070. Promoting EV adoption, electrifying public transportation, implementing smart grid technologies, and improving energy efficiency in buildings, industry, and agriculture are all cost-effective components of a comprehensive energy security strategy.

9. Conclusion

For India, resilience has become the defining principle of energy security. As the world's third-largest energy consumer and one of its fastest-growing major economies, India must simultaneously ensure affordable energy access, sustain robust economic growth, reduce import vulnerabilities, and honour its climate commitments, while navigating an increasingly complex and contested geopolitical environment. This is not merely a technical challenge.

India's energy-security challenge is multidimensional, involving economic growth, energy access, public health, industrial competitiveness, and climate responsibility. Short-term resilience still depends on reliable access to oil, gas, and coal, diversified import routes, and adequate strategic reserves. At the same time, long-term resilience requires faster expansion of domestic renewable and nuclear capacity, grid and storage infrastructure, critical-mineral security, clean-energy manufacturing, and energy efficiency. The central policy task is therefore not to choose between conventional energy security and the clean-energy transition, but to manage both within a coherent framework that limits exposure to geopolitical shocks while strengthening domestic technological and

industrial capability. A diversified portfolio of fuels, suppliers, routes, technologies, and strategic partnerships offers the most robust basis for maintaining affordability, reliability, and sustainability during a period of heightened global uncertainty.

India's pathway to Viksit Bharat 2047 and Net Zero 2070 runs through precisely this combination. By advancing energy security, economic growth, and the green transition simultaneously, rather than treating them as competing objectives, India can position itself not merely as a large energy market, but as a shaper of the global energy system for decades to come.

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BEF aims to serve as a dedicated platform for fostering dialogue on promoting the concept in the Indian Ocean and other regions. The forum focuses on conducting studies on the potential, prospects and challenges of blue economy; providing regular inputs to practitioners in the government and the private sectors; and promoting advocacy for its smooth adoption in national economic policies.



FIDC, has been engaged in exploring nuances of India's development cooperation programme, keeping in view the wider perspective of South-South Cooperation in the backdrop of international development cooperation scenario. It is a tripartite initiative of the Development Partnership Administration (DPA) of the Ministry of External Affairs, Government of India, academia and civil society organisations.



FISD aims to harness the full potential and synergy between science and technology, diplomacy, foreign policy and development cooperation in order to meet India's development and security needs. It is also engaged in strengthening India's engagement with the international system and on key global issues involving science and technology.



As part of its work programme, RIS has been deeply involved in strengthening economic integration in the South Asia region. In this context, the role of the South Asia Centre for Policy Studies (SACEPS) is very important. SACEPS is a network organisation engaged in addressing regional issues of common concerns in South Asia.



Knowledge generated endogenously among the Southern partners can help in consolidation of stronger common issues at different global policy fora. The purpose of NeST is to provide a global platform for Southern Think-Tanks for collaboratively generating, systematising, consolidating and sharing knowledge on SSC approaches for international development.

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Research and Information System for Developing Countries (RIS) is a New Delhi-based autonomous policy research institute that specialises in issues related to international economic development, trade, investment and technology. RIS is envisioned as a forum for fostering effective policy dialogue and capacity-building among developing countries on global and regional economic issues.

The focus of the work programme of RIS is to promote South-South Cooperation and collaborate with developing countries in multilateral negotiations in various forums. RIS is engaged across inter-governmental processes of several regional economic cooperation initiatives. Through its intensive network of think tanks, RIS seeks to strengthen policy coherence on international economic issues and the development partnership canvas.

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