



Navigating
EU-India Renewable
Hydrogen Trade:
**Certification
Challenges and
Strategic Pathways**

Technical briefing:
Navigating RFNBO certification

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About the Industrial Transition Accelerator



The Industrial Transition Accelerator (ITA) is a global multistakeholder initiative, **managed by Mission Possible Partnership (MPP)**, to fast-track decarbonisation in energy-intensive industry and transport sectors.

Launched in December 2023 at the COP28 World Climate Action Summit by the UAE COP28 Presidency, UN Climate Change, and Bloomberg Philanthropies, the ITA brings together global leaders from across industry, energy, financial institutions, and governments to overcome challenges and unlock investment at scale to speed up the use of decarbonisation solutions across the following sectors: aluminium, aviation, cement, chemicals, shipping and steel.

Drawing on Mission Possible Partnership's extensive industry networks and deep expertise, the ITA works on the ground to unlock project finance and elevates learnings on the global stage.

The ITA is led by Co-Chairs H.E. Dr. Sultan Al Jaber, Simon Stiell, and Michael R. Bloomberg, supported by the wider ITA Leadership Council.

The Co-Chairs of the ITA



H.E. Dr. Sultan Al Jaber

Minister of Industry and Advanced Technology of the United Arab Emirates and COP28 President



Simon Stiell

Executive Secretary of UN Climate Change



Michael R. Bloomberg

UN Secretary-General's Special Envoy on Climate Ambition and Solutions, and Founder of Bloomberg L.P. and Bloomberg Philanthropies

ITA Leadership Council members come from a variety of organisations — including international industry groups, intergovernmental institutions, and nongovernmental organisations — with a broad set of viewpoints. These diverse views and rich expertise inform the work of the ITA Secretariat. Leadership Council members welcome this publication, but they may not agree with every detail or recommendation. The organisations with which Leadership Council members are affiliated have not been asked to formally endorse this publication.

About Mission Possible Partnership



Mission Possible Partnership (MPP) is an independent non-profit organisation advancing global clean industry transformation. Since 2019, we have been working with some of the most energy-intensive industries – aluminium, aviation, cement, chemicals, shipping and steel – to cut their global GHG emissions. We mobilise business, finance, government and civil society leaders to speed up the

shift to clean materials, chemicals and fuels. Having charted sectoral pathways to net-zero, we continue to forge new territory, lifting the barriers to enable a critical mass of clean industrial projects to break ground by 2030. Mission Possible Partnership has people and partners on the ground in North America, Brazil, Europe, the Middle East, North Africa, India and Asia Pacific.



The India Project Support Programme

To achieve its vision and mission, the ITA is undertaking a series of Project Support Programmes in specific geographies designed to support the pipeline of green industrial projects being developed there. In November 2025, the ITA officially launched its India Project Support Programme.

The India Project Support Programme aims to catalyse action toward decarbonising the country's energy intensive industries and transport sectors. The programme will accelerate India's flagship industrial projects toward investment readiness, focusing on clean, low-carbon growth across chemicals, steel, cement, aluminium,

aviation, and shipping sectors. It will concentrate on unlocking demand, de-risking finance, and fast-tracking projects that can define India's leadership in clean manufacturing.

Structural challenges, including uncertain clean demand, high capital costs, regulatory bottlenecks in lead markets and under-developed infrastructure continue to hinder clean industrial projects' progress toward Final Investment Decision (FID). The India Project Support Programme seeks to address these bottlenecks by mobilising action across stakeholders to align policy, demand, and finance, helping a first wave of flagship projects to bankable status.

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Together, we remain committed to securing a competitive and sustainable future for India's clean industrial developments.



Context and Objective

The European Union's (EU's) Renewable Fuels of Non-Biological Origin (RFNBO) framework establishes detailed conditions under which renewable hydrogen and its derivatives may count towards Member State renewable energy targets. One of the key conditions is the geographic correlation requirement under Article 7 of Commission Delegated Regulation (EU) 2023/1184, which links renewable electricity used for hydrogen production to the bidding zones architecture in the electricity market.

In the EU, bidding zones are used to reflect areas where electricity can flow freely without grid congestion. RFNBO's geographic correlation rule is intended to prevent renewable electricity from being counted for hydrogen production in locations where the grid cannot physically deliver it. This safeguard protects the integrity of the EU power system and ensures that renewable generation and hydrogen production are genuinely linked.

However, electricity systems outside the EU are often structured differently. In some countries, including India, the grid operates as an integrated national system, even though administrative bid areas exist. In such systems, electricity may flow freely across regions and prices may remain

uniform most of the time. As international trade in renewable hydrogen expands, differences in grid structure and market design can affect how RFNBO rules are interpreted and applied in third-country contexts. Where such differences are not adequately addressed, they can create bottlenecks for export-oriented projects in meeting RFNBO criteria, securing investment, and advancing EU–India clean industrial partnerships.

This brief examines how geographic correlation under RFNBO can be applied in integrated country grids from which the EU may plan to import green hydrogen derivatives. Using India as an example, the paper analyses the practical challenges faced by export-oriented projects and outlines options to meaningfully address RFNBO compliance and certification challenges.

The objective of this brief is not to change the environmental safeguards of the framework, but to ensure that implementation supports investable cross-border trade, strengthens the formation of resilient EU–India clean hydrogen value chains, and provides regulatory clarity for projects in markets such as India, while preserving the integrity of the framework and providing a neutral lens to the situation.





Executive Summary

The European Union's decarbonisation pathway places renewable hydrogen at the centre of its industrial strategy. Under the Renewable Energy Directive III (RED III), Member States are required to ensure that at least 42% of hydrogen used in industry is sourced from Renewable Fuels of Non-Biological Origin (RFNBOs) by 2030, increasing to 60% by 2035. Delivering these targets will require rapid scale-up of both domestic production and international supply. Recent analysis suggests that by 2030, only around 60% of projected RFNBO demand will be secured by domestic production and binding import agreements, reinforcing the relevance of resilient international trade partnerships.

India is emerging as a global hub for green hydrogen derivatives production, second only to China in announced clean ammonia and methanol capacity. The current pipeline comprises ~52 announced projects, representing an estimated 30–35 million tonnes per annum (MTPA) of green ammonia and methanol capacity and potential investment of roughly USD 120-150 billion. Supported by strong renewable resource availability and recently concluded tenders discovering green hydrogen prices as low as USD 3.08 per kg, India is well-positioned to be a key partner in building resilient EU–India clean hydrogen value chains. Yet only one commercial-scale green ammonia project has reached Final Investment Decision (FID)¹, with several others at Front End Engineering Design (FEED) or pre-FEED stages. Discussions with project developers indicate that RFNBO compliance, particularly the interpretation and application of geographic correlation under Article 7 of Delegated Regulation (EU) 2023/1184, is a critical barrier to FID.

Under the current RFNBO framework, renewable electricity used for hydrogen production must meet at least one of the following criteria:

A

Generated in the **same bidding zone** as the electrolyser;

B

Generated in an **interconnected bidding zone** where day-ahead electricity prices are **equal to or higher than** those in the electrolyser's zone;

C

Generated in an **offshore bidding zone** that is interconnected with the electrolyser's bidding zone.

The purpose of the geographic correlation requirement in RFNBO is to ensure that renewable electricity used for hydrogen production is linked to the location of consumption — i.e., electricity supplied to hydrogen production should not originate from regions where transmission constraints prevent actual deliverability.

In the EU's context, bidding zones, defined as the *largest geographical area where energy (electricity) can be traded without grid capacity allocation*, function as proxies for structural congestion. Without such safeguards, renewable generation in one structurally constrained area could be claimed for hydrogen production elsewhere, undermining the additionality objective and distorting decarbonisation outcomes within the EU power system.

¹ AM Green Ammonia project of 1 MTPA



Barrier for project developers in India

India's electricity system differs structurally from that of the EU, particularly in how electricity markets are organised, priced, and physically interconnected. Unlike the EU's zonal market design, India operates as a single synchronous national grid where market outcomes, transmission access, and system operations are largely unified. While India defines administrative bid areas for operational purposes, these do not function as structural congestion boundaries in the same manner as EU bidding zones. This creates important distinctions in how geographic correlation under RFNBO rules may be interpreted in practice:

-
- Day-ahead market operations first determine an unconstrained Market Clearing Price (MCP) applicable pan-India. Only in case of transmission congestion is a market splitting process applied, which may result in different Area Clearing Prices (ACP) occurring in less than 0.5% of the time blocks (in FY 24-25), representing a reduction from around 2% over the preceding three-year period.

 - Electricity flows are predominantly governed by long-term transmission access frameworks known as General Network Access (GNA), under which grid network feasibility is assessed at the time of grant of the GNA, confirming that power can flow from the point of generation to any point of consumption across the national grid without transmission constraints. As a result, GNA-based transactions are not subject to congestion-driven market splitting, with renewable generation further accorded dispatch priority in transmission.

 - Further, these bidding areas are also interconnected via the Inter-State Transmission System (ISTS), even though not all areas are adjacent.

These characteristics suggest that India's administrative bid areas do not reflect persistent or structural congestion in the electricity system. Instead, they operate primarily as operational constructs that are activated only in rare instances of transmission constraints. Further, the Central Electricity Regulatory Commission (CERC) Power Market Regulations, 2021, have removed the earlier reference to pre-defined bid areas for market splitting, reinforcing that such areas are not fixed structural zones but are applied dynamically based on system conditions.

For example, consider a solar plant located in Gujarat and a hydrogen or ammonia production facility located in Odisha. In practice, such projects typically source bulk electricity through long-term power purchase agreements (PPAs) supported by transmission access. These regions are physically interconnected through India's national transmission system and operated under a single national market-clearing price for over 99.5% of time periods in FY 2024–25. Yet, under the current interpretation of RFNBO rules, the regions may be treated as separate bidding zones, making the project non-compliant.



In practice, the following challenges are faced by projects in India:

1

Uncertainty on the recognition of India as a single bidding zone

India's electricity market establishes a single national market clearing price nearly all the time, with price separation occurring only as an exception in cases of transmission congestion. However, it remains unclear whether this price formation mechanism, characterised by sustained price uniformity and exception-based market splitting, qualifies as a "single bidding zone" under RFNBO rules.

2

Uncertainty around "interconnected bidding zone" eligibility

Many projects plan to procure renewable electricity with generators located in different Indian states. Even where these non-adjacent areas are physically connected through the national transmission system, it is not clear whether they qualify as interconnected bidding zones under Article 7. While the day-ahead price test would still apply, the eligibility of these areas under the interconnected provision remains uncertain.

3

Treatment of long-term PPAs is unclear

Most green hydrogen derivatives projects rely on long-term renewable PPAs supported by transmission access. However, RFNBO geographic correlation is assessed using day-ahead market price signals generally applicable for short-term markets. There is no separate or distinct guidance for the treatment of long-term contracted electricity, and the same geographic correlation requirements apply as for electricity sourced through short-term markets, including reliance on bidding zones and day-ahead price signals.

In this context, the application of geographic correlation under RFNBO rules may require consideration of India's unique price establishment process, physical interconnection between non-adjacent zones, and the structure of long-term renewable PPAs, rather than relying solely on formal administrative boundaries. While the intent of the RFNBO framework is not in question, challenges arise from structural differences between the EU's zonal congestion-based electricity market design and integrated national grids such as India's



This briefing proposes **four strategic pathways** to enhance clarity and predictability while preserving the safeguards embedded in Article 7:

Recognition of India as a single bidding zone based on its price establishment mechanism, given that the electricity market establishes a single national market clearing price, with market splitting occurring only as an exception. (Owner: Voluntary schemes, supported by interpretative guidance from the European Commission)

1

Clarified interpretation of “interconnected bidding zones” to confirm that physically connected (i.e., by means of one or more inter-connectors as per Article 2(40) of Directive (EU) 2019/944), non-adjacent zones may qualify as interconnected zones and meet requirements of Article 7, subject to price equivalence test. (Owner: European Commission Directorate-General for Energy (DG ENER), Voluntary schemes)

2

Clear distinction between long-term procurement frameworks and short-term market zoning in India, and guidance on how renewable electricity delivered under long-term PPAs supported by country-wide transmission access should be assessed under RFNBO geographic correlation requirements. (Owner: Indian Regulators, European Commission, Voluntary schemes)

3

Reconfiguration of India’s electricity market design to align price establishment with underlying grid conditions, either by ensuring a single national market clearing price at all times without exception-based market splitting, or by consolidating administrative bid areas based on objective congestion and price convergence data. (Owner: Ministry of Power, Grid-India, CEA, CERC)

4

These pathways are not mutually exclusive and may be pursued individually or in combination. Based on recent developments and stakeholder feedback, Pathways 1 and 2 could materially reduce certification uncertainty and seem feasible in the near-term. By contrast, Pathways 3 and 4 would require coordinated regulatory action over a longer time horizon, yet remain important for a durable resolution.

For Pathways 1 and 2, a consistent and predictable application of RFNBO rules across the broader project pipeline would likely require formal interpretative guidance from the European Commission and consensus among voluntary certification schemes on key technical issues.

It is also noted that, under the European Commission’s AccelerateEU plan, a targeted review of the RFNBO production criteria has been brought forward to Q2 2026, ahead of the originally envisaged 2028 timeline. While the review may create the possibility for formal amendments to the Delegated Acts, the scope, timing, and outcomes remain uncertain [35].

While the analysis in this brief focuses on the EU-India context, the underlying challenges are not unique to India. Similar concerns appear in other third-countries. The next 12–24 months represent a narrow decision window for projects in India and other third countries, where developers are targeting commissioning between 2027 and 2030. Regulatory clarity in third-country contexts is therefore not merely a technical certification matter. It is central to unlocking progress of a significant portion of the global pipeline towards FID and strengthening new clean industrial partnerships between the EU and its trading partners.



Context: Strategic Importance of EU–India Clean Hydrogen Trade

EU Renewable Hydrogen Demand and Supply Outlooks

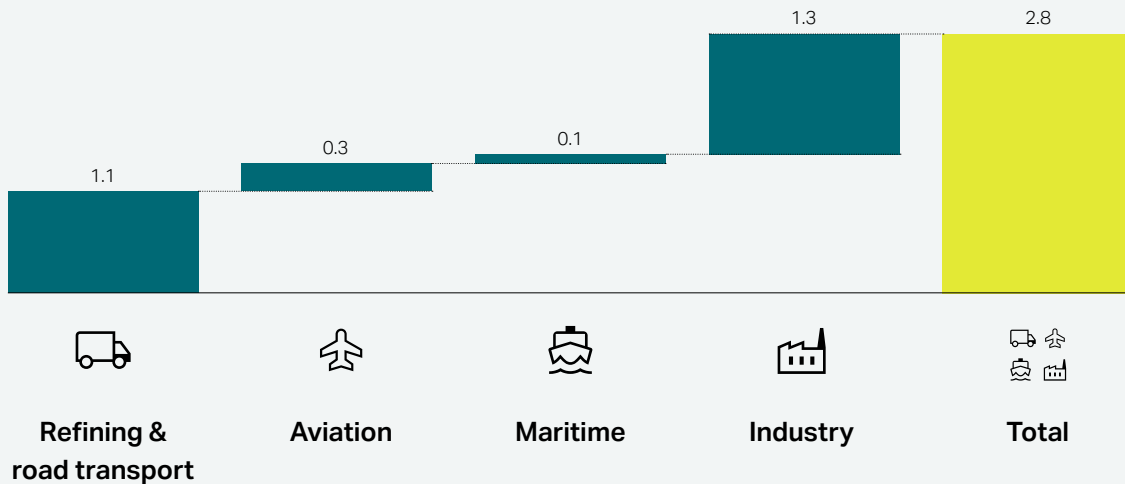
Europe’s decarbonisation targets require a rapid and large-scale deployment of renewable hydrogen across energy-intensive and hard-to-abate sectors. Under RED III, Member States must ensure that renewable fuels of non-biological origin account for at least 42% of hydrogen used in industry by 2030, rising to 60% by 2035. A diversified supply base, combining domestic production and international partnerships, will be important to meeting projected demand across industry and transport (see Exhibit 1).

However, demand is materialising slower than expected. While Member States were required to transpose the Directive’s provisions by 21 May 2025, currently, Denmark is the only country

to have fully transposed RED III by the RFNBO-target deadlines. Several countries, such as the Czech Republic, Romania, and Finland also report partial or advanced progress on binding quotas for hydrogen and transport fuels, but are not yet confirmed as fully compliant [26].

More recent analysis, including Clean Hydrogen Monitor 2025 [19], suggests that **regulatory demand for RFNBO hydrogen in the EU could reach 2.8 – 3.2 Mt by 2030**, with domestic supply amounting to around 1.43 Mt/year and supplemented by only ~0.25 Mt/year of binding import agreements (see Exhibit 2). In total, secured domestic production and binding import agreements could cover roughly 60% of projected regulatory demand, underscoring the importance of building additional supply channels.

Exhibit 1: Estimated regulatory demand for RFNBO hydrogen in the EU by 2030 (Mt/year)



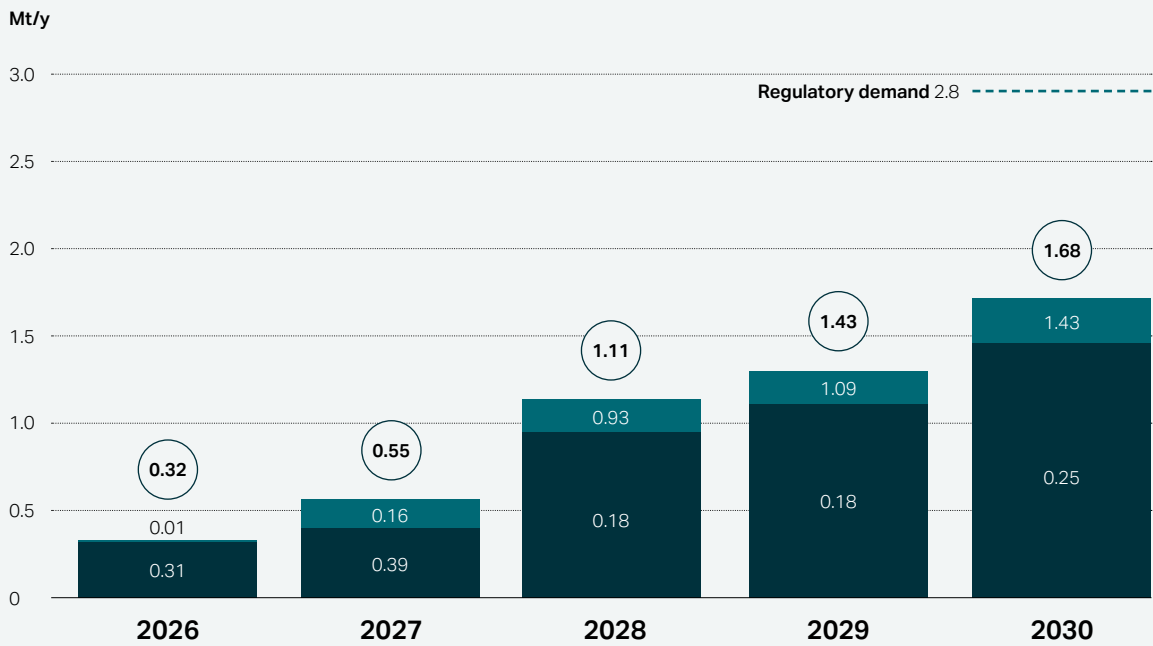
Source: Clean Hydrogen Monitor 2025, Hydrogen Europe



Europe's industrial competitiveness considerations further reinforce the importance of building resilient renewable hydrogen supply chains. International supply partnerships in renewable hydrogen could therefore be an important element of the EU's broader decarbonisation strategy, and the pace at which third-country projects reach FIDs will be relevant to the formation of cross-border value chains aligned with the EU's decarbonisation targets.

Exhibit 2: EU electrolytic hydrogen supply outlook and binding imports vs regulatory demand by 2030

● Binding Imported H₂ Equivalent ● Cumulative electrolytic outlook in Mt/year ○ Total



Source: Clean Hydrogen Monitor 2025, Hydrogen Europe





India's Green Hydrogen Derivatives Pipeline and EU-India Partnership Potential

India is emerging as a **global hub for green hydrogen derivatives production, second only to China in announced clean ammonia and methanol capacity**. India's National Green Hydrogen Mission (NGHM) was launched to position the country as a global leader in clean energy and industrial transition.

Exhibit 3: Clean chemical (ammonia and methanol) pipeline for the top 10 countries

● # projects announced ● # projects at FID (FID + operating) **Total**

Country	# projects announced	# projects at FID (FID + operating)	Total
China	129	30	159
India*	51	1	52
United States	44	5	49
Australia**	40	0	40
Spain	31	1	32
Brazil*	29	0	29
Egypt*	29	0	29
Chile*	28	0	28
Oman*	17	1	18
Canada	16	1	17

* EMDE country in new industrial sunbelt
** Non-EMDE country in new industrial sunbelt

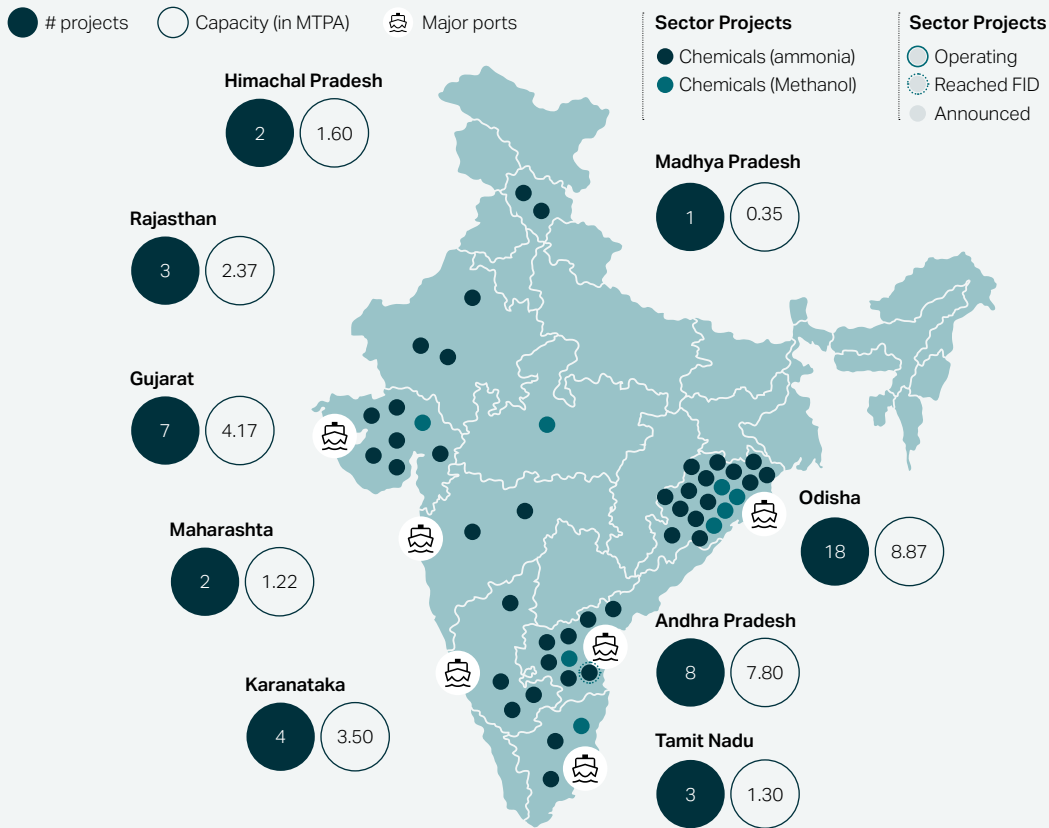
Source: ITA and BCG Analysis [20]





Exhibit 4: Green chemicals (ammonia/methanol) projects in India

The ITA has identified 52 commercial - scale green ammonia and methanol projects aligned with its parameters



Represents a huge opportunity for the country

30-35

Green ammonia/methanol capacity (MTPA)

5-6

Est. Green hydrogen required (MTPA)

120-150

Est. investment (USD billion)

75-80

Est. carbon abatement (MtCO₂ e p.a.)

Note: 1. Pipeline has been identified as per ITA's criteria; It also includes 4 projects where the location is unspecified
Source: ITA and BCG Analysis

The current pipeline comprises ~52 announced projects, representing an estimated 30–35 MTPA of green ammonia and methanol capacity (Exhibit 4). This pipeline could unlock \$120–\$150 billion in investment, create thousands of green jobs, and expand India's green hydrogen capacity between 5 and 6 MTPA by 2030, surpassing the NGHM target of 5 MTPA.

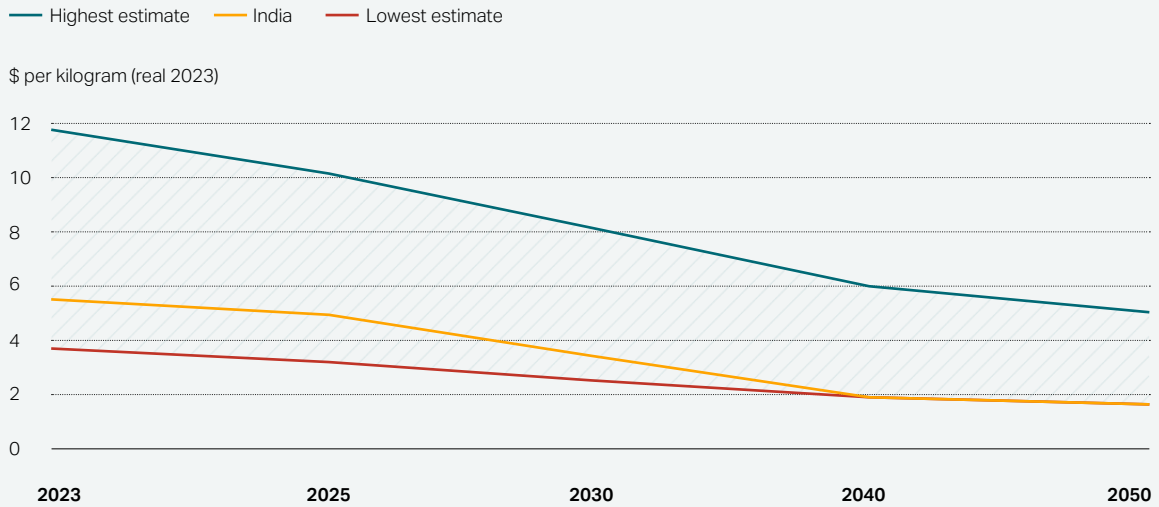
Green ammonia dominates the pipeline with 44 projects and ~30 MTPA capacity, further strengthened by SECI Green Ammonia tender (0.724 MTPA). In parallel, green methanol projects are also taking shape, with at least eight commercial-scale projects underway. In parallel, major Indian ports, including Deendayal (Kandla),

Paradip, and V.O. Chidambaranar (Tuticorin) ports are being upgraded and prepared to handle large-scale exports of green ammonia and methanol, strengthening the country's readiness to serve international markets.

India's pipeline is underpinned by strong renewable resource availability. With solar photovoltaic (PV) costs at \$0.038/kWh, below the global average [30], the levelised cost of hydrogen (LCOH) in India is projected to decline to \$3–3.5 per kg by 2030, significantly below the projected global average of \$5–6 per kg. Notably, recently concluded tenders have already discovered prices as low as \$3.08/kg [24], reflecting India's position as a globally competitive production location.



Exhibit 5: Global LCOH estimates, 2023–2050



Source: BNEF Hydrogen Cost Outlook 2025 [20]

EU-India hydrogen trade can be a mutually beneficial industrial partnership: India’s scale, resource availability, and cost competitiveness in renewable energy and hydrogen production can be complemented by Europe’s strengths in electrolyser manufacturing, advanced technologies, and project development expertise. Bright spots, such as AM Green’s partnerships with European technology providers and offtakers for its large-scale green ammonia plant in Kakinada, demonstrate the potential for EU-India collaboration across the hydrogen value chain. Scaling such collaboration could enable co-development of projects, long-term technology partnerships, and integration of supply chains, strengthening resilience and competitiveness across both regions.

However, progress has been slow. While most projects in India are targeting commissioning between 2027 and 2030, aligning closely with the EU’s renewable hydrogen import ramp-up, only **one project has reached FID**. Discussions with project developers indicate that RFNBO compliance, particularly the lack of clarity on the geographic correlation requirement, has emerged as a critical barrier to FID delaying investment decisions.

In the absence of timely clarification, a significant portion of India’s pipeline risks delays or failure to progress to FID within the targeted timelines, affecting the development of EU-India clean hydrogen value chains and the broader realisation of RED III targets.



EU RFNBO Criteria and the Critical Importance of Bidding Zones

Regulatory Structure of the RFNBO Certification Requirements

The EU's certification framework, codified in Delegated Regulations 2023/1184 and 2023/1185, establishes three foundational requirements for hydrogen production to be counted as renewable for the purposes of EU energy and climate targets [1].

1. Additionality

Hydrogen production must be linked to renewable electricity capacity that is additional to what would otherwise have been deployed. The Delegated Act specifies commissioning timelines and contracting conditions to demonstrate that hydrogen demand does not redirect existing renewable electricity capacity.

2. Temporal correlation

Electricity consumption for hydrogen production must be temporally matched with renewable electricity generation. Until 31 December 2029, monthly correlation is permitted. From 1 January 2030 onward, hourly correlation will apply.



3. Geographic correlation

Article 7 of Commission Delegated Regulation (EU) 2023/1184 sets out the conditions under which the geographic correlation requirement is considered fulfilled. The provision states that the geographical correlation condition shall be deemed complied with if **at least one of the following criteria** relating to the location of the electrolyser is satisfied:

- a. *the installation generating renewable electricity under the renewable power purchase agreement is located, or was located at the time it entered into operation, in the same bidding zone as the electrolyser;*
- b. *the installation generating renewable electricity is located in an interconnected bidding zone, including in another Member State, and electricity prices in the relevant time period on the day-ahead market in the interconnected bidding zone are equal to or higher than in the bidding zone where the renewable hydrogen (or its derivative) is produced;*
- c. *the installation generating renewable electricity under the renewables power purchase agreement is located in an offshore bidding zone that is interconnected with the bidding zone where the electrolyser is located.*

Among the three RFNBO criteria, **geographic correlation plays a particularly important role in linking renewable electricity supply to the physical and economic structure of the power system**. It operates as a safeguard to ensure that the renewable electricity supply is aligned with the defined bidding zone structure of the EU electricity market.



The Significance of Bidding Zones in RFNBO Geographic Correlation Criteria

Within the EU internal electricity market, a “bidding zone” is formally defined in Regulation (EU) 2019/943. Article 2(65) defines a bidding zone as:

“the largest geographical area within which market participants are able to exchange energy without capacity allocation.” [8]

In practice, bidding zones in the EU are established to reflect structural network constraints in the transmission system ensuring market liquidity and efficiency.

Under the RFNBO Delegated Act, geographic correlation requires renewable electricity used for hydrogen production to originate from the same bidding zone as the hydrogen facility, unless the renewable electricity installation is located in **an interconnected bidding zone**, or the renewable electricity is generated in an interconnected offshore bidding zone [1]. Without such safeguards, there is a risk that renewable electricity in one region could be claimed for hydrogen production in another region where **transmission constraints prevent actual delivery**. This could undermine the additionality objective and distort decarbonisation outcomes within the EU power system.

Bidding zone configurations within the EU are not static. Regulation (EU) 2019/943 provides a basis for periodic review of bidding zone configurations — where structural bottlenecks persist or where zone boundaries no longer align with physical network realities, reconfiguration may be considered [8]. This review mechanism underscores that bidding zones are regulatory constructs designed to reflect structural congestion and promote efficient market outcomes.

Interpretation of “Interconnected Bidding Zones” Under Article 7

Article 7(1)(b) of Delegated Regulation (EU) 2023/1184 permits renewable electricity to be sourced from an “interconnected bidding zone,” provided that day-ahead electricity prices in the relevant time period are equal to or higher than those in the bidding zone where hydrogen is produced [1].

The European Commission’s Q&A of 14 March 2024 (Q23) further clarifies the meaning of “interconnected” in this context [11]:

“While interconnected bidding zones are usually adjacent, there may be exceptions, e.g., if the bidding zones are connected via a direct line such as a sub-sea cable but otherwise not adjacent.”

This indicates that **adjacency is not a strict requirement**. Rather, the determining factor is whether bidding zones are physically connected through transmission infrastructure i.e., via direct transmission line.

In the EU, the Electricity Market Directive (EU) 2019/944 Art. 2(40) defines “interconnected systems” in the electricity market as follows:

“a number of transmission and distribution systems linked together by means of one or more interconnectors”

This definition suggests that interconnected systems are not limited to bilateral or adjacent linkages but **may encompass multiple linked transmission systems** forming a wider integrated network.

In the context of Article 7(1)(b), the **operative condition remains the market price equivalence test**. Where day-ahead prices in the production and consumption bidding zones are equal during the relevant time period, this is treated as an indication that structural congestion does not separate the two zones. In such cases, renewable electricity sourcing across those zones, if interconnected, may satisfy the geographic correlation requirement, even if the zones are not directly adjacent.



Rationale Behind Introducing RFNBO Criteria on Geographic Correlation

The geographic correlation requirement under the RFNBO Delegated Act could be understood in the context of structural congestion within the EU internal electricity market.

The EU electricity market operates across multiple timeframes, with short-term markets, particularly the day-ahead market playing a central role in price formation and cross-border trade. In 2023, spot trading on the European Power Exchange (EPEX) SPOT reached record volumes, with 542.1 terawatt-hours (TWh) traded in the Day-Ahead market and 175.7 TWh in the Intraday market [22]. At the same time, EU policy reforms have sought to strengthen longer-term contracting frameworks alongside these markets. As noted by the OECD, reforms introduced in 2023 emphasised increased uptake of long-term contracts, including PPAs and Contracts for Difference (CfDs), to reduce dependence on more volatile short-term markets and enhance investment stability [23].

Despite high levels of market integration, physical grid bottlenecks remain a persistent feature of the EU power system. Congestion management needs increased by 14.5% in 2023, leading to significant system costs [9]. According to the Agency for the Cooperation of Energy Regulators (ACER)'s Market Monitoring Report, the total cost of managing congestion through remedial actions including curtailment, redispatch, and countertrading exceeded Euro (EUR) 4 billion in 2024, affecting approximately 60 TWh of electricity [9].

Further evidence of structural congestion includes:

- In the Core region, only 54% of physical transmission capacity was made available on the most congested cross-border lines in 2024, compared to the 70% minimum requirement under Regulation 2019/943, resulting in an estimated €580 million welfare loss if the rule were fully implemented [7].
- EU infrastructure projects are delayed relative to planned commissioning timelines, prolonging reliance on remedial measures [9].
- ACER notes that TSOs continue to use derogations (exemptions from the 70% capacity rule) because internal congestion and loop flows would violate security limits if capacity were fully opened [9].

Persistent congestion within parts of the EU electricity system provides the context for the introduction of geographic correlation under Article 7 of Delegated Regulation 2023/1184 [1]. By linking renewable electricity attribution to established bidding zone boundaries, the framework ensures consistency with the EU's congestion management architecture under Regulation 2019/943 [8].



Interpretation of Concept of Bidding Zones in Third Countries and Practical Implications for RFNBO Certification

The European Commission's Q&A on the implementation of Delegated Regulations 2023/1184 and 2023/1185 provides additional clarification on how the concept of bidding zones should be applied in third-country contexts.

As stated in the Q&A document:

- *Certifiers should assess whether, at the location of the electrolyser, market regulations applied are similar to the rules set out for bidding zones in Regulation (EU) 2019/943. In this context, "similar" means that there are **rules requiring the establishment of hourly electricity prices in a geographical area**. If such rules are in place, the geographical area for which the prices are established should be considered as a bidding zone for the purpose of the implementation of the methodology.*
- *If such rules are not in place, certifiers should assess whether the **electricity network in the country of production is integrated or whether there are several separated networks**. If there are several networks, each network should be considered as a bidding zone.*
- *If the electricity network of the country is **integrated and there are no geographically differentiated electricity prices**, the whole country may be considered as one bidding zone for the purpose of the implementation of the RFNBO Delegated Act.*

Therefore, in third-country contexts, the concept of a bidding zone needs to be interpreted based on the:

1. Presence of hourly price establishment mechanisms;
2. Physical integration of the electricity network; and
3. Absence of geographically differentiated pricing

This clarification is significant since electricity system design differs materially between the EU and third countries. In systems such as India's, the electricity grid operates as a nationally integrated synchronous network with centralised dispatch, where administrative bid areas exist primarily for operational purposes rather than as representations of structural congestion. Price formation is based on a single national market clearing price under normal conditions, with market splitting and zonal price differentiation occurring only as an exception in cases of transmission constraints. Congestion is therefore managed operationally, and electricity prices remain uniform across regions for nearly all time periods. **As a result, administrative bidding boundaries in such systems may not serve as reliable proxies for structural congestion** in the same manner as in the EU, and their treatment for purposes of assessing compliance with the geographical correlation requirement requires context-specific interpretation.



Geographic Correlation Challenge for Clean Hydrogen Projects in India

As outlined above, India is emerging as a significant partner to the EU in clean hydrogen value chains. However, as noted, regulatory clarity on RFNBO compliance has become a decisive factor in project progression. The interpretation of geographic correlation under Article 7 has emerged as a key issue for export-oriented developers.

In practice, many of the announced projects plan to source renewable electricity through long-term PPAs with generators located in different Indian states and electricity delivered through the national transmission system. These projects are generally capable of meeting RFNBO additionality and temporal correlation requirements. However, because renewable generation and hydrogen production may be located in different administrative bid areas, **it is unclear whether such sourcing qualifies as originating from the "same bidding zone" or from an eligible "interconnected bidding zone" under Article 7.**

The uncertainty spans recognition of India's price establishment mechanism, interpretation of physically connected regions as interconnected bidding zones, and treatment of long-term PPA-based electricity supply. Understanding how geographic correlation applies to integrated grid systems is therefore critical to advancing EU-India clean industrial partnerships.

Overview of India's Electricity Grid and Bid Areas

What is the configuration of India's electricity grid and bidding zones?

India operates a **single, synchronous national grid, functioning at one frequency and coordinated centrally** by the National Load Dispatch Centre (NLDC), Regional Load Dispatch Centres (RLDCs), and State Load Dispatch Centres (SLDCs). The system is physically integrated and fully synchronised across the country. The Government of India formally describes this framework as "One Nation, One Grid, One Frequency," reflecting the physical integration of the country's electricity system under a unified operational structure [28]. The Inter-State Transmission System (ISTS) functions as a unified national backbone. While congestion may occur in specific zones, it is limited and reflected through temporary market splitting, with a single national price prevailing for most (over 99%) time periods.



Price Establishment Process and Role of Bidding Areas

Under Indian regulation, a “bid area” is defined as:

“The largest geographical area within which market participants are able to exchange energy without capacity allocation.” [16]

This definition is materially identical to the EU definition of a “bidding zone” under Regulation (EU) 2019/943.

The price discovery process in the Indian Day-Ahead Market follows a sequential methodology, in which a single national price is established first and transmission constraints are incorporated subsequently [29].

Step 1: Uniform Price Auction Framework

IX Business Rules state that the market operates as a “double sided close bid auction with uniform Market Clearing Price for all buyers and sellers.”

The market is designed to clear all accepted bids at a single price, ensuring that buyers and sellers across the nation transact at a common market clearing price.

Step 2: Determination of Unconstrained Market Clearing Price (MCP)

Business Rules state that “all bids and offers are aggregated and Provisional Market Clearing Price or Unconstrained MCP will be determined... based on the unconstrained scenario.”

Price discovery is first carried out by treating the entire national grid as a single market without any transmission limitations. All supply and demand bids across India are pooled together to determine a single unconstrained market clearing price.

Step 3: Introduction of Transmission Constraints After Price Discovery

Business Rules further state that “based on the ATC received from NLDC, the Exchange will re-run the bid matching process...”

Transmission constraints are not part of the initial price formation. Instead, they are introduced only after the unconstrained price has been established, through verification of available transfer capacity across transmission corridors.

Step 4: Outcome in the Absence of Congestion

Business Rules imply that where sufficient transmission capacity is available, the unconstrained MCP remains valid.

In the absence of congestion, the initially determined national price continues to apply uniformly across all regions, with no differentiation between bid areas.

Step 5: Market Splitting in Case of Congestion

Business Rules state that “in case of congestion... the solution shall be determined through market splitting process, which may result into different prices for different areas.”

Only when transmission constraints prevent the system from clearing as a single market does the exchange apply market splitting. This results in Area Clearing Prices (ACP) for specific areas affected by congestion.



In summary: The market is designed to clear at a uniform price by default and to split into area-specific prices only in response to physical transmission constraints, which occurs on an exceptional basis (~0.5% of time in FY 2024–25). This characteristic is central to assessing whether India's price establishment mechanism aligns with the intent of bidding zone-based geographic correlation under RFNBO rules.

The above-mentioned congestion data represents a reduction from the preceding three-year period (July 2022 – June 2025), during which price divergence across zones was observed in around 2% of time intervals. This indicates that congestion has declined over time and remains limited and episodic in nature. Available operational data further suggests that such instances are largely localised to specific corridors for example, higher incidence has been observed in pockets such as the Punjab corridor (~1.8%), parts of the Southern region including Kerala (~0.48%), and certain Northern region flows (generally below 1%) while most inter-regional flows exhibit minimal congestion [37].

Further, the regulatory framework governing market splitting in India has evolved over time. Under the earlier CERC Power Market Regulations, 2010, market splitting was explicitly defined with reference to "pre-determined bid areas or zones" identified in advance by the system operator [31]. **However, in the updated CERC Power Market Regulations, 2021, reference to pre-defined bid areas has been removed. Instead, market splitting is now described as a mechanism applied in the presence of transmission congestion, without mandating fixed or pre-notified bidding zones [32].** This shift indicates that bid areas in India are not designed as persistent structural congestion boundaries, but rather as operational constructs that may be invoked dynamically in response to congestion conditions.

Electricity Market Structure and the Role of Power Purchase Agreements

How is electricity for green hydrogen and its derivatives projects sourced and what are its implications for grid congestion?

A further structural factor reinforcing the integrated nature of India's electricity system is the General Network Access (GNA) regime. Unlike a market model that relies predominantly on short-term trading and zonal congestion signals, **India's electricity flows are largely scheduled through long- and medium-term transmission rights under GNA, where network feasibility is assessed upfront to ensure that contracted power can be delivered across the national grid without transmission constraints.**

Under this framework:

- **Approximately 90 per cent** of national electricity consumption is scheduled through long- and medium-term PPAs [18]. These agreements are signed for 25 years.
- These long-term electricity flows are supported by **prior network feasibility assessments**, ensuring congestion-free delivery under the GNA framework.
- Renewable power under long-term contracts **does not require separate cross-zonal capacity allocation** between production and consumption locations. Once GNA is granted, transmission access is assured across the national grid without reliance on short-term market-based congestion management. As a result, GNA-based electricity supply operates independently of short-term market splitting.
- Only about 10-12 per cent is routed through short-term markets or power exchanges. Within this framework, renewable generation under **Green GNA is accorded the highest scheduling priority**, followed by conventional GNA and then Temporary General Network Access (TGNA). CERC (Indian Electricity Grid Code) Regulations, 2010 states that "The SLDC/RLDC shall make all efforts to evacuate the available solar and wind power and treat as a must-run station [5]".



This structure has three implications:

1. Electricity flows relevant for hydrogen production are largely governed by long-term PPAs under GNA rather than short-term market outcomes.

A significant share of electricity in India, including that contracted by hydrogen project developers, is sourced through long-term PPAs with assured transmission access. These transactions are not dependent on short-term market clearing or zonal price signals. However, under current RFNBO provisions, geographic correlation is assessed based on day-ahead market constructs, creating a disconnect between how electricity is procured in practice and how compliance is evaluated.

2. GNA enables pan-India electricity delivery without congestion-linked capacity allocation between regions

Under the GNA framework, network feasibility is assessed upfront at the time of grant, ensuring that electricity can be scheduled and delivered from any injection point to any withdrawal point across the national grid. As a result, long-term contracted electricity does not require separate cross-zonal capacity allocation and is not subject to congestion-driven market splitting, reinforcing the integrated nature of the grid.

3. Priority dispatch and transmission access of renewable supply

Renewable generation under Green GNA is accorded priority in scheduling and dispatch, reducing curtailment risk and ensuring delivery certainty for contracted renewable power. This strengthens the physical linkage between renewable generation and hydrogen production across different regions integrated by the national grid.

Interconnected Bidding Zone Interpretation in the Indian Context

Do bid areas in India satisfy the criteria of “interconnected bidding zones” under Article 7(1)(b), when assessed against physical interconnection and day-ahead price equivalence?

Article 7(1)(b) of Delegated Regulation (EU) 2023/1184 allows renewable electricity to be sourced from interconnected bidding zones, subject to day-ahead price equivalence [1][11].

India operates a single synchronous national grid in which all bid areas are physically interconnected through the ISTS (there may or may not be a direct line). Under the *Electricity Market Directive (EU) 2019/944*, an “interconnected system” refers to transmission systems linked by one or more interconnectors.

Accordingly, even if India’s administrative bid areas may not qualify as “interconnected bidding zones” as per the Commission’s Q&A, particularly where no direct line exists between specific zones, they may nevertheless **be interpreted as interconnected under the broader definition set out in the Electricity Market Directive, subject to the price equivalence test. Hence, it may be interpreted that the operative test under the interconnected definition is demonstrable physical interconnection and price equivalence, rather than geographic adjacency alone.**



Illustrative Example

Consider a solar plant located in Gujarat and a hydrogen or ammonia production facility located in Odisha which may be interpreted as separate administrative bidding areas.

Under India's unified synchronous grid:

- The project procures renewable electricity through a long-term (25-year) PPA supported by GNA, enabling supply at uniform contracted prices.
- The GNA framework confirms that electricity can physically flow from the point of generation in Gujarat to the point of consumption in Odisha, based on prior network feasibility assessment, which governs the majority of electricity transactions in India.
- For the remaining share of short-term market transactions (approximately 10%), a single national market clearing price is established for over 99.5% of time periods in FY 2024–25, with divergence occurring only in exceptional cases of transmission congestion.
- Both regions are physically connected through the Inter-State Transmission System (ISTS), forming part of a single synchronised national grid.
- Renewable generation is prioritised in dispatch under Green GNA.

However, under the current RFNBO interpretation, this project may not satisfy the geographic correlation requirement, as the electrolyser and solar plant may be treated as being located in separate administrative bid areas, and the zones may be considered non-adjacent despite being physically connected, thereby not qualifying under the interconnected bidding zone provision either. **Hence, there is a need for clarification on the interpretation of bidding zones and interconnected zones in the context of integrated electricity systems, to ensure that such projects can be assessed in line with their underlying physical and market characteristics.**

Note: Beyond geographic correlation, certain certification-related requirements may also affect RFNBO compliance for Indian developers. India's policy framework provides a time-bound waiver of ISTS charges for renewable electricity supplied to green hydrogen projects, currently available to projects commissioned on or before 31 December 2030 [36]. In some cases, eligibility for this waiver is conditioned on restrictions on the issuance of Renewable Energy Certificates (RECs) or other Energy Attribute Certificates (EACs). This creates a potential conflict with RFNBO compliance: under the EU framework, demonstration of renewable electricity sourcing relies on the issuance and cancellation of EACs to ensure traceability and prevent double counting. When REC/EAC issuance is restricted or prohibited, projects may struggle to evidence compliance with additionality and geographic correlation requirements

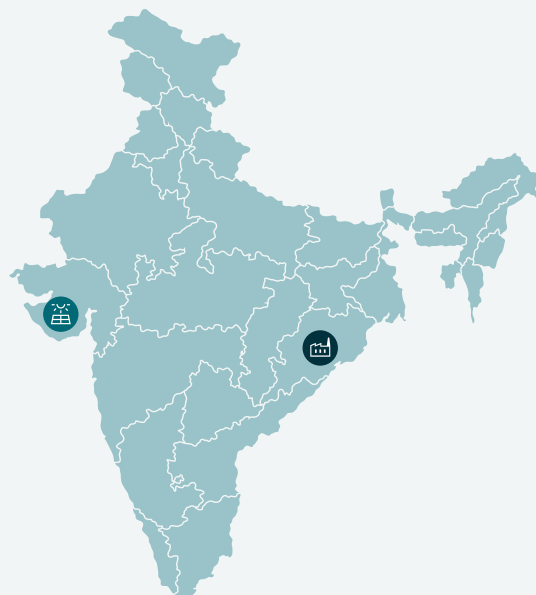
Exhibit 4: Illustrative example of cross-regional renewable supply



Electrolyser and Ammonia Production Facility



Solar plant





Recent Positive Developments in EU–India Industrial Partnerships and Regulatory Landscape

Recent developments in EU–India economic and regulatory engagement provide a constructive context for advancing dialogue on renewable hydrogen certification and cross-border trade.

In early 2026, **the European Union and India concluded negotiations on a comprehensive Free Trade Agreement (FTA)**, marking a significant milestone in their bilateral economic relationship [12]. Alongside the FTA, leaders agreed to deepen cooperation in clean energy and climate action, including the establishment of dedicated mechanisms to advance renewable hydrogen collaboration.

As reflected in the Joint Statement of 2026, the EU and India agreed to operationalise a **Green Hydrogen Task Force** to foster cooperation on hydrogen production, storage, and distribution to support efforts to decarbonise hard-to-abate sectors [13].

These structured cooperation platforms provide a formal channel through which issues related to RFNBO implementation, including interpretation of geographic correlation and interconnected bidding zones, may be examined in a coordinated manner.

In parallel, recent developments within the European Parliament indicate growing attention to the practical implementation of the RFNBO framework and catalyse sector’s development. A cross-party group of Members of the European Parliament formally called for an **accelerated review of the RFNBO Delegated Acts** [25].

More recently, under the European Commission’s AccelerateEU plan, **a targeted review of the RFNBO production criteria has been brought forward to Q2 2026**, ahead of the originally envisaged 2028 timeline [35]. In principle, this create the possibility for formal amendments to the Delegated Acts, including aspects related to geographic correlation requirement. However, the scope, timing, and outcomes of such a review remain uncertain.

Further, at project level, **AM Green’s** green ammonia project in Kakinada (Andhra Pradesh), one of the few projects to have reached Final Investment Decision (FID), provides an early example of EU–India collaboration across the hydrogen value chain:

- **EU technology partnerships:** The project involves several European technology providers, underscoring the role of EU industrial capabilities in enabling large-scale hydrogen and green ammonia production in India. Electrolyser technology is being supplied by John Cockerill (Belgium), Air Liquide (France) is providing the nitrogen generation unit, and Casale (Switzerland) is serving as the ammonia technology licensor and engineering partner for the green ammonia complex.
- **EU-linked offtake arrangements:** The project has secured long-term offtake agreements with European and global buyers such as Yara Clean Ammonia, Uniper, and RWE, reflecting alignment with emerging European demand for RFNBO-compliant hydrogen derivatives. [34]

Taken together, the FTA framework, the establishment of the Green Hydrogen Task Force, and emerging project-level collaborations indicate a growing alignment between EU and India’s renewable hydrogen markets. These developments signal a shared commitment to scaling renewable hydrogen trade while strengthening cross-border value chains across technology, production, and offtake. They also provide a timely and structured platform to address outstanding certification and regulatory questions, including the application of RFNBO geographic correlation requirements, in a manner that supports both investment certainty and long-term trade development.



Strategic Pathways to Address RFNBO Challenge and Unlock EU–India Clean Trade

Summary

The analysis above indicates that implementation challenges arise not from the objectives of the RFNBO framework, nor from the practical functioning of the Indian electricity market, but from differences in electricity market design, terminological interpretation, and grid architecture between the EU and certain third countries.

The following pathways aim to preserve the intent of the Delegated Regulation while enhancing clarity, predictability, and proportionality in third-country contexts.

Path #	Pathways	Description	Feasibility
Path 1	Recognition of India as a single bidding zone based on its price establishment mechanism	Owner: Voluntary Schemes supported by interpretative guidance from the European Commission) Recognise that India’s electricity market qualifies as a single bidding zone, given that a single national market clearing price is always established , with market splitting occurring only as an exception in cases of transmission congestion.	High: Relies on interpretation of existing price formation mechanisms without requiring modification of the Delegated Regulation
Path 2	Clarified Interpretation of “Interconnected Bidding Zones” to include non-adjacent zones	Owner: European Commission (DG ENER), Voluntary schemes Provide interpretative clarification that physically connected electricity systems including non-adjacent zones linked through transmission infrastructure may qualify as “interconnected” under Article 7 and as per the EU Electricity Market Directive, subject to the existing day-ahead price equivalence test.	High: Relies on interpretative clarification without reopening the Delegated Regulation
Path 3	Distinction Between Long-Term Procurement and Short-Term Market Zoning and guidance within RFNBO on treatment of long-term PPAs	Owner: Indian Regulators (Ministry of Power, Grid-India, Central Electricity Authority (CEA), and Central Electricity Regulatory Commission (CERC)); European Commission (DG ENER) Indian regulators to provide clarification that renewable electricity delivered under long-term transmission access frameworks such as General Network Access (GNA) operates independently of short-term congestion-based market splitting. In parallel, European Commission to provide guidance within RFNBO implementation or certification methodologies on how renewable electricity procured through long-term PPAs supported by country-wide transmission access should be assessed under geographic correlation requirements.	Medium: Requires coordinated clarification at both national and EU levels and explicit amendment in regulations
Path 4	Reconfiguration of India’s electricity market design to align price establishment with underlying grid conditions	Owner: Indian Regulators (Ministry of Power, Grid-India, Central Electricity Authority (CEA), and Central Electricity Regulatory Commission (CERC)) Reconfigure the electricity market design to align price establishment with underlying grid conditions, either by ensuring a single national market clearing price at all times without exception-based market splitting, or by consolidating administrative bid areas based on objective congestion and price behaviour.	Low: Requires structural reforms, regulatory amendments, and stakeholder consultation

The strategic pathways outlined above are not mutually exclusive. They can be pursued individually or in combination to address compliance barriers across stakeholders. In practice, combining EU-level clarification with domestic regulatory alignment in India could significantly reduce certification uncertainty (combination of pathway 1 and 2).



Deep-Dive on Strategic Pathways

Path 1: Recognition of India as a Single Bidding Zone Based on its Price Establishment Mechanism

Article 7(1)(a) of Delegated Regulation (EU) 2023/1184 permits renewable electricity to be sourced from the “same bidding zone” as the electrolyser. Under Regulation (EU) 2019/943, bidding zones are defined as geographical areas within which electricity prices are established for the purposes of market clearing.

The European Commission’s Q&A on the implementation of the Hydrogen Delegated Acts further clarifies that certification bodies should assess whether rules exist for the establishment of electricity prices within a geographical area, and that such areas should be considered as bidding zones. In this context, bidding zones are intended to reflect areas where structural congestion is limited.

In the Indian context, the day-ahead market is designed to establish a single national market-clearing price under normal system conditions, with market splitting and zonal price differentiation occurring only as an exception in cases of transmission congestion. Price discovery is first carried out on an unconstrained basis across the entire national grid, and constraints are introduced only subsequently. As a result, a single national price is established for ~99.5% of time periods (based on FY 2024–25 data).

This price establishment mechanism reflects the absence of persistent structural congestion across the system under normal operating conditions. Administrative bid areas are activated only in limited instances of congestion and do not represent enduring structural price zones in the same manner as EU bidding zones.

In this context, **voluntary schemes could recognise that India’s electricity market satisfies the underlying rationale of a single bidding zone under Article 7(1)(a), based on the manner in which prices are established and the limited role of congestion-driven market splitting.**

Such recognition would align the assessment of geographic correlation with actual market design and price formation, rather than relying solely on formal definitions of bid areas. In practice, this would enable renewable electricity sourced across different regions within India to be treated as originating from the same bidding zone, where a single national price is established.

It should be noted, however, that voluntary schemes are not mandated to make country-wide or system-level determinations. Their role, consistent with the European Commission’s Q&A guidance, is to apply the relevant criteria on a project-by-project basis.

While such assessments may enable individual projects to demonstrate compliance, achieving consistent outcomes across a broader project pipeline would likely require further interpretative guidance from the European Commission at the system level.



The key implementation considerations for this pathway are summarised below:

Particulars	Details
Owner	Voluntary schemes, European Commission; Indian policymakers (to provide clarification on India's grid structure)
Feasibility	High: Relies on interpretation of existing price formation mechanisms and publicly available market data, without requiring modification of the Delegated Regulation
Impact on projects	Very high: Cross-regional renewable sourcing across India would qualify under the "same bidding zone" condition, significantly reducing uncertainty for export-oriented hydrogen projects
Advantages	<ul style="list-style-type: none"> ➤ Aligns RFNBO geographic correlation assessment with actual price formation mechanisms in integrated electricity systems ➤ Provides regulatory certainty for cross-state renewable sourcing without requiring structural market redesign or redefinition of bidding zones ➤ Maintains environmental integrity by relying on observable price formation as an indicator of congestion
Challenges	<ul style="list-style-type: none"> ➤ Requires acceptance and alignment among voluntary schemes and the European Commission to ensure consistent application ➤ Recognition based on current price establishment may require reassessment if market design evolves or if frequency of congestion-driven price divergence increases over time

Path 2: Clarified Interpretation of "Interconnected Bidding Zones" to include non-adjacent zones

Article 7(1)(b) of Delegated Regulation (EU) 2023/1184 permits renewable electricity to be sourced from an "interconnected bidding zone", provided that day-ahead electricity prices in the relevant period are equal to or higher than those in the hydrogen production zone.

The European Commission's Q&A clarifies that adjacency is not a strict requirement, and that physically connected zones, even if not geographically contiguous, may qualify as interconnected. This interpretation is consistent with the broader framework of the EU electricity market. Article 2(40) of Directive (EU) 2019/944 defines "interconnected systems" as "a number of transmission and distribution systems linked together by means of **one or more interconnectors**." Accordingly, interconnected bidding zones may include non-adjacent zones linked through transmission infrastructure.

DG ENER could provide formal clarification confirming that interconnected zones include

physically connected electricity system(s), including those comprising more than two non-adjacent linked zones, where day-ahead prices demonstrate the absence of structural congestion.

This clarification would align interpretation with the Electricity Market Directive's definition of interconnected systems and maintain the centrality of the price test. It would not modify the Regulation but would provide interpretative certainty.

In practice, this would allow physically integrated grids to be assessed on the basis of interconnection and price behaviour rather than strict geographic adjacency.

In addition, there is a **need for clarity on how the price equivalence condition is applied over time** and how deviations are treated.

The current framework does not explicitly specify whether compliance with Article 7(1)(b) must be assessed continuously or at the time of commissioning, nor how periods of non-compliance should be treated.



There is a need for clarity on the treatment of differences in market time resolution. In India, electricity markets operate at **15-minute intervals**, whereas RFNBO provisions assess price equivalence on an hourly basis. Clarification is required on how the price equivalence condition under Article 7(1)(b) should be applied in such contexts.

Given that electricity prices may diverge in limited time periods due to occasional congestion, the absence of clear guidance creates uncertainty

for long-term projects. **Clarification could be provided on whether a form of grandfathering applies where the price equivalence condition is met at the start of operations, and whether a proportional approach should apply in cases of temporary non-compliance, whereby only output corresponding to non-compliant periods is excluded rather than the entire production.** Such clarification would enhance investment certainty while remaining consistent with the treatment of similar provisions under the RFNBO framework.

The key implementation considerations for this pathway are summarised below:

Particulars	Details
Owner	DG ENER (interpretative clarification) in coordination with voluntary schemes
Feasibility	High: Relies on interpretative clarification without reopening the Delegated Regulation
Impact on projects	Medium to High: Green hydrogen derivative projects securing renewable electricity (RE) from non-adjacent zones with same or higher prices will be covered under the same bidding zone.
Advantages	<ul style="list-style-type: none"> > Strengthens legal certainty by clarifying the scope of “interconnected” within the existing Article 7 framework > Maintains environmental safeguards by preserving the price equivalence test as the core congestion indicator
Challenges	<ul style="list-style-type: none"> > Administrative and compliance requirements related to demonstrating hourly price equivalence across interconnected bidding zones would need to be supported by a clear and standardised verification methodology. Note: However, given that hourly generation and consumption reporting will already be required under temporal correlation rules from 2030, the incremental burden may be limited provided reliable official price data is publicly available. > Potential regulatory uncertainty if price equivalence is not consistently maintained over time, requiring reassessment of eligibility and creating risk for long-term projects, unless appropriate grandfathering provisions are introduced.



Path 3: Distinction Between Long-Term Procurement and Short-Term Market Zoning and Guidance Within RFNBO on the treatment of Long-Term PPAs

In systems where electricity flows are predominantly governed by long-term transmission access frameworks such as the GNA regime in India, renewable electricity delivered under long-term PPAs operates independently of short-term congestion-based market splitting.

Under the GNA framework, network feasibility is assessed upfront to ensure that electricity can be scheduled and delivered across the national grid without transmission constraints. As a result, long-term contracted electricity is not dependent on short-term zonal price segmentation and does not rely on congestion-driven market outcomes.

Indian regulators could formally clarify, through appropriate regulatory documentation, that renewable electricity delivered under long-term transmission access frameworks operates **independently of short-term market zoning and is supported by assured physical deliverability across the national grid.**

In parallel, guidance at the European Commission could **clarify how renewable electricity delivered under long-term PPA structures supported by transmission access should be assessed** under RFNBO geographic correlation requirements. This would ensure that certification methodologies appropriately reflect the operational distinction between long-term contracted supply and short-term spot market price formation.

The key implementation considerations for this pathway are summarised below:

Particulars	Details
Owner	<ul style="list-style-type: none"> ➤ Indian regulators (e.g., Ministry of Power, CERC, Grid-India) and ➤ European Commission (DG ENER) in coordination with certification bodies.
Feasibility	Medium: Requires coordinated clarification at both national and EU levels and explicit amendment in regulations
Impact on projects	High: Provides a clear pathway for projects relying on long-term PPAs to demonstrate compliance without being constrained by short-term market constructs
Advantages	<ul style="list-style-type: none"> ➤ Better reflects the operational reality of systems where long-term PPAs via GNA govern electricity flows rather than short-term congestion-driven market splitting ➤ Aligns RFNBO geographic correlation assessment with physical delivery and contractual structures rather than short-term market signals
Challenges	<ul style="list-style-type: none"> ➤ Requires clear and formal regulatory documentation or explanatory guidance, along with alignment with EU interpretative standards, to ensure credibility and acceptance by certification bodies ➤ May require amendments or detailed guidance under the RFNBO framework, which can be time-consuming to develop and implement ➤ Coordination between national and EU authorities is necessary to avoid divergent interpretations.



Path 4: Reconfiguration of India's Electricity Market Design to Align Price Establishment with Underlying Grid Conditions

The geographic correlation requirement under Article 7 of Delegated Regulation (EU) 2023/1184 relies on bidding zone boundaries as proxies for structural congestion. In India, however, the electricity market is designed to establish a single national market-clearing price under normal conditions, with market splitting occurring only in cases of transmission congestion.

While this design already reflects a largely integrated system, **the continued existence of exception-based market splitting and administrative bid areas may create ambiguity** in how the system is interpreted under RFNBO geographic correlation requirements.

Under this pathway, Indian regulators could undertake structural reforms to further align price establishment with underlying grid conditions.

One approach would be to modify the price establishment mechanism to ensure that a single national market-clearing price is maintained at all times, including in periods of congestion. Under such a design, transmission constraints would be managed operationally by the system

operator without resulting in market splitting or zonal price differentiation. This would eliminate exception-based price divergence and ensure that the market consistently operates with a uniform national price.

Alternatively, regulators could rationalise and consolidate administrative bid areas based on objective evidence of congestion and price behaviour. Where analysis demonstrates that certain regions are not separated by persistent structural congestion, these areas could be combined into larger administrative bidding areas. This would align the formal definition of bidding areas more closely with actual grid conditions, while still allowing for zonal differentiation where justified by underlying network constraints. Such an approach would be consistent with the EU's own bidding zone review process under Regulation (EU) 2019/943, which provides for periodic reassessment and adjustment of bidding zone configurations to ensure they reflect underlying structural congestion in the system.

In practice, aligning price establishment mechanisms with actual system conditions would provide a clear and durable basis for recognising India's electricity system within bidding zone-based frameworks, including under RFNBO geographic correlation requirements.



The key implementation considerations for this pathway are summarised below:

Particulars	Details
Owner	Indian regulators (Ministry of Power, Grid-India, Central Electricity Authority (CEA), and Central Electricity Regulatory Commission (CERC))
Feasibility	Low: Requires structural market design changes, regulatory amendments, and stakeholder consultation
Impact on projects	Very high: A clearer and more consistent price establishment framework would significantly reduce ambiguity in geographic correlation assessment and support large-scale project deployment
Advantages	<ul style="list-style-type: none">➤ Aligns formal market design with underlying grid conditions and price formation mechanisms➤ Provides durable and legally robust clarity for application of bidding zone-based frameworks➤ Reduces reliance on interpretative approaches by addressing the issue at its structural root
Challenges	<ul style="list-style-type: none">➤ Requires regulatory and market design reforms, including consultation and approval processes, which may be time-consuming➤ May have broader implications for market participants, price signals, system operations, and investment planning for grid infrastructure.➤ Implementation timelines may extend beyond project development cycles, limiting suitability as a near-term solution

The pathways outlined above do not seek to modify the environmental safeguards embedded in the RFNBO Delegated Regulation. Rather, they aim to ensure proportionate, context-sensitive application of geographic correlation in electricity systems that differ structurally from the EU model. Anchoring compliance in objective indicators such as physical interconnection and sustained price convergence can enhance regulatory clarity while preserving the integrity of the framework.





Conclusion

The EU's RFNBO framework represents one of the most advanced regulatory architectures globally for ensuring that renewable hydrogen delivers genuine emissions reductions. The principles of additionality, temporal correlation, and geographic correlation are central to safeguarding environmental integrity within the EU electricity market.

At the same time, the EU's decarbonisation pathway envisions both domestic production and international partnerships as complementary pillars of supply. Current market evidence suggests that binding agreements remain limited, and building resilient international value chains alongside domestic scale-up will be important to meeting regulatory demand timelines.

India represents a structurally important case in this context. It operates a single synchronous national grid, exhibits sustained price convergence across administrative bid areas, and hosts one of the world's largest green ammonia and methanol pipelines. Yet interpretative uncertainty around geographic correlation and bidding-zone equivalence has emerged as a material investment variable for projects targeting EU markets.

Clarifying the application of RFNBO geographic correlation in third-country contexts would materially reduce regulatory uncertainty and support the timely progression of projects to the Final Investment Decision. A clearer interpretation of Article 7 would strengthen the conditions for building resilient EU–India clean

hydrogen value chains, aligned with the EU's decarbonisation targets and India's clean industrial ambitions.

It should be noted that these challenges are not unique to India. Similar considerations may arise across other third countries with electricity systems and market structures that do not align directly with the EU's power system architecture. Addressing the interpretative questions identified in this brief could therefore support a broader set of supply partnerships and contribute to the development of resilient international renewable hydrogen partnerships.

The analysis presented in this note suggests that implementation challenges do not arise from the objectives of the RFNBO framework, but from differences in grid design and market architecture between the EU and certain third countries. Geographic correlation was designed as a safeguard against structural congestion within the EU's zonal market. In large, integrated third-country systems where price convergence and physical connections between grids demonstrate the absence of structural separation, a proportionate and technically grounded interpretation is required to avoid unintended barriers.

The next 12–24 months, therefore, represent a narrow decision window for Final Investment Decisions. Regulatory clarity during this period will directly influence whether projects progress towards bankable offtake agreements and financial close.



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List of Acronyms

ACP	Area Clearing Price
ACER	Agency for the Cooperation of Energy Regulators
BCG	Boston Consulting Group
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CfD	Contract for Difference
COP28	28th Conference of the Parties (UN Climate Change Conference, Dubai 2023)
DG ENER	Directorate-General for Energy (European Commission)
EAC	Energy Attribute Certificates
EPEX	European Power Exchange
EU	European Union
EUR	Euro
FEED	Front End Engineering Design
FID	Final Investment Decision
FTA	Free Trade Agreement
GHG	Greenhouse Gas
GNA	General Network Access
IEX	Indian Energy Exchange
ISTS	Inter-State Transmission System
ITA	Industrial Transition Accelerator
LCOH	Levelised Cost of Hydrogen
MCP	Market Clearing Price
MNRE	Ministry of New and Renewable Energy (India)
MPP	Mission Possible Partnership
MTPA	Million Tonnes Per Annum
NGHM	National Green Hydrogen Mission (India)
NLDC	National Load Dispatch Centre
OECD	Organisation for Economic Co-operation and Development
PPA	Power Purchase Agreement
PV	Photovoltaic
RE	Renewable Electricity
REC	Renewable Energy Certificates RED III: Renewable Energy Directive III (Directive (EU) 2023/2413)
RFNBO	Renewable Fuels of Non-Biological Origin
RLDC	Regional Load Dispatch Centre
SECI	Solar Energy Corporation of India
SLDC	State Load Dispatch Centre
T-GNA	Temporary General Network Access
TSO	Transmission System Operator
TWh	Terawatt-hour
UAE	United Arab Emirates
UN	United Nations



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