International Journal of Sustainable Studies, Technologies, and Assessments

IJSSTA

Original Article

Green Technologies: compared situations and collaboration perspectives between the EU and India

Dr. Grazzi Marcello

LUMMSA University

Corresponding Author Email: marcello.grazzi2000@gmail.com

Received: 22 October 2025 / Revised: 08 November 2025 / Accepted: 04 December 2025 / Published online: 30 December 2025

https://doi.org/10.5281/zenodo.18138878

Abstract: This article compares the green technology outlooks of the European Union (EU) and India, with a view to promoting deeper bilateral cooperation in order to strengthen both actors' positions. The work develops on four strategic sectors (critical minerals, batteries, solar and wind power, and green hydrogen), which present complementary vulnerabilities and assets across the EU and India's landscapes. In particular, Europe presents capital opportunities, advanced technologies and innovative regulatory frameworks, but is hindered by high production costs and external dependence on key inputs. Conversely, India shows a fast-growing economy with significant but underexploited resource potential and manufacturing capacity, which often rely on fossil fuels and imported components. The article suggests bilateral partnerships grounded in mutual interdependence rather than competition. This approach could bound both actors' development to shared growth, while diversifying supply chains, reinforcing energy security and enhancing industrial competitiveness. In conclusion, EU-India cooperation in green technologies could become a model for a more efficient and cooperative global order.

Keywords: *EU-India relations; green technologies; energy transition; interdependence; cooperation; critical minerals; green hydrogen; solar; wind; batteries*.

1. Introduction

This article compares the green technology horizons of the European Union and India, while arguing that deeper cooperation between the two can strengthen both actors. Rather than considering interdependence as a vulnerability, mutual reliance is regarded as a strategic asset, as foundation for an innovative international model. According to this perspective, enhanced EU-India ties rely on sectoral cooperation in areas such as critical minerals, batteries, solar and wind power, and green hydrogen. In this view, the aim is not a zero-sum race for leadership, but, on the other hand, a common trajectory of growth: each partner's advancements is supposed to reinforce the other's, and neither can fully achieve green transition objectives without the other. In this sense, bilateral growth bounds the EU and India's development in a new collaborative economic perspective, where cooperation replaces competition as the primary means to achieve collective prosperity.

2. Background and Context

Europe represents one of the largest markets in the world. In recent years, however, the European Union has lost its economic momentum, in favour of stagnation, declining competitiveness, and policy paralysis. Germany, the continent's economic engine, has faced multiple years of recession, reflecting broader structural challenges across the Union. In this respect, issues such as youth unemployment, stagnant wages, and high taxation illustrate only part of a more profound problem, which may have significant repercussions in the coming decades (Giménez, 2025). The Draghi Report on competitiveness identifies three strategic vulnerabilities for the EU: trade, energy, and defence. In clean energy technologies, European firms face strong competition from China, which benefits from lower costs and more flexible regulation. Difficulties in innovation, commercialisation and scaling up have led to industrial crises and plant closures. Specifically, there is no guarantee that Europe will be able to meet its own demand for clean technologies, as Chinese imports remain a faster and cheaper route to decarbonisation (Kumar et al., 2025). Therefore, a strategy is needed to secure supply chains, enhance energy independence, and maintain industrial competitiveness (Draghi, 2024). Against this backdrop, the energy sector could become a game changer for the EU's structural resilience. Green technologies offer opportunities to open new markets while increasing Europe's geopolitical weight. The shift from an oil-based system to a renewables-based one will reshape relations with suppliers such as Russia and require a rethinking of energy security strategies. Critical raw materials, such as lithium and cobalt, risk becoming a tool of geopolitical leverage, like oil and gas nowadays. In this context, cooperation with partners such as India could support fairer trade, diversify supply chains and strengthen Europe's green resilience (Treyer, 2022). Still, Europe remains one of the global leaders in climate action. With continued investment, stronger governance, and deeper international partnerships, the EU can turn the green transition into both a sustainability achievement and a source of industrial and geopolitical competitiveness (Verre, 2020).

On the other hand, India is one of the fastest-growing major economies. Between 2023 and 2024, it recorded an estimated growth rate of 8.2%, with projections of 6.2% in 2025 and 6.3% in 2026. The country aspires to reach high middle-income status by 2047 and climate neutrality by 2070 (World Bank, 2024; News On Air, 2025). On the international stage, India pursues a policy of strategic autonomy, maintaining friendly but non-binding relations with major powers. It is relevant to consider that this multi-alignment approach enables India to participate in multiple initiatives, as it can balance relations between competing powers while pursuing economic growth and geopolitical influence (Pande, 2025). While India's demand for green energy is rising rapidly, coal is still dominant (59.9% of the energy mix) as the main driver for energy production, followed by oil (28.1%) and gas (7.15%). Renewables account for just 2.22%. Imports of coal, gas and oil reinforce external dependence (NITI Aayog, 2025). Nevertheless, progress is visible: by mid-2025, renewable capacity had reached 235.7 GW. From 2014 to 2025, solar capacity grew from 2.82 GW to 110.9, and wind from 21 GW to 51.3. Access to electricity and clean cooking fuels has also expanded steadily, improving living standards (Press Information Bureau, 2025). Despite progress, coal and oil remain central energy drivers. According to the report *Synchronizing Energy Transitions Towards Possible Net-Zero for India*, coal will remain central for at least two decades, with projected investments of 2-2.5 trillion dollars by 2070 (BioEnergyTimes, 2024). Growth potential requires careful coordination and deeper international engagement to overcome structural weaknesses. Therefore, there is significant economic momentum for India, provided that opportunities arising from the adoption of renewables are effectively exploited. The green transition and green energy technologies are fields where market dominance will contribute to the development of a modern India, capable of competing in the global arena while leading innovation. To achieve this objective, it is believed that a stronger collaboration with the European Union may benefit both actors, since their weaknesses are largely complementary. For example, as further explained, the EU possesses machinery and funds for rare earths extraction and refining, but not rare earths in its subsoil. India, conversely, is rich in untapped critical minerals.

3. Critical Minerals

Since 2008, the European Union has been adopting measures to secure critical raw materials (CRMs), starting with the Raw Materials Initiative. This initiative is complemented by the Commission's list of CRMs, regularly updated to effectively address market and geopolitical developments. Currently, European countries rely heavily on raw materials imports, which are mainly produced and supplied by third countries, such as China, Turkey and South Africa. This dependency makes the EU vulnerable to supply disruptions. Therefore, the Critical Raw Materials Act was designed to ensure a secure and sustainable supply, in order to meet climate and digital targets while preserving EU's industrial competitiveness and the single market's integrity. In particular, the Act sets out specific domestic benchmarks by 2030 for the diversification of the EU supplies: at least 10% of the EU's annual consumption for extraction; 40% for processing; 25% for recycling; a maximum of 65% from a single third country. In this context, trade agreements further enhance supply security and lower investment risks (EU Commission, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act_en).

Raw materials are crucial in strategic sectors such as defence, aerospace, electric mobility and renewable energy, essential for national security and geopolitical leverage (Bortoletto, 2025). To establish the significance of each raw material, the EU adopts two main criteria: the economic importance parameter, which determines the end-use application of the mineral, together with its added value in the corresponding manufacturing sector; and the supply risk parameter, which considers the disruption risk in the EU supply, specifically taking into account supply concentration and governance performance of the supplier (Galbo, 2023). For example, in 2024 the EU heavily relied on China for magnesium and gallium, on Brazil for ferro-niobium, on Turkey for borates, on Tajikistan for antimony. Globally, in 2024 95% of critical minerals were imported from China, Malaysia and Russia (EUROSTAT, 2025).

To reduce dependency, the European Union issued 47 supply-diversification projects: 25 on extraction, 24 on processing, and 10 on recycling. These initiatives finance extraction companies that are commercial partners of the Union and capital-intensive initiatives that provide public guarantees, in order to attract private investments (Jamasmie, 2025). Similarly, the European Raw Materials Alliance, launched in 2020, brings together industry, member states, and the European Investment Bank to promote economic resilience, job creation, and innovation investments (EU Commission, https://single-market-economy.ec.europa.eu/industry/industrial-alliances/european-raw-materials-alliance_en).

The Indian territory presents a vast quantity of mineral reserves. However, only 20% of its geological potential has been explored. If resources would be unlocked in a timely, efficient, and sustainable manner, they could transform the country into a global extraction hub, boosting supply worldwide while achieving self-sufficiency in critical minerals supply. The country is foreseen to become a key actor in the minerals sector, as the government's stability, its growing middle class, robust manufacturing ecosystem, and large amounts of investment create an attractive environment for home and foreign markets (Agarwal, 2025). Currently, however, India remains heavily reliant on imports of minerals essential for green technologies, such as lithium, cobalt, nickel, neodymium, and processed silicon. Domestic extraction is constrained by weak regulatory frameworks, limited private sector participation, insufficient incentives, and a lack of technical expertise. Moreover, India's processing and refining capacity is underdeveloped, exposing the country to dependencies. These may turn into structural vulnerabilities since competitors such as China become major suppliers of critical minerals, which are essential for several strategic sectors, including EVs, renewable energy, and defence. Thus, this dependency may be used as geopolitical leverage in the context of bilateral rivalry, in both economic and security sectors (Bansal & Chadha, 2025; Shetty, 2024).

In response, the government has introduced the National Mineral Policy (2019), aimed at enhancing the upstream of critical minerals through sustainable mining, and the more ambitious National Critical Mineral Mission (NCMM, 2024-2031). NCMM's objective is to ensure supply security of at least 15 critical minerals through 1.200 domestic exploration projects and the acquisition of 50 overseas mining assets. It is expected to raise USD 2 billion in investment, together with initiatives on recycling, stockpiling, and research. The mission also includes four regional mineral processing parks, three Centres of Excellence, and 1.000 new patents (IEA, 2025). Complementing this, the 2020 Production-Linked Incentive (PLI) schemes encourage domestic manufacturing through performance-based financial incentives. PLI are implemented in strategic sectors such as automotive, photovoltaics, and semiconductors, in order to achieve greater geopolitical independence. However, while it has supported India's industrial growth, its focus remains largely on end-products rather than upstream extraction and processing, limiting the country's long-term competitiveness (Press Information Bureau, 2025 (1); Bansal & Chadha, 2025).

In the international context, geopolitical challenges highlight the necessity to diversify supply sources through partnerships beyond traditional international relations. New approaches should focus on multilateral collaborations to reduce dependencies while ensuring security. With this view, in 2023 India joined the U.S.-led Mineral Security Partnership (MSP), aligning more closely with Western markets and expertise. Bilateral agreements have also been signed with Japan and Australia, for example the Japan-India Minerals and Metals Partnership and a Memorandum of Understanding with Canberra, which include tariff reduction, mutual investments and trade cooperation. The main objective of these initiatives is to lower Chinese dependencies through diversification of suppliers. Similarly, the Khanij Bidesh India Ltd. (KABIL, 2019) joint venture has further expanded India's footprint in Africa and Latin America. This project aims at enhancing the whole Indian mineral value chain to meet both commercial and domestic demands. It provides preferential access to mineral resources while positioning New Delhi as a potential leader of the Global South in the mineral race, given that the country overcomes its supply weaknesses (Chadha et al., 2025).

4. Batteries

In the field of battery production, the European Union accounts for 7% of global output, with only 15% managed by European-headquartered companies. Globally, China and the USA dominate the battery market, with China leading the supply of battery raw materials. Since the EU's domestic production is insufficient, it is forced to import to meet demand from strategic sectors that implement batteries in major sectors such as automotive (ACEA, 2025). As production costs are 50% higher than in China, European competitiveness is at risk, entailing geopolitical instability and foreign dependencies. Indeed, producers are rethinking industrial plans considering difficulties and uncertainty about future profitability. In this context, the bankruptcy of Northvolt, Europe's main battery producer, is a sign of this process. However, domestic production opportunities exist. For example, Korean investments in Europe, or joint ventures between EU brands, such as Stellantis, and Chinese companies, such as CATL (Lombardo et al., 2025). Indeed, Europe aims to become self-sufficient in battery cell manufacturing by 2026 and in key battery components by 2030. By contrast, 53% of planned battery production is at risk due to delays and cancellations deriving from uncertainty. The main obstacle to onshoring lies in the complexity of the production supply chain, starting from raw materials extraction and processing, which does not allow for a complete onshore (Transport & Environment, 2024). Similarly to the European Raw Materials Alliance, the 2017 European Battery Alliance coordinates national authorities, industry research institutes and relevant stakeholders. Following the Strategic Action Plan on Batteries issued in 2018, the initiative aims at securing access to raw materials, supporting European battery cell manufacturing, strengthening industrial leadership through research and innovation, and securing a highly skilled workforce (EU Commission, https://single-market-economy.ec.europa.eu/industry/industrial-alliances/european-battery-alliance_en).

India's battery manufacturing capacity remains small compared to Chinese or American ones: in 2021, it accounted for less than 1% of global production, with only 18 GWh (Moerenhout et al., 2023). Imports cover most of the Indian demand. To close this gap, the government launched in 2022 the National Programme on Advanced Chemistry Cell (ACC), with a target of 55 GWh capacity (Sun, 2025). The government's aim is to double the battery market by 2030, in order to rapidly emerge as dominant player in battery manufacturing through investment plans, growth of green technology demand, and low cost of manufacturing. PLI schemes have supported local assembly, but bottlenecks persist, including reliance on imported raw materials, insufficient infrastructure, technology gaps in R&D, and shortages of skilled labour. Recycling initiatives, tax benefits, and the new regulatory frameworks, such as the Battery Waste Management Rules, are helping to strengthen domestic supply chains. Foreign investors such as Panasonic, Suzuki, and Toshiba have also entered the market. Still, low EV adoption and high production costs hinder demand growth, together with underdeveloped raw materials' extraction (Fennell, 2025; Agarwal, 2024). The establishment of gigafactories is seen as essential to scale production, in order to ensure self-reliance and reduce geopolitical risks.

5. Solar Power

Solar energy is a key pillar of the EU's green transition. The EU Solar Energy Strategy (2022), part of the REPowerEU plan, aims to expand domestic solar PV capacity, develop skilled labour, and strengthen continental partnerships for onshore production (European Commission, 2022). In addition, the 2022 European Solar PV Industry Alliance's objective is to deploy up to 30 GW of annual solar panels production by 2025, in order to reduce risks and support decarbonisation targets (Solar Alliance, https://solaralliance.eu/). In the EU, the demand for solar panels is mostly covered by China alone (98%). This dependency creates short-term risks for the resilience of the European value chain, including price stability and energy security. Therefore, this weakness is reflected in the field of national security as well. For example, the price drop of solar panels provoked by Chinese competition redirected European producers' investments to other markets, such as the U.S. one, enhancing the structural dependencies from abroad. These mechanisms show the strategic importance of solar panels in the international relations domain (European Solar Charter, https://energy.ec.europa.eu/topics/renewable-energy/solar-energy/european-solar-charter_en).

Solar power is particularly significant in India's green transition. Here, progress has been more substantial. Installed solar capacity increased from 2.82 GW in 2014 to 110.9 GW in 2025, placing the country third worldwide, overcoming Japan (Press Information Bureau, 2025). The National Institute of Solar Energy estimates India's potential capacity at 748 GW, while projections foresee 479 GW of solar panels installed by 2047. Within the 2030 target of 500 GW renewables, solar is expected to account for 280 GW (Mordor Intelligence, 2025). Policy initiatives such as the 2010 Jawaharlal Nehru National Solar Mission (JNNSM) and the 2015 International Solar Alliance (ISA) have created a framework to stimulate major investments in cutting-edge R&D and domestic supply chains, while supporting the vision of a global interconnected solar grid. The final aim is to create a competitive solar grid as quick as possible at affordable prices (India Science, Technology and Innovation Portal, https://www.indiascienceandtechnology.gov.in/st-visions/national-mission/jawaharlal-nehru-national-solar-mission-jnnsm; Press Information Bureau, 2025). The solar sector is tightly linked to the development of storage technologies, since the intermittent nature of this energy source. The government has promoted onshore production of solar batteries to reduce dependency on Chinese imports, with relevant geopolitical implications. PLI schemes and tariff measures such as the Basic Customs Duty (2022) support domestic manufacturing. Between 2024 and 2025, India's solar manufacturing capacity doubled to 74 GW, while PV cell production nearly tripled to 25 GW (Agarwal, 2024; Press Information Bureau, 2025). In addition, a flagship project, the 750 MW Rewa plant in Madhya Pradesh, was achieved, which has attracted major foreign investment and represents an instrument to scale up solar energy domestic production (World Bank, 2024).

6. Wind

Wind represents a major opportunity in the EU energy sector. It is positive that the EU exports more wind turbines than it imports (Eurostat, 2024). The proposed European supergrid, sourcing wind energy from the North Sea, could reduce energy prices by 32% and strengthen energy independence, supported by projects like SCARLET for superconducting cables. It is expected that by 2030 the investments on the supergrid will reach 600 billion euros. The renovation of the European grids is necessary, since 40% of them are more than 40 years old. Cooperation between Member States is essential to reach the independence objectives (Palumberi, 2025).

Beyond solar, India is also a major player in wind energy, ranking fourth globally. The country already shows 51.6 GW of installed capacity and a potential of over 1,100 GW. Government targets foresee 140 GW of installed capacity by 2030 through the support of a strong domestic turbine manufacturing base. This includes companies such as Suzlon and Tata Power (Press Information Bureau, 2025 (2); Mordor Intelligence, https://www.mordorintelligence.com/industry-reports/india-wind-energy-market/companies).

7. Hydrogen

Hydrogen represents a key opportunity in the field of green energy technologies, as its development will be a crucial instrument for the production of green energy in future markets. In 2022, 96% of EU hydrogen production relied on natural gas, generating relevant CO2 emissions. The REPowerEU Strategy aims at producing and importing 10 million tonnes of green hydrogen by 2030, covering 10% of the EU energy mix by 2050. This decarbonising process will have a major impact on energy-intensive industrial and transportation sectors, which are required to reach net-zero emissions. In this trajectory, the European Clean Hydrogen Alliance and European Hydrogen Bank support infrastructure development, investment security, and international coordination (EU

Commission, https://energy.ec.europa.eu/topics/eus-energy-system/hydrogen/key-actions-eu-hydrogen-strategy_en). In the same direction, the H2med project is a significant example of the European hydrogen strategy. It is a hydrogen pipeline that is designed to connect the Iberian Peninsula to Northwest Europe, projected to provide 2 million tonnes of secure and affordable green hydrogen by 2030 (H2med Project, https://h2medproject.com/). Despite these initiatives, production and consumption remain below expectations, requiring strategic investments and imports to meet the 2030 targets (Homann et al., 2025).

In India, the 2023 National Green Hydrogen Mission (NGHM) is part of the decarbonisation objectives of the country. It aims at creating an integrated ecosystem for hydrogen production, usage, and export through cutting-edge technologies and advanced distribution chains. These include innovative pipelines, tankers, and storage facilities. The plan is foreseen to boost Indian competitiveness around green hydrogen (Ministry of New and Renewable Energy, 2023). By 2030, NGHM's target is to produce 5 million tonnes of annual green hydrogen output, together with 125 GW of associated renewable capacity, and cost reductions to USD 1.5/kg. The plan will be supported by USD 90 billion in investment and the creation of 600,000 jobs. This process is expected to reduce fossil fuel imports of more than 11.4 billion euros. Given its resource base and geopolitical positioning, India could emerge as one of the world's lowest-cost producers of green hydrogen by 2050, strengthening both its energy security and industrial competitiveness (Ministry of New and Renewable Energy, 2025; Green Hydrogen Organisation, https://gh2.org/countries/india).

8. Discussion: Collaboration and Future Prospects

For each strategic sector, the EU and India can collaborate to enhance their positions in the green technology landscape. In minerals extraction, India's vast untapped reserves represent a major opportunity for investment. European financing in Indian extraction and processing industries could ensure privileged access to critical raw materials for the EU, while supporting India's industrial upgrading and integration into global value chains. Such an approach, grounded in equitable partnership, would strengthen both sides' resilience in increasingly competitive global supply chains.

A similar logic applies to the battery and hydrogen sectors. Industrial collaboration in batteries and storage technologies would help the EU meet its electrification targets while, at the same time, accelerating India's EV adoption and the integration of renewables into its energy grid. Coordinated investments in green hydrogen, including common standards, shared infrastructure and cross-border value chains, could position the EU and India as key players in emerging hydrogen markets.

Regarding solar and wind power, India's growing demand for solar panels and wind turbines could be partly met by European firms. In return, European companies could invest in India's workforce and manufacturing base, sharing industrial capacities while lowering implementation costs. This process would support the development of a global hub for bilateral manufacturing capable of challenging China's current primacy.

Sectoral cooperation between the EU and India should be grounded on a renewed perspective on sustainability, reciprocity, and long-term resilience. This vision is rooted in peer interdependence, i.e., a framework that prioritises shared goals over unilateral national interests. This innovative approach calls for deeper economic integration and a redefinition of partnership beyond transactional cooperation. This would replace competition and vulnerability with solidarity and mutual strength. As a result, both actors could align their policies to form a unified foundation of international interests, reinforcing their capacity to influence the global system. Such a framework would not only enhance the respective competitiveness of India and the EU, but could also serve as a future model for a more cooperative world order if extended to other countries.

It is relevant to consider that collaborative technological and green projects can turn potential flashpoints into platforms for dialogue. When countries invest together in renewable energy, efficient irrigation, and shared monitoring systems, they create mutual benefits that are costly to jeopardize. Initiatives of this kind could help reframe tensions around the GERD between Ethiopia and Egypt (Verre, 2022), or in post-conflict contexts like Nagorno-Karabakh (Verre, 2025), from zero-sum rivalries into long-term partnerships rooted in shared water security.

9. Conclusions

Both the European Union and India face structural challenges in the development and deployment of green technologies. For the EU, external dependence on critical raw materials, batteries, and solar components represents a potential geopolitical vulnerability. For India, a carbon-intensive energy mix risks undermining its long-term competitiveness in a decarbonising global economy. In both cases, the potential to achieve a successful green transition is evident, but the EU and India still present major delays in its realisation when compared with global leaders such as China. Therefore, investment and effective implementation of green technologies become crucial for future strategic primacy.

At the same time, geopolitical competition is accelerating the need for more resilient and diversified supply chains. In this context, bilateral EU-India partnerships in specific sectors can enhance both actors' positions, since their weaknesses are largely complementary. India lacks the scale of investment required to fully exploit its resource and manufacturing potential, while the EU is constrained by a relatively high-cost green industry that is often over-reliant on foreign supply, which undermines its competitiveness. Critical minerals are a clear example: India's untapped resources offer an opportunity for European investment, in exchange for more secure access to raw materials. According to this scenario, both actors would benefit from enhanced cooperation, that would bring relevant economic expansion and a better positioning in global geopolitics.

If the EU and India succeed in building equitable partnerships, both can benefit from shared achievements. This implies a bilateral relationship grounded in reciprocity and peer interdependence, in which interconnection is regarded as a strategic asset rather than a fragility. Such an approach would entail a shift in the paradigm of international relations: narrowly defined national competition is renounced in favour of a model in which collective prosperity is prioritised. According to this perspective, EU-India cooperation in green technologies can be understood not only as an economic opportunity, but also as an element of a more stable and cooperative international order.

10. References

[1] ACEA (2025). *Fact sheet: EU battery supply chain and import reliance*. https://www.acea.auto/fact/fact-sheet-eu-battery-supply-chain-and-import-reliance/

[2] Agarwal, A. (2025). *Critical minerals and India's role in securing a low carbon global economy*. *World Economic Forum Annual Meeting*. https://www.weforum.org/stories/2025/01/critical-minerals-india-securing-low-carbon-global-economy/

[3] Agarwal, N. (2024). *Indian Battery Sector Report 2025.* Wright Encyclopedia. https://www.wrightresearch.in/encyclopedia/indian-battery-sector-report-2024/

[4] Bansal, K. & Chadha, R. (2025). *Critical Mineral Supply Chains*. Working Paper. https://csep.org/working-paper/critical-mineral-supply-chains-challenges-for-india/

[5] BioEnergyTimes (2024). *Report launch: Mapping India's path to net-zero energy by 2070*. All News, *Ethanol*. https://bioenergytimes.com/report-launch-mapping-indias-path-to-net-zero-energy-by-2070/

[6] Bortoletto, F. (2025, June 4). *EU launches 13 projects in third countries to diversify imports of critical minerals*. EU News. https://www.eunews.it/en/2025/06/04/eu-launches-13-projects-in-third-countries-to-diversify-imports-of-critical-minerals/

[7] Chadha, R. et al. (2025). *State of the Sector: Critical Energy Transition Minerals for India*. Volume I. https://csep.org/Journals/state-of-the-sector-critical-energy-transition-minerals-for-india-vol-1/

[8] Draghi, M. (2024). *The Future of European Competitiveness*. *Part A, A competitiveness strategy for Europe*. https://data.europa.eu/doi/10.2872/9356120

[9] European Commission (2022). *EU Solar Energy Strategy*. *SWD 148*. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52022DC0221

[10] Eurostat (2024). *EU imports in green energy products higher than exports*. *News Articles*. https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20241014-1

[11] Eurostat (2025). *International trade in critical raw materials*. *Statistics Explained*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_critical_raw_materials

[12] Fennell, Z. (2025). *India's ascent in global battery manufacturing*. OMDIA. https://omdia.tech.informa.com/om128512/indias-ascent-in-global-battery-manufacturing

[13] Galbo, A. (2023). *THE EMERGING GEOPOLITICS OF LITHIUM AND LI-ION BATTERIES*. https://iari.site/2023/01/29/the-emerging-geopolitics-of-lithium-and-li-ion-batteries/

[14] Giménez, A. (2025, March 2). *A European's Pessimism, Europe's Decline, and the Question of Irrelevance*. The Gazelle. https://www.thegazelle.org/issue/270/european-pessimism

[15] Homann, Q. et al. (2025). *The Case for Recalibrating Europe's Hydrogen Strategy*. https://rmi.org/the-case-for-re-calibrating-europes-hydrogen-strategy/.

[16] IEA (2025). *National Critical Mineral Mission*. *Policies*. https://www.iea.org/policies/25735-national-critical-mineral-mission

[17] Jamasmie, C. (2025, March 25). *EU selects 47 strategic projects to secure critical minerals access*. Mining.com. https://www.mining.com/eu-unveils-47-strategic-projects-to-secure-critical-minerals-access/.

[18] Kumar, K., Pandey, N. K., Verre, F., & Shah, R. (2025c). Cybersecurity Challenges in the Digitization and Integration of Renewable Energy Systems: a review. *IEEE Transactions on Engineering Management*, 72, 3042–3054. https://doi.org/10.1109/tem.2025.3586557.

[19] Lombardo, T., Paoli, L., Fernandez Pales, A., Gül, T. (2025). *The battery industry has entered a new phase*. Commentary. https://www.iea.org/commentaries/the-battery-industry-has-entered-a-new-phase

[20] Ministry of New and Renewable Energy (2023). *Brief on Green Hydrogen*. *Hydrogen Overview*. https://mnre.gov.in/en/hydrogen-overview/

[21] Ministry of New and Renewable Energy (2025). *Programme/Scheme wise Cumulative Physical Progress as on 31st October, 2025*. *Physical Achievements*. https://mnre.gov.in/en/physical-progress/

[22] Moerenhout, T. et Al. (2023). *India's Potential in the Midstream of Battery Production*. IISD Publications. https://www.iisd.org/system/files/2023-09/india-potential-midstream-battery-production.pdf

[23] Mordor Intelligence (2025). *Battery Industry In India Size & Share Analysis - Growth Trends & Forecasts (2025 - 2030)*. *Battery Research*. https://www.mordorintelligence.com/industry-reports/india-battery-market

[24] News On Air (2025, July 30). *IMF Raises India's Growth Forecast to 6.4% for 2025 and 2026, Retains Status as Fastest-Growing Major Economy*. News on Air. https://www.newsonair.gov.in/imf-raises-indias-growth-forecast-to-6-4-for-2025-and-2026-retains-status-as-fastest-growing-major-economy/

[25] NITI Aayog (2025). *India Climate & Energy Dashboard*. *India Energy*. https://iced.niti.gov.in/energy

[26] Palumberi, F. (2025*). Supergrid europea per la sicurezza energetica*. *Lotta Comunista,* n. 658, p. 17

[27] Pande, A. (2025). *India's multi-alignment and rising geopolitical profile*. *Politics*. https://www.gisreportsonline.com/r/india-strategic-autonomy/

[28] Press Information Bureau, 2025, https://www.pib.gov.in/PressNoteDetails.aspx?id=155063&NoteId=155063&ModuleId=3

[29] Press Information Bureau, 2025 (1), https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=155082&ModuleId=3

[30] Press Information Bureau, 2025 (2), https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=155158&ModuleId=3

[31] Shetty, R. (2024). *Assessing the Nature of India's Critical Minerals Vulnerabilities vis-à-vis China*. *Takshashila Discussion*, Document 2024-12. https://takshashila.org.in/content/publications/20241217-assessing-nature-of-indias-critical-minerals.html

[32] Sun, S. (2025). *Battery Industry in India - Statistics & Facts*. *Metals & Electronics*. https://www.statista.com/topics/11919/battery-industry-in-india/?srsltid=AfmBOopSHdNgeYPxr35IlUdsZdLa3BzgiZ5_l2UMIvVRYAx7Cgsh4ijF#topicOverview
[33] Transport & Environment (2024). *An industrial blueprint for batteries in Europe.* Report. https://www.transportenvironment.org/articles/an-industrial-blueprint-for-batteries-in-europe
[34] Treyer, S. (2022). *Geopolitics and green transition: new balances, new challenges*. *The social and economic challenges of ecological transformation,* Special issue 24, 16-19. https://journals.openedition.org/factsreports/pdf/6854.
[35] Verre, F. (2020). Water conflicts in Western Asia: the Turkish-Syrian regional rivalry over the Euphrates River. *Rivista di Studi Politici Internazionali*, 87(3). https://www.jstor.org/stable/27094394.
[36] Verre F. (2020). Michel 'Aflaq and the Origins of the Syrian Baathist Party. The ideological construction of a 'Civil Religion': 1947-1952. *Africana, Rivista di studi extraeuropei*, 26(1), 197-212. https://www.torrossa.com/en/resources/an/4924894.
[37] Verre, F. (2021). Hydro-Diplomacy in Southeast Asia: The Taiwanese case. Journal of Management Policy and Practice, 22(1). https://doi.org/10.33423/jmpp.v22i1.4177.
[38] Verre F. (2021). The "Green Dragon": China's sustainable development strategy under Xi Jinping, iProgressus. Rivista di storia, scrittura e società, 8(1), 131-154. https://www.rivistaprogressus.it/wp-content/uploads/rivista-progressus-1_2021-finale.pdf.
[39] Verre F. (2021). Chinese' hydropower policy in Myanmar. The cases of Yadanabon Bridge and Myitsone Dam, *Rivista di Studi Politici Internazionali*, 88(2), 225-244. https://rspi.it/wp-content/uploads/02-Indice-2-2021.pdf.
[40] Verre, F. (2022). The dispute between Ethiopia and Egypt over the Grand Ethiopian Renaissance Dam. Rivista di Studi Politici Internazionali, 89(1). https://www.jstor.org/stable/27273599?seq=1.
[41] Verre, F. (2024b). Rethinking the Mosul Dam: a reassessment of its impact beyond the traditional narratives. *Journal of Political Science Bulletin of Yerevan University*, 3(2(8)), 99–121. https://doi.org/10.46991/jops/2024.3.8.099.
[42] Verre, F. (2025b). Water insecurity in the South Caucasus: A Hydro-Strategic Assessment of the Nagorno-Karabakh conflict. *Journal of Political Science Bulletin of Yerevan University*, 4(2(11)), 58–77. https://doi.org/10.46991/jops/2025.4.11.058.
[43] World Bank (2024). *The World Bank in India*. https://www.worldbank.org/en/country/india/overview#3.