International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

Green Growth or Green Geopolitics? India's Role in the Global Energy Transition

Anusha Bagla

Greenwood High International School, Bengaluru, India

DOI: 10.46609/IJSSER.2026.v11i02.013 URL: https://doi.org/10.46609/IJSSER.2026.v11i02.013

Received: 3 February 2026 / Accepted: 18 February 2026 / Published: 24 February 2026

ABSTRACT

India's energy transition represents a critical juncture in its developmental trajectory, shaped simultaneously by economic imperatives and geopolitical aspirations. As the world's third-largest energy consumer, India must reconcile rising energy demand with the need to reduce long-term dependence on fossil fuels and align with global climate commitments. This paper examines whether India's transition is primarily motivated by green-growth objectives—such as declining renewable-energy costs, employment restructuring, and enhanced energy security—or by green-geopolitical considerations, including coalition-building, standards-setting, and leadership across the Global South. Employing a dual analytical framework that integrates a Total-Cost-of-Energy (TCE) assessment with an international-relations perspective, the study synthesizes evidence from government mission documents, multilateral analyses, and India's diplomatic initiatives. The findings indicate that while renewables increasingly dominate new investment (supported by falling solar costs and emerging opportunities in green hydrogen) and offer clear economic advantages, structural constraints—particularly financing costs, grid bottlenecks, and off-taker risks—remain significant constraints. Concurrently, India leverages platforms such as the International Solar Alliance, the G20's Green Development Pact, and the National Green Hydrogen Mission to shape emerging global norms and secure strategic market access. The paper concludes that India's optimal pathway is a synthesis: green growth that is geopolitically informed, aligning domestic economic priorities with strategic international leadership.

Keywords: energy diplomacy, energy security, green geopolitics, green growth, green hydrogen

1. Introduction

The energy transition is the long-term shift from fossil-fuel-based systems (coal, oil, and gas) to low-carbon energy built on renewables, electrification, storage, and efficiency improvements

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

across production, distribution, and consumption. It is also a societal project that requires adaptive finance, enabling policy, and public buy-in, and it must be a 'just' transition that protects workers and vulnerable communities during structural change. The global energy transition has emerged as a central pillar of contemporary climate governance, development strategy, and geopolitical competition. As the world confronts the accelerating climate crisis (manifested through rising temperatures, extreme weather events, and mounting economic losses) the shift from fossil-fuel-based systems to low-carbon energy has become urgent and multidimensional. This transition encompasses technological change, institutional reform, societal adaptation, reconfigures geopolitical alignments, and influences global governance. It increasingly shapes patterns of trade, investment, and international cooperation. Within this landscape, India occupies a pivotal position.

India is the world's third-largest energy consumer and one of the fastest-growing major economies, with electricity demand projected to rise sharply over the next decade. Its energy system reflects a dual identity. On one hand, India remains heavily dependent on coal to supports domestic and industrial energy requirement and supports livelihoods in several states. On the other, India has emerged as global leader in renewable-energy deployment, international solar cooperation, and green-hydrogen ambition. Over the last decade, India has expanded energy access, added record renewable capacity, and positioned itself as a pivotal actor in global energy governance.

This duality raises a fundamental analytical question: Is India's energy transition primarily an economic project aimed at green growth, or a geopolitical strategy designed to enhance energy security, shape global norms, and strengthen global leadership?

Existing scholarships tend to examine these dimensions separately. Economic studies focus on cost, externalities associated with coal, employment effects, investment flows, and the role of industrial policy in shaping clean-energy markets. International-relations studies, by contrast, examine India's coalition-building, diplomacy standards-setting, and leadership across the Global South through initiatives such as the ISA, the Global Biofuels Alliance, and emerging hydrogen-certification frameworks.

Yet in practice, these domains intersect. Domestic industrial policy influences export competitiveness; global rules on hydrogen and carbon border adjustments shape India's market access; and India's leadership in platforms such as the International Solar Alliance (ISA) feeds back into domestic credibility and concessional finance and technology partnerships. The research gap lies in the absence of an integrated framework that analyses India's energy transition as both an economic transformation and a geopolitical project.

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

This paper addresses that gap through two guiding research questions:

1. Is India's energy transition driven more by green-growth imperatives or by green-geopolitical strategy?
2. Where do these two perspectives converge, and where do they diverge in shaping policy choices, investments, and diplomatic behaviour?

2. Background & Literature Context

India's energy landscape has undergone a significant structural shift over the past decade, shaped by rising demand, persistent coal dependence, and rapid growth in renewable capacity. Coal continues to account for roughly 70% of India's electricity generation, anchoring baseload generation and supporting employment in several states. At the same time, India has emerged as one of the world's most dynamic renewable-energy markets. Solar and wind capacity additions have accelerated, supported by falling technology costs, large-scale solar parks, national targets such as 500 GW of non-fossil capacity by 2030, and the achievement of 50% non-fossil installed capacity by 2025. Key policy instruments such as the National Solar Mission, Production-Linked Incentives (PLI) for solar modules and batteries, and the National Green Hydrogen Mission have accelerated this shift.

A substantial body of economic literature analyses the drivers and constraints of this transition. Analyses by the International Energy Agency (IEA) highlights India's requirement of USD 400 billion or more in clean-energy investment by 2030 to meet renewable-energy and green-hydrogen targets, while also noting persistent financing constraints, high cost of capital, and transmission challenges. Studies by the World Bank and World Economic Forum (WEF) emphasize the economic benefits of renewables, including declining levelised costs of solar and wind, reduced exposure to fossil-fuel price volatility, and substantial employment potential in manufacturing, construction, and operations.

Parallel to this, a growing body of geopolitical literature examines India's evolving role in global energy governance. Commentaries from Observer Research Foundation (ORF), Carnegie India, and academic platforms such as LSE South Asia analyse India's leadership in the International Solar Alliance (ISA), its agenda-setting during the G20 Presidency, and its strategic use of clean-energy diplomacy to mobilise concessional finance, shape global standards, and strengthen South–South cooperation. These studies highlight how India leverages renewable energy to enhance energy security, diversify supply chains, and position itself as a "bridge nation" between developed and developing economies.

Despite these contributions, the literature remains fragmented. Economic analyses focus primarily on costs, investment flows, and employment, while geopolitical studies examine

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

diplomacy, alliances, and norm-setting. Few works integrate these two perspectives or analyse how domestic economic priorities and international strategic ambitions co-evolve within India's energy transition. This paper addresses that gap by combining a Total-Cost-of-Energy (TCE) economic framework with an international-relations lens, offering a unified analysis of how green growth and green geopolitics jointly shape India's energy trajectory.

3. Methodology

This study adopts a qualitative, interdisciplinary research design grounded in secondary data analysis. Due to the multidimensional nature of India's energy transition, the methodology integrates insights from economics, public policy, and international relations to examine how green-growth imperatives and green-geopolitical strategies jointly shape national energy choices. The approach is interpretive rather than statistical.

The analysis is structured around a dual analytical framework. The first component, the Green Growth lens, assesses the economic drivers of India's transition, focusing aspects like cost competitiveness of renewables relative to coal, financing needs and investment gaps, employment restructuring across coal and renewable sectors, energy-security implications of reduced fossil-fuel imports. This component draws on Total-Cost-of-Energy (TCE) principles, which incorporate externalities such as air pollution, climate damages, and water stress into comparative assessments.

The second component, the Green Geopolitics lens, examines India's diplomatic and strategic actions in global energy governance. This includes analysis of coalition-building (e.g., International Solar Alliance), agenda-setting in multilateral forums (e.g., G20 Green Development Pact), standards alignment (e.g., hydrogen certification), and broader questions of strategic autonomy and influence across the Global South.

Data for the study is drawn from official government documents (MNRE mission papers, PIB releases, policy guidelines), multilateral reports (IEA, WEF), and reliable news sources. These sources provide credible information on both domestic policy evolution and India's international positioning.

A case-study method is employed to illustrate the interaction between economic and geopolitical drivers. The National Green Hydrogen Mission is selected due to its dual relevance for industrial strategy and global standard setting. The study is subject to limitations: it relies exclusively on secondary data, focuses primarily on India rather than comparative cases, and does not include quantitative modelling. Nonetheless, the integrated framework offers a robust basis for analysing the co-evolution of green growth and green geopolitics in India's energy transition.

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

4. Green Growth: Economics of the Transition

As the country's energy demand continues to rise—driven by industrialisation, urbanisation, and rising incomes—the central policy challenge is to deliver reliable, affordable power while reducing long-term system risks. From this perspective, the transition to green energy is not merely a climate response but an economic modernization strategy. Four interlinked drivers—finance, cost competitiveness, employment restructuring, and energy security—explain why green growth has become a core pillar of India's development trajectory.

India requires an estimated USD 1.5 trillion in clean-energy investment by 2030 to remain aligned with its non-fossil capacity targets and to address the climate challenge at scale. While renewable-energy investment has grown rapidly over the past decade, there are gaps and challenges. There are high domestic interest rates, distribution-sector payment delays, transmission constraints, and capital is more expensive than in advanced economies. Although sovereign green bonds, blended-finance facilities, and rising DFI participation have improved liquidity, India still needs deeper credit-enhancement mechanisms and long-tenor financing to scale renewables at the required pace.

Solar photovoltaic (PV) tariffs in India have fallen dramatically over the past decade, making utility-scale solar cheaper than new coal in most states. Green hydrogen remains expensive today, but its long-term export potential is significant. India's National Green Hydrogen Mission positions the country to become a competitive producer of green hydrogen, ammonia, and methanol by leveraging low-cost renewables and scale economies. Early investments in electrolyzer manufacturing, certification schemes, and port-based hubs are designed to capture future export markets in Europe and Asia.

The energy transition is also reshaping India's labour market. Coal mining and thermal-power employment are expected to decline over the next two decades as older plants retire and new coal additions slow. In contrast, the renewable-energy sector—spanning manufacturing, construction, operations and maintenance, and green-hydrogen value chains—is generating new employment opportunities. Estimates suggest that large-scale renewable deployment and supply-chain localization could create hundreds of thousands of jobs, particularly in solar module manufacturing, battery production, and electrolyzer assembly. However, these gains are unevenly distributed. Coal-dependent regions require targeted just-transition strategies, including reskilling programs, social-protection mechanisms, and fiscal diversification to mitigate regional shocks.

Energy security is a further economic driver. India imports over 85% of its crude oil and a significant share of natural gas, exposing the economy to global price volatility and geopolitical

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834
Volume:11, Issue:02 "February 2026"

disruptions. Renewable energy—being domestically sourced—reduces import dependence, improves balance-of-payments stability, and enhances long-term price certainty. The diversification of supply chains through domestic manufacturing incentives (e.g., PV modules, batteries, electrolyzers) also reduces vulnerability to concentrated global markets. In this sense, green growth strengthens macroeconomic resilience while supporting strategic autonomy.

India has demonstrated third-largest growth in power generation capacity in the world after China and the United States over the past five years. There has been a surge in investment in renewables, led by solar PV, which constitutes more than half of total non-fossil investment over this period. India has a target of 500 GW of non-fossil-fuel based energy capacity by 2030. As of July 2025, India has achieved a landmark in its energy transition journey by reaching 50% of its installed electricity capacity from non-fossil fuel sources—five years ahead of the target set under its Nationally Determined Contributions (NDCs) to the Paris Agreement. There has been a steady year-on-year increase in electricity demand, and a drop in renewable power prices, that is coming closer to the thermal power prices. Solar power is now cheaper than new coal in some regions. Prices of green hydrogen are coming down with advancement in technology & economies of scale.

At the face value of price, coal appears to be cheaper today, however it increases long term cost in many direct and indirect ways. Usage of coal for energy generation causes environmental damage, poses health hazards and regulatory risks, increases healthcare cost, and can face volatility in fuel prices & availability. All these factors make it economically unsustainable in the long run. On the other hand, although clean energy projects (like solar farms and hydrogen plans) need huge investments in the beginning, they offer lower total cost over time, stable and predictable energy pricing, health and environmental benefits, and alignment with climate goals.

The following aspects are usually considered for cost benefit analysis: -

Total Cost of Energy Framework Including Externalities

Dimension	**Coal-Based Energy**	**Renewable Energy**
Initial Cost	Lower upfront costs due to existing infrastructure and domestic reserves	Higher upfront installation costs, though declining due to technological progress and economies of scale

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

Operational Cost	High recurring costs from fuel procurement, maintenance of ageing plants, pollution control, and regulatory compliance	Very low fuel costs (sunlight, wind) and relatively low maintenance costs over long periods
Environmental & Social Costs (Externalities)	High negative externalities: air pollution, health damage, climate change, and ecosystem degradation	Minimal emissions, lower health risks, and limited environmental damage
Energy Security & Price Stability	Vulnerable to supply disruptions, geopolitical tensions, and price volatility in global fuel markets	Domestically sourced, scalable, and largely insulated from global price shocks
Impact on Growth & Employment	Declining sector with economic risk for coal-dependent regions and labour	Expanding sector with strong job creation and potential for structural transformation
Overall Long-Run Cost	High total system cost when externalities and risks are included	Lower total system cost over time without negative externalities

Coal based energy has hidden liabilities which make it a high-risk bet. Continued reliance on coal risks stranded assets as global capital shifts to non-fossil fuel-based energy, while future cost of inaction will compound exponentially. By contrast, clean energy projects lower lifetime costs, stable pricing, and ESG-aligned growth. India’s evolving climate finance architecture, backed by stronger budgets, international partnerships, and private capital, is accelerating this transition. The economic case is clear: delay raises systemic risk, while decisive action secures resilience, competitiveness, and long-term prosperity.

Taken together, these factors demonstrate that India’s energy transition is increasingly framed as a project of economic modernization and long-term sustainability. Falling renewable costs, rising externality burdens of coal, employment restructuring, and energy-security imperatives collectively position green growth not as an environmental luxury but as an economic necessity.

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

The transition aligns India's development goals with global decarbonisation trends, reinforcing the argument that economic logic—not only climate ambition—is driving the shift toward a low-carbon future.

5. Green Geopolitics: Diplomacy & Strategy

Clean energy is no longer the alternative; it is the backbone of the next industrial revolution. India's shift to renewable energy is not merely a technological shift towards clean energy or moral imperative, but it is also a strategic instrument for restructuring of global capital and leadership. India's renewable energy push demonstrates how climate action can be leveraged to enhance international influence, attract investment, and safeguard national interests. Historically global energy order was dictated by the geography of fossil fuels. Going forward, India is leveraging its renewable transition to reshape the energy market, moving from a "price-taker" in energy markets to a "norm-setter". By hosting summits, leading alliances, and shaping global narratives, India positions itself as a climate leader while simultaneously advancing its developmental priorities.

G20 Summit 2023: At the G20 Summit, India placed climate change at the center of its agenda. The summit's messaging emphasized the need for sustainable finance, equitable energy transitions, and global cooperation on renewables. India used the platform to highlight its domestic achievements in solar and wind power while calling for greater flows of climate finance from advanced economies. By doing so, India not only reinforced its credibility as a responsible member & leader but also signaled that clean energy is integral to its growth model. Hosting the G20 allowed India to project itself as a bridge between developed and developing nations, advocating for climate justice while showcasing its renewable energy leadership. India's 2023 G20 Presidency marked a pivot in how the world discusses climate change. Under the theme Vasudhaiva Kutumbakam (One Earth, One Family, One Future), India successfully shifted the narrative from "burden-sharing" to "opportunity-creation."

Key Economic Deliverables of G20 (2023)

Initiative	**Economic Objective**	**Geopolitical Impact**
Global Biofuels Alliance	Creating a global market for biofuels and stabilizing prices.	Positions India as a hub for ethanol and compressed biogas technology.

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

Green Development Pact	Bridging the financing gap between the Global North and South.	Advocates for trillions in concessional finance for developing nations.
Tripling RE Capacity	Encouraging a global target of tripling renewable energy by 2030.	Incentivizes global supply chain diversification away from a single-country (China) dominance.

International Solar Alliance (ISA): Headquartered in Gurugram, India, the ISA serves as a platform to aggregate demand across the Global South, creating the economies of scale necessary to drive down the cost of solar technology and financing. By bringing together over 100 signatory countries, India is effectively building a "Solar Bloc." Economically, the ISA reduces transaction costs for solar investments by harmonizing standards, pooling demand, and facilitating knowledge sharing. It enhances India's soft power by positioning it as the convenor of a global coalition for solar energy. For developing countries, ISA offers a pathway to affordable clean energy, while for India, it creates opportunities to export technology, attract investment, and secure strategic partnerships. It also reduces the "risk premium" for investors in developing nations, where capital costs have been high for green projects. Through its "Towards 1000" strategy, the ISA aims to mobilize $1 trillion in investments by 2030. It positions India as the central node in a global network of technology transfer and regulatory standards. The International Solar Alliance (ISA) has expanded over 100 members & signatory countries, with concrete programs that have mobilized financing and facilitated solar deployment in developing nations, including initiatives that supported solar pumps, rooftop installations, and innovative startups. This has contributed to expanding solar capacity among member countries significantly showing tangible progress toward the ISA's "Towards 1000" goals for 2030. ISA has also facilitated technical support that makes solar deployments more feasible on the ground.

However, actual project implementation has been slower than expected due to regulatory hurdles, uneven financial commitments, and capacity constraints in many member states, which restrict the Alliance's ability to translate ambitious goals into broad large-scale, on-ground solar capacity. Actual financing commitments and large projects remain limited, and most solar investment continues to flow to major economies rather than smaller developing states that ISA seeks to support. Administrative hurdles, funding gaps, and uneven technical capacity across members constrain ISA's catalytic impact.

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

India’s National Green Hydrogen Mission: - The National Green Hydrogen Mission (NGHM) represents India’s most ambitious bid to transition from a price-taking energy importer to a price-setting net exporter of clean fuel. From an economic perspective, the mission is designed to capitalize on India's low-cost renewable power to produce green hydrogen at a globally competitive target of about $2.00 per kg by 2030. By aiming to capture 10% of the global market share by 2030, India is using green hydrogen as a macroeconomic hedge to reduce its trade deficit while asserting technological leadership in the nascent global carbon-neutral economy.

India’s renewable energy expansion (targeting 500 GW of non-fossil fuel capacity by 2030) serves as a two-pronged strategy. Domestically, it reduces dependence on imported fossil fuels and stabilizes the balance of payments. Internationally, it emphasizes India’s seriousness in meeting climate commitments, thereby attracting concessional finance and foreign direct investment. This as a virtuous cycle: global leadership in renewables enhances credibility, which in turn lowers the cost of capital and accelerates deployment. Moreover, India’s push for green hydrogen and solar manufacturing creates new export opportunities, embedding clean energy into its trade strategy.

India’s climate diplomacy is carefully calibrated. India leverages renewables to argue for greater climate finance and technology transfer, protecting its national interests while advancing global cooperation. India’s push for renewables is a strategic hedge against external shocks. Energy security is a prerequisite for fiscal stability (Current Account Deficit Management, building a domestic manufacturing base, Job Creation & GDP Growth)

Clean energy investments not only provide environmental dividends but also geopolitical returns & global leadership, turning solar power into a source of both growth and prestige. India has demonstrated that climate leadership is not a zero-sum game with national development. India is positioning itself as a "bridge nation" between the developed and developing worlds. India has moved from being a participant in the global energy market to being one of its primary architects.

India leverages energy as a strategic tool of diplomacy and power by linking its clean energy transition to broader goals of energy security, international leadership, and influence in global governance. Clean energy for India is not merely a technological shift but a pathway to global leadership, demonstrated through initiatives such as the International Solar Alliance, hosting G20 summit, National Green Hydrogen Mission, regional power connectivity & cross border electricity trade. By promoting solar deployment, sharing policy expertise, and mobilizing finance for developing countries, India enhances its soft power while shaping norms around sustainable development and climate responsibility. Clean energy thus becomes a strategic asset, projecting India as a responsible leader.

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

6. Case Study: India's National Green Hydrogen Mission

India is the world's third-largest energy consumer with significant reliance on imported fossil fuels. India launched its National Green Hydrogen Mission to address energy security concerns and meet ambitious climate targets announced at COP26.

India's National Green Hydrogen Mission is a major initiative launched by the Government Of India in January 2023, and it aims to make the country a global hub for green hydrogen production, usage, and export of green hydrogen and its related technologies. By 2030, India targets 5 million tonnes of annual production, backed by ₹8 lakh crore (~$88 billion) in investments, with the dual goals of reducing fossil fuel imports and positioning itself as a clean energy leader.

When hydrogen is produced using renewable energy, it is called Green Hydrogen. For example, when renewable energy is used for the electrolysis of water, it produces oxygen and hydrogen; from which hydrogen can be used as an energy source (green hydrogen). Green hydrogen is essential because it enables decarbonisation of hard-to-abate sectors, such as steel, shipping, aviation, and fertilisers. In these industries usage of just electricity (usually generated from other renewable sources) is technically or economically unfeasible.

<u>Triggers leading to National Green Hydrogen Mission</u>

This initiative was triggered by multiple factors:

- Climate Commitments (To meet COP26 pledges and net-zero by 2070),
- Energy Independence (Reduce reliance on imported oil, coal, and gas to achieve energy independence by 2047)
- Industrial Decarbonization (Provide clean fuel for hard-to-abate sectors)
- Global Competitiveness (Capture share of the emerging trillion-dollar hydrogen market),
- Geopolitical Trigger (Fossil fuel volatility in 2022 due to the Russo-Ukrainian war, underscored the need for domestic alternatives)
- International Pressure (Global hydrogen strategies by EU, Japan, and Australia pushed India to act)
- Domestic Push (Indian industries demanded policy support for hydrogen adoption)
- Strategic Diplomacy (For India to build economic & technical leadership in an emerging global clean-energy market)

 Copyright © IJSSER 2026, All rights reserved

Timelines leading to National Green Hydrogen Mission: -

- On 15 August 2021, Indian Prime Minister announced the idea of a national hydrogen mission during his Independence Day speech,
- In Nov 2021 (COP26, Glasgow), India Prime Minister announced *Panchamrit* commitments: 500 GW non-fossil capacity by 2030, net-zero by 2070.
- In Feb 2022 (Union Budget): Finance Minister announces support for hydrogen and clean energy R&D.
- Throughout 2022, energy price shocks due to Russia-Ukraine war highlight risks of fossil fuel dependence, and global recognition of hydrogen's role in decarbonization grew,
- In Aug 2022, MNRE (Ministry of New and Renewable Energy) drafts a framework for the National Green Hydrogen Mission.
- 4 January 2023, Union Cabinet approved National Green Hydrogen Mission with ₹19,744 crore outlay, and the initiative was officially launched
- In 2023-20204, following the launch, the Ministry of New and Renewable Energy released policy frameworks

The mission has several ambitious targets:

- Production Capacity: Develop a green hydrogen production capacity of at least 5 Million Metric Tonnes (MMT) per annum.
- Renewable Energy Capacity: Add about 125 GW of renewable energy capacity.
- Investment & Jobs: Attract over ₹8 lakh crore in total investments and create over 6 lakh jobs.
- Emission Reduction: Abate nearly 50 MMT of annual greenhouse gas emissions.
- Import Reduction: Reduce cumulative fossil fuel imports by over ₹1 lakh crore.

It is built on a comprehensive framework implemented by the Ministry of New and Renewable Energy (MNRE):

- Strategic Interventions for Green Hydrogen Transition (SIGHT) Programme: Provides financial incentives for domestic manufacturing of electrolyzers and production of green hydrogen to reduce costs and boost technological competitiveness.
- Pilot Projects: Supports demonstration projects in emerging and hard-to-abate sectors like steel, mobility (heavy-duty transport, shipping), and decentralized energy applications to identify operational gaps and feasibility.

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

- Green Hydrogen Hubs: Identifies and develops regions, particularly major ports (e.g., Deendayal Port, V.O. Chidambaranar Port, and Paradip Port), capable of supporting large-scale production and/or utilization of hydrogen for both domestic use and export.
- Enabling Policy Framework: Includes provisions like the waiver of inter-state transmission charges for renewable energy used for green hydrogen production to ensure low-cost energy supply.
- Research & Development (R&D): Facilitates a public-private partnership framework (Strategic Hydrogen Innovation Partnership – SHIP) to develop globally competitive indigenous technologies across the value chain.
- Standards and Regulations: Establishes a robust national framework, including the Green Hydrogen Certification Scheme of India (GHCI), for certification, safety, and environmental norms to build market credibility.

Under the SIGHT (Strategic Interventions for Green Hydrogen Transition) program, the government has already awarded incentives for 3,000 MW of annual electrolyzer manufacturing and over 860,000 tonnes of hydrogen production capacity to major players like Reliance, Adani, and L&T. The Ministry of New and Renewable Energy is developing a certification framework to officially define what qualifies as green hydrogen in India.

The National Green Hydrogen Mission carries high economic and political stakes for India because it sits at the intersection of industrial transformation, energy security, and global leadership

Economically, the mission aims to create a new industrial ecosystem (e.g. electrolyzer manufacturing, production of renewable power and green fuel), attract large-scale investment & climate financing. It will drive economic growth by creating new industries, jobs, and export opportunities in hydrogen and derivatives (ammonia, methanol). It is estimated to significantly lower hydrogen cost through cheap renewables and local electrolyzer manufacturing. It also helps India to move away from vulnerability, created by imports of fossil fuels and foreign green energy supply chains. It strengthens India's strategic autonomy by reducing dependence on imported fossil fuels and insulating the economy from volatile global energy prices. India's green hydrogen policy and strategy are designed to create a robust ecosystem that balances domestic demand with global opportunities. At the national level, the government would mandate minimum green hydrogen usage across key industries to ensure steady demand and accelerate decarbonization. On the international front, India is actively pursuing strategic partnerships with regions like Europe, Japan, and the Gulf nations to facilitate exports and establish itself as a reliable supplier in the emerging global hydrogen market. To support this

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

vision, infrastructure development is being prioritized through the creation of hydrogen hubs, port-based projects, and pilot programs.

Politically, it signals India's intent to lead in the global clean energy race, strengthening its bargaining power in climate negotiations and positioning itself as a reliable supplier. At the international level, the mission enhances India's diplomatic leverage by allowing it to shape emerging norms and standards in the global hydrogen economy, particularly for developing countries. At the same time, the mission is tied to India's net-zero by 2070 pledge, making it a cornerstone of credibility in international diplomacy. By investing early and at scale through its National Green Hydrogen Mission, India seeks to shape future energy supply chains rather than depending on them. According to India's ministry of New and Renewable Energy: "This will contribute to India's aim to become Aatmanirbhar (self-reliant) through clean energy and serve as an inspiration for the global Clean Energy Transition". This strengthens India's autonomy, a core principle of India's foreign policy, allowing it to work towards climate action without being constrained by external pressures and sanctions.

India's green hydrogen mission is closely intertwined with international relations, where energy diplomacy plays a central role. Through hydrogen diplomacy, India is leveraging partnerships under the India-Middle East-Europe Economic Corridor (IMEC) to establish itself as a key exporter of green hydrogen, strengthening economic and strategic ties with Europe and Gulf nations. At the same time, India is positioning itself in strategic competition against traditional fossil fuel exporters and China's dominance in clean technology, aiming to secure a leadership role in the emerging global energy landscape. These efforts also enhance India's credibility in climate negotiations such as COP26 and COP28, reinforcing its image as a responsible actor committed to global decarbonization while balancing its developmental priorities.

The National Green Hydrogen Mission is ambitious, but it comes with several trade-offs, risks, and tensions that policymakers and industry must navigate. Cost is a central challenge; green hydrogen remains significantly more expensive than fossil-based hydrogen. It makes large-scale adoption dependent on subsidies, incentives, and long-term policy certainty. This creates a risk of subsidy dependence and raises fiscal sustainability concerns. Water use is another concern as green hydrogen production through electrolysis requires substantial quantities of freshwater, potentially creating competition between industrial use and local needs unless desalination or wastewater solutions are scaled. Storage, transport, and distribution systems for hydrogen are underdeveloped. At the global level, competition is intensifying, with many countries racing ahead with hydrogen strategies. India risks losing market share if infrastructure and technology adoption lag. This mission is a high-stakes balancing act: success could secure India's energy independence and global influence, while delays risk stranded fossil assets, missed export opportunities, and weakened climate leadership.

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

7. Discussion

Let’s analyse the Economic and Geopolitical perspectives to understand where they align and where they diverge.

Economics Perspectives: -

Since its inception in 2023, India’s National Green Hydrogen Mission (NGHM) has evolved from a policy framework into a cornerstone of the nation’s industrial strategy. While its environmental benefits are clear, the mission is equally significant from an economic standpoint. It promises to reshape India’s energy landscape, reduce import dependence, create new industries, and generate employment, all while positioning the country as a global hub for hydrogen exports. The mission is expected to attract investments worth ₹8 lakh crore (~$88 billion) by 2030. These funds will be directed toward building electrolyzer manufacturing capacity, renewable energy infrastructure, hydrogen hubs, and transport networks. While the upfront costs are high, the long-term savings are substantial. By replacing fossil fuel imports with domestically produced hydrogen, India could save ₹1 lakh crore annually on its energy bill thus also relieving pressure on Current Account Deficit (CAD).

The government is offering incentives to lower the cost of hydrogen production, making it competitive with conventional fuels. Through the SIGHT (Strategic Interventions for Green Hydrogen Transition) program, India is steadily progressing towards lowering production costs from $5–6/kg (2023) to approximately $3.8–4.2/kg (2026). The mission targets the production of 5 million Metric Tonnes (MMT) of green hydrogen by 2030, supported by 125 GW of dedicated renewable energy capacity.

The mission has triggered a massive capital influx from both the public and private sectors:

- The Hub Model: Projects like the NTPC Pudimadaka Green Hydrogen Hub (₹1.85 lakh crore) have turned coastal regions into industrial clusters.
- Private CAPEX: Early investment trends suggest a growing role for private enterprises alongside public sector participation,
    - SIGHT Incentives: The ₹17,490 crore incentive pool has successfully localized electrolyzer manufacturing, reducing reliance on Chinese imports and fostering a domestic supply chain for Alkaline and PEM (Proton Exchange Membrane) technologies.

The NGHM is a significant engine for non-farm employment. The mission is projected to generate 600,000 direct and indirect jobs across multiple sectors like: -

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

- Electrolyzer manufacturing (factories, engineering, R&D).
- Renewable energy projects (solar and wind farms powering hydrogen production).
- Infrastructure development (pipelines, storage facilities, hydrogen hubs).
- Transport and logistics (hydrogen-powered vehicles, shipping, and export terminals).

This job creation is particularly important for India, where the transition to clean energy must also support livelihoods and economic inclusion.

Green hydrogen is expected to catalyze growth in industries that are traditionally hard to decarbonize, such as steel, cement, and fertilizers. By mandating minimum hydrogen usage in these sectors, India is not only reducing emissions but also creating new markets. The mission could add $35–40 billion annually to India's GDP by 2030 through industrial expansion, exports, and reduced fossil fuel dependency.

Additionally, India's ambition to become a major exporter of hydrogen and derivatives (like ammonia and methanol) opens up new trade opportunities. Europe, Japan, and Gulf nations are already seeking reliable suppliers, and India's geographic position and renewable energy potential give it a competitive edge

The mission has to navigate through some economic challenges:

- High initial costs of electrolyzers and hydrogen infrastructure.
- Global competition with countries like Saudi Arabia and Australia (also aiming to dominate hydrogen exports)
- Technology advancement, India must rapidly scale domestic innovation to avoid reliance on foreign suppliers.
- Infrastructure Gap: 80% of distribution still relies on cargo/trucking. Developing a dedicated storage and distribution infrastructure will be required for seamless low cost supply.
- Financing Costs: "First-of-a-Kind" projects face higher perceived risks from investors and lenders, leading to high interest rates and drive up the final Levelized Cost Of Hydrogen

<u>Geopolitical and Diplomacy Perspective: -</u>

By positioning itself as a global hub for green hydrogen, India is not merely seeking energy security but is actively recalibrating its position in the global hierarchy. By positioning itself as a

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834
Volume:11, Issue:02 "February 2026"

global hub for green hydrogen production and export, India aims to reshape alliances, strengthen treaties, and enhance its global influence in the energy transition.

The NGHM is a critical component of India's strategy to offer the world a democratic, resilient supply chain alternative to China. India has leveraged hydrogen diplomacy to build new frameworks of cooperation. The mission has catalyzed strategic alliances across regions. Within the Quadrilateral Security Dialogue (India, USA, Japan, Australia), Green Hydrogen has emerged as a "cleaner" alternative to traditional security cooperation. India has entered a "Clean Energy Supply Chain" agreement with Japan and Australia to co-develop electrolyzer components, aimed at breaking the Chinese monopoly on rare-earth-dependent membranes.

- Europe: India is aligning with the EU's hydrogen import strategy, positioning itself as a reliable supplier to meet Europe's decarbonization goals.
- Japan: Collaboration with Japan emphasizes technology partnerships, particularly in electrolyzer manufacturing and hydrogen mobility.
- Gulf Nations: Partnerships with Saudi Arabia and the UAE focus on joint ventures for hydrogen production and export, diversifying energy ties beyond oil.
- Australia: Cooperation on critical minerals essential for hydrogen technologies strengthens Indo-Pacific energy security.
- The India-Middle East-Europe Economic Corridor (IMEC) has been increasingly discussed as a significant evolution in global trade. The corridor's important international relations component is the Hydrogen Pipeline. It facilitates the direct export of green energy to the Mediterranean, bypassing vulnerable maritime chokepoints, securing a more resilient and autonomous supply chain. Under the India-Middle East-Europe Economic Corridor (IMEC), hydrogen export agreements are being negotiated with Gulf nations and European partners. These treaties are designed to secure long-term supply chains, reduce dependence on fossil fuels, and integrate India into global clean energy markets.
- By partnering with the UAE and Saudi Arabia on green hydrogen projects, India is actively assisting its traditional oil suppliers in pivoting their economies toward a sustainable future. This shift transforms a historically transactional buyer-seller relationship into a strong technological partnership.
- India-EU: Under the "India-EU Green Hydrogen Task Force," India has aligned its certification schemes with the EU's "Delegated Acts," ensuring that Indian green ammonia enters the European market without falling foul of the Carbon Border Adjustment Mechanism (CBAM).

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

- Singapore and Japan: India has been exploring long-term offtake agreements with partners such as Singapore and Japan, effectively tying their energy security to Indian production.
- Bilateral agreements with countries such as Germany and Japan focus on technology transfer, joint R&D, and investment in hydrogen infrastructure.

India's leadership in green hydrogen enhances its credibility in climate diplomacy. At COP26 and COP28, India's commitments to hydrogen were framed as part of its broader pledge to achieve net-zero by 2070. This bolsters India's image as a responsible actor balancing development with sustainability. By offering green hydrogen as a clean alternative, India also strengthens South-South cooperation, providing developing nations with affordable pathways to decarbonization.

The mission positions India in strategic competition with China, which dominates clean technology supply chains. By investing in domestic electrolyzer manufacturing and securing critical mineral partnerships, India seeks to reduce dependence on Chinese imports. Simultaneously, India's hydrogen diplomacy challenges traditional fossil fuel exporters, offering a renewable alternative that could reshape global energy geopolitics.

India's Green Hydrogen Mission is more than a domestic energy policy—it is a tool of international relations. Through treaties, alliances, and global influence, India is embedding itself in the architecture of the clean energy transition. The mission strengthens India's geopolitical standing, diversifies its energy partnerships, and enhances its role as a climate leader on the world stage.

India's achievement of 50% non-fossil fuel installed capacity ahead of the target year is a testament to its ambition, innovation, and commitment to sustainable development. It affirms that development and decarbonization are not contradictory goals but can in fact reinforce each other.

Economics and International Relations Perspectives, at a glance: -

	Economic Perspective	International Relations Perspective
Primary Goal	Reduce fossil fuel imports, reduce Current Account Deficit, cut energy costs, and boost domestic	Climate leadership, Enhance India's climate diplomacy and global leadership in clean energy.

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834
Volume:11, Issue:02 "February 2026"

	industry.	
Key Driver	SIGHT Program: Subsidies for domestic electrolyzer manufacturing and production.	Strategic Partnerships**:** MOUs with Germany, Japan, and Singapore for export corridors.
Industrial Impact	Stimulates new sectors (electrolyzers, hydrogen storage, renewable energy integration).	Positions India as a reliable partner for countries seeking green hydrogen supply chains.
Employment & Growth	Creates jobs in manufacturing, R&D, and infrastructure.	Builds strategic alliances with EU, Japan, and others, opening technology transfer and investment opportunities.
Energy Security	Reduces vulnerability to oil and gas price fluctuations.	Strengthens India's bargaining power in global energy negotiations.
Global Competitiveness	Aims to make India a hub for affordable green hydrogen exports.	Enhances India's credibility in climate negotiations and supports its net-zero pledge.
Policy Drivers	Economic imperatives: cost savings, industrial growth, and innovation.	Diplomatic imperatives: climate leadership, partnerships, and geopolitical influence.

8. Conclusion

The mission is mutually reinforcing, but the balance leans toward 'International Relations & Diplomacy' shaping 'Economic policies & initiatives. India's strong diplomatic push (to be seen as a climate leader and a trusted partner in the global energy transition) is serving as an engine to shape the domestic economic priorities & policies (e.g. subsidies, R&D investments, export-

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

oriented strategies), ensuring India's green hydrogen ambitions align with global demand and geopolitical opportunities.

The thought that IR & Diplomacy (Why) is driving Economic Policy (How) comes from the following aspects: -

- Global external standards are guiding domestic production norms: The European Union has set much more rigid rules for what qualifies as "green" hydrogen (known as Renewable Fuels of Non-Biological Origin - RFNBO)—compared to India's more flexible definition. If India wants to export hydrogen to Indian producers must comply with these stricter European standards. To ensure Indian hydrogen remains eligible for export, the Ministry of New and Renewable Energy (MNRE) launched the Green Hydrogen Certification Scheme of India (GHCI) in 2025/26, explicitly aligning it with global norms. If India had settled for a looser domestic standard, that would have been cheaper but internationally "stranded."
- Forced Shift in India's industrial policy driven by international environmental regulations, specifically the EU's Carbon Border Adjustment Mechanism (CBAM): Starting January 1, 2026, the EU will impose a fee on imported goods based on how much carbon dioxide (CO_2) was emitted during their production. This mainly impacts carbon-intensive goods: steel, cement, aluminum, fertilizers, electricity, and hydrogen. India is heavily impacted because it is one of the top exporters of steel and aluminum to the EU, and its production processes are generally more coal reliant. From 2026, Indian exporters will have to purchase CBAM certificates to cover their carbon emissions, which could add a substantial cost; their products will become too expensive to compete in Europe, leading to a massive loss in export revenue. In response to that, Indian government has pivoted its existing National Green Hydrogen Mission to focus heavily on industrial decarbonization. This wasn't just a choice for domestic efficiency; it was a survival strategy to protect export revenue.
- Diplomacy-led aggregation of green hydrogen demand from international buyers is serving as a stimulus for domestic financial incentives for production. Producing green hydrogen is currently very expensive. Private companies (investors) would be afraid to spend billions without any certainty of offtake at a profitable price. Through the Indo-German Green Hydrogen Task Force and the H2Global tender mechanism, Indian diplomats and officials negotiated with Germany, Europe, and Japan to secure commitments to buy Indian-produced green hydrogen. With guaranteed buyers secured by diplomacy, the Indian government felt confident enough to launch SIGHT (Strategic Interventions for Green Hydrogen Transition) program.

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

- India's domestic R&D priorities are being influenced by its diplomatic Strategic Partnerships. India made diplomatic agreements (e.g., Strategic Clean Energy Partnership) with the US and Japan. These agreements specifically targeted certain hydrogen technologies: AEM (Anion Exchange Membrane) and SOEC (Solid Oxide Electrolysis Cell) electrolyzers. In response to these international agreements, India's domestic R&D funding program (Strategic Hydrogen Innovation Partnership - SHIP) - was adjusted to specifically fund these AEM and SOEC technologies.
- Global Climate Commitments are creating internal pressures to shape economic policies: India pledged to reach net-zero emissions by 2070 and has been actively showing climate leadership in international climate forums (e.g., COP summits). This creates diplomatic pressure on India to show credible action.

Acknowledgements

The author thanks her teachers, parents, and mentors for background inputs and the reviewers for comments. Any errors are the author's own.

References

[1] International Energy Agency. (2025). *World Energy Investment 2025: India country section*. https://www.iea.org/reports/world-energy-investment-2025/india

[2] International Energy Agency. (n.d.). *India – Energy mix*. https://www.iea.org/countries/india/energy-mix

[3] Ministry of New and Renewable Energy (MNRE). (2023). *National Green Hydrogen Mission*. https://mnre.gov.in/en/national-green-hydrogen-mission/

[4] Press Information Bureau (PIB). (2024, July 24). *National Green Hydrogen Mission (Lok Sabha reply)*. https://pib.gov.in/PressReleasePage.aspx?PRID=2039091

[5] Press Information Bureau (PIB). (2025, July 14). *India achieves 50% non-fossil fuel installed capacity (MNRE)*. https://pib.gov.in/PressReleasePage.aspx?PRID=2144627

[6] G20 Research Group. (2023). *G20 New Delhi Leaders' Declaration*. https://g20.utoronto.ca/2023/230909-declaration.html

[7] S&P Global Commodity Insights. (2023, Sept 9). *G20 leaders pledge to support tripling renewables globally by 2030*. www.spglobal.com

Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

[8] International Solar Alliance (ISA). (n.d.). *About ISA & "Towards 1000"*. https://isa.int/about_uss

[9] Ministry of New and Renewable Energy (2025, April 29). *Green Hydrogen Certification Scheme of India (GHCI)*. https://mnre.gov.in/en/notice/green-hydrogen-certification-scheme-of-india/

[10] Ministry of New and Renewable Energy (n.d.). https://mnre.gov.in/

[11] International Energy Agency. (2025). *World energy outlook 2025*. www.iea.org

[12] International Energy Agency. (2024). *World energy outlook 2024*. www.iea.org

[13] ISI Delhi. (2021). *Social cost of power from coal and renewables*. Indian Statistical Institute. https://www.isid.ac.in/~epu/dispapers/dp21_04.pdf

[14] Intergovernmental Panel on Climate Change. (2023). *AR6 synthesis report: Climate change 2023*. https://www.ipcc.ch/report/ar6/syr/

[15] Press Information Bureau. (2024, November 4). *Address by Union Minister of New and Renewable Energy, Shri Pralhad Joshi at the 7th ISA Assembly*. Government of India. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2070668

[16] Deloitte. (2025, July 17). *India needs to invest US$1.5 trillion by 2030 for climate action at scale*. https://www.deloitte.com/in/en/about/press-room/india-needs-to-invest-usd-1-5-trillion-by-2030.html

[17] World Economic Forum (2024, May 27). *How India is emerging as an advanced energy superpower*. https://www.weforum.org/stories/2024/05/india-emerging-advanced-energy-superpower/

[18] Morsel India. (2025, August 20). *India's green diplomacy could be its biggest soft power tool yet*. https://morselindia.in/indias-green-diplomacy-could-be-its-biggest-soft-power-tool-yet/

[19] Drishti IAS. (2025, October 16). *Towards India's clean energy revolution*. https://www.drishtiias.com/daily-updates/daily-news-editorials/towards-indias-clean-energy-revolution

[20] Gili, A., & De Blasio, N. (2024, March 26). *India - The new global green hydrogen powerhouse?* https://www.belfercenter.org/publication/india-new-global-green-hydrogen-powerhouse

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

[21] Ministry of New and Renewable Energy. (2025, April 29). *Green Hydrogen Certification Scheme of India (GHCI)*. Government of India. mnre.gov.in

[22] Indo-German Energy Forum (IGEF). (2025). *Bridging India's Green Hydrogen Certification to EU RFNBO* [White Paper]. https://energyforum.in/fileadmin/india/media_elements/publications/GH2/GH2_Certification_to_EU_RFNBO.pdf

[23] Press Information Bureau. (2025, November 12). *Unlocking India's Green Hydrogen Production Potential*. Government of India. https://www.pib.gov.in/PressNoteDetails.aspx?id=155990&NoteId=155990&ModuleId=3

[24] India-U.S. Strategic Clean Energy Partnership (SCEP): Ministry of New and Renewable Energy. (2024, September 17). *U.S.-India Strategic Clean Energy Partnership (SCEP) ministerial advances key initiatives on clean energy transition*. Government of India. https://ddnews.gov.in/en/u-s-india-strategic-clean-energy-partnership-scep-ministerial-advances-key-initiatives-on-clean-energy-transition/

[25] National Green Hydrogen Mission & SHIP (Strategic Hydrogen Innovation Partnership): Ministry of New and Renewable Energy. (2024, February 8). *DST is supporting Hydrogen and Fuel Cell Program: Research & Development programme including through a public-private partnership framework*. Press Information Bureau. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2004181

[26] Observer Research Foundation. (2025, January 3). *India-EU green hydrogen partnership: Powering a sustainable future*. https://www.orfonline.org/expert-speak/india-eu-green-hydrogen-partnership-powering-a-sustainable-future

[27] Press Information Bureau. (2023, October 10). *India and Saudi Arabia decide to promote investment in new & renewable energy*. Ministry of New and Renewable Energy. https://www.pib.gov.in/PressReleasePage.aspx?PRID=1966200

[28] Press Information Bureau (PIB). (2025, October 16). *India and Australia Strengthen Energy Cooperation through the 5th India-Australia Energy Dialogue*. Government of India. https://www.eqmagpro.com/india-and-australia-strengthen-energy-cooperation-through-the-5th-india-australia-energy-dialogue-eq/

[29] Press Information Bureau [PIB], Government of India. (2024, August 20). *Shri Pralhad Joshi chairs the project offtake agreement signing ceremony of Green Ammonia from India to Japan*. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2047042

 Copyright © IJSSER 2026, All rights reserved

ISSN: 2455-8834

Volume:11, Issue:02 "February 2026"

[30] Ministry for Economic Affairs and Climate Action (Federal Republic of Germany), & Ministry of New and Renewable Energy (Republic of India). (2022). *Joint declaration of intent on the Indo-German Green Hydrogen Task Force*

 Copyright © IJSSER 2026, All rights reserved