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SUSTAINABLE FUTURES COLLABORATIVE

What Does Net-Zero Mean?

Defining Goals Aligned With National Contexts

Net-zero (NZ) emissions targets have emerged as a central pillar of global climate ambition. As of June 2025 (following the US's second withdrawal from the Paris Agreement), 142 countries have announced—or are considering—net-zero targets. Together, they account for nearly 76% of global greenhouse gas (GHG) emissions and 84% of the world's population. However, these targets vary in scope and timelines, reflecting differences in historical responsibility, development needs, domestic capabilities, political realities, and economic structures. Developed economies like the European Union and Japan target reaching net-zero by 2050, while China aims to reach it by 2060. India has committed to achieving net-zero emissions by 2070.

As India gradually pivots towards a net-zero pathway, it is crucial to establish a clear, shared understanding among national and sub-national governments, policymakers, regulators, industries, and civil society of what 'net-zero' truly means in the domestic context. Without this coherence, strategies risk being fragmented or misaligned across levels of governance and sectors of the economy.

This issue brief outlines key considerations that can help shape a comprehensive definition of net-zero emissions for India, not by prescribing implementation strategies, but by deconstructing net-zero

targets by their constituent elements necessary for clarity, comparability, and accountability. The brief discusses these elements across four aspects: [1] **Targets** *reflect "what" the entity aims to achieve and whether interim milestones are included.* [2] **Scope** *defines "what all is covered".* To put into perspective, two entities may share the same headline target but differ significantly in coverage. [3] **Sinks and Offsets** *clarify how residual emissions will be addressed, and what forms of carbon removals are deemed acceptable, credible, and verifiable.* [4] **Governance** *encompasses institutional arrangements for reporting, monitoring, and review.* Ensuring that those responsible for delivering on targets are held to account through appropriate mechanisms, incentives, and oversight structures.

Taken together, these dimensions form the building blocks of a robust net-zero definition. The brief's objective is to support India in deciding the design of the end-goal itself, rather than outlining the path to reach it.

Defining components of a net-zero target

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1. Targets

Target type and interim targets

Globally, net-zero targets vary not just in timelines but also in terminology and structure. Countries use terms like 'carbon neutrality,' 'climate neutrality,' and 'GHG neutrality,' which often obscure differences in what's actually included.

Beyond the terminology used, the credibility of net-zero definitions also hinges on whether they include measurable interim milestones.

A UN Secretary-General–commissioned report emphasises that credible net-zero definitions should include short-term benchmarks and time-bound targets, rather than relying solely on long-term aspirations.

Interim targets are often absent in net-zero definitions, despite their critical role in enhancing transparency and ambition. Only 33% of subnational governments and 8% of companies had included them as of 2020. Their inclusion, however, is essential for assessing whether an entity is on a credible path toward its long-term goal. Countries employ different forms of interim targets: ranging from *absolute caps* and *percentage reductions from historical baselines*, to *emissions intensity targets* or *business-as-usual (BAU) comparisons*. Choosing between them is a strategic decision shaped by a country's growth and climate ambition. *Intensity-based targets*—focus on emissions per unit of economic output—are particularly useful for rapidly growing countries. They highlight efficiency improvements and allow operational expansion while still demonstrating a commitment to reducing environmental impact. In contrast, *absolute* or *baseline-based targets*—define a fixed emissions ceiling or a reduction relative to a historical benchmark—are often more appropriate for countries with more predictable growth. They tend to align more directly with global carbon budgets and science-based climate frameworks, offering a clearer view of absolute emissions trajectories.

For India, a robust net-zero framework must specify whether interim targets are embedded, clarify the basis on which they are benchmarked, and establish a peaking and decline timeline. Drawing on structured models such as China's and South Africa's "peak-plateau-decline" approach can help manage transition risks while signalling a transparent emissions trajectory.

2. Scope

Coverage of gases and accounting boundaries

Countries with net-zero targets vary significantly in which greenhouse gases and sectors they include. Some like Japan, the EU, and the US cover all major GHGs—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. Others like South Africa and Brazil limit coverage to CO_2 alone.

Many countries like Argentina, Canada, and Russia include emissions from land-use, land-use change, and forestry (LULUCF), and agriculture. These sectors, while often difficult to quantify, are critical due to their dual role as both sources and sinks. However, coverage of international aviation and shipping remains comparatively more inconsistent. For example, the UK includes both, the EU includes only international aviation, and Germany and the US exclude both.

India must determine whether its net-zero target will be economy-wide or partial. An economy-wide approach covering all major GHGs and sectors enhances mitigation credibility but increases complexity. A phased approach may be more feasible initially, but should include a timeline for full inclusion.

However, defining what is 'covered' goes beyond sectors and gases. It also requires clarity on how emissions are categorised and measured. This brings into focus the distinction between operational and systemic emissions, both of which have implications for emissions accounting, responsibility attribution, and long-term transition planning.

Operational and systemic emissions

Operational emissions refer to direct emissions emitted from a firm's day-to-day activities—including a firm's own technology, infrastructure and operations—such as on-site fuel combustion or purchased electricity consumption, commonly captured under Scope 1 and Scope 2 inventories. In contrast, *systemic emissions include indirect embedded emissions influenced by infrastructure choices, sectoral interlinkages, and consumption patterns*, often aligning with Scope 3 emissions for the observing entity, though the same emissions may be classified as Scope 1 or Scope 2 for other actors in the value chain, depending on their position. Therefore, distinctions must be made carefully, as the classification depends on the observer's position in the value chain.

This differentiation has significant implications for how India conceptualises and operationalises its net-zero ambitions. Focusing only on operational emissions offers a practical and measurable starting point. India's mitigation policies—such as PAT and REC—have historically focused on operational emissions due to better data availability and ease of MRV (Measurement, Reporting, and Verification) systems for direct emissions. This focus allows for clear attribution of responsibility and straightforward compliance mechanisms. However, the exclusion of systemic emissions from national accounting risks missing a significant share of embedded carbon in India's economic system, particularly those locked into long-lived assets and infrastructure decisions made today.

Limiting attention to operational emissions alone can create a false sense of progress while embedded emissions continue to accumulate unnoticed. For instance, a firm may reduce its own emissions footprint through energy efficiency upgrades while continuing to rely on high-carbon supply chains, thereby shifting rather than reducing emissions. Over time, this narrow approach risks locking the economy into carbon-intensive development pathways.

By contrast, integrating systemic emissions into the framing of net-zero forces a broader estimation with the interdependencies across sectors and value chains. It demands upstream and downstream responsibility, encourages low-carbon innovation in procurement and design, and fosters more transformative shifts in production and consumption.

Therefore, a credible net-zero definition for India may begin with operational emissions for feasibility but must signal a structured ambition to progressively integrate systemic emissions. Doing so would not only align with global best practices but also enable greater clarity, comparability, and accountability in tracking mitigation outcomes. More importantly, it ensures that net-zero is not narrowly reduced to a technical compliance target but becomes a lever for systemic transformation.

Geographical variations across Indian states

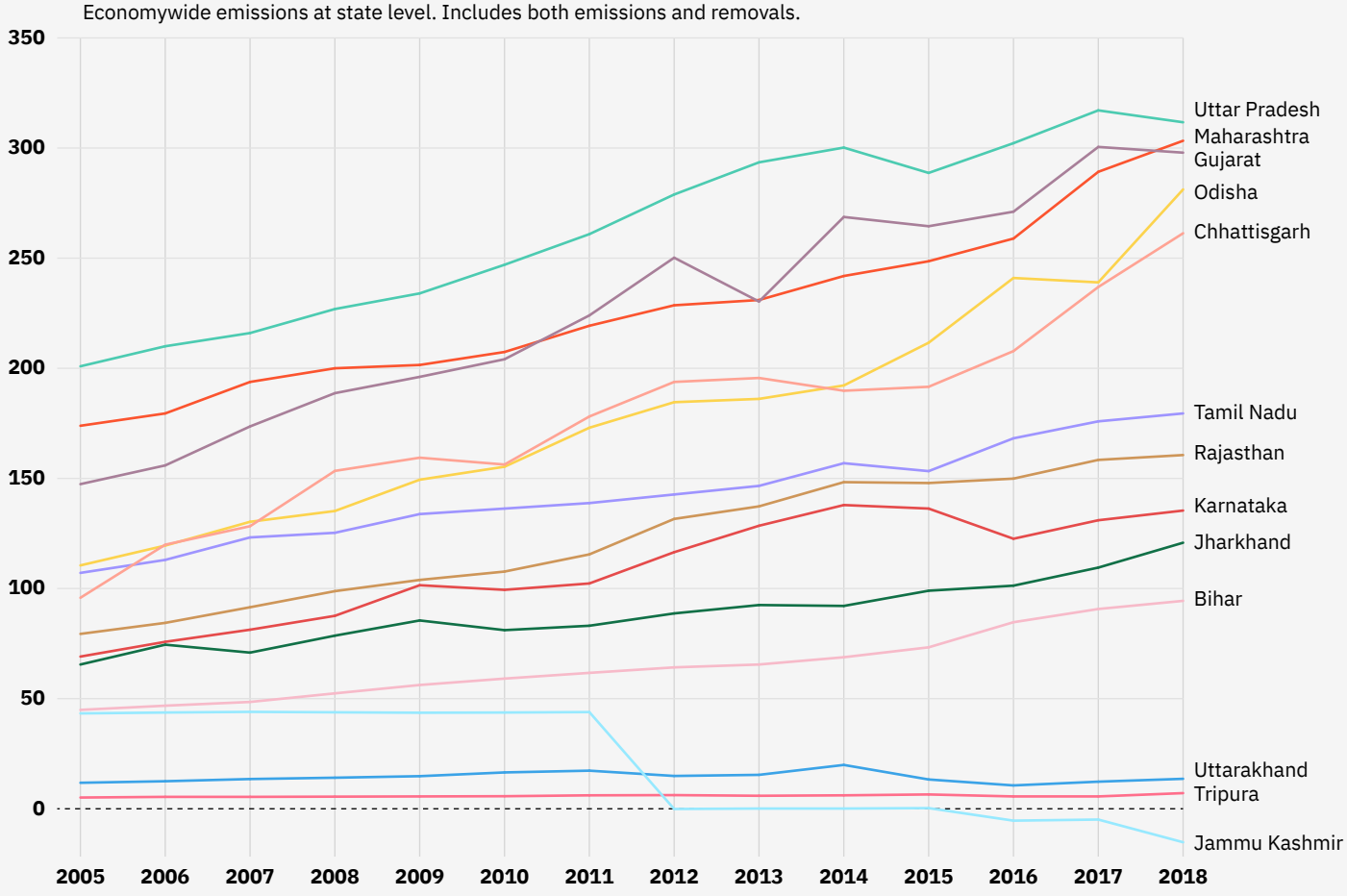
Given India's federal structure, state governments will be central to net-zero implementation. A uniform, top-down definition will likely not be able to account for the diversity in socio-economic profiles, emissions baselines, and institutional capacities across states (as seen in graph below). For instance, highly industrialised states like Gujarat and Maharashtra, while comparatively better positioned institutionally and financially and also likely closer to peaking emissions, may face higher decarbonisation costs due to existing energy-intensive infrastructure. In contrast, coal-dependent states such as Chhattisgarh or Jharkhand will need tailored just transition plans to support workers and communities reliant on the coal economy. The diversity in starting points is already evident in subnational net-zero announcements by states like Tamil Nadu, Kerala, Maharashtra, Gujarat, Odisha, Goa, and Bihar. For instance, both Tamil Nadu and Gujarat are manufacturing-heavy and have made significant strides in renewable energy deployment, yet their transition trajectories differ slightly. Gujarat's early investments in grid integration, large-scale solar parks, and market-based incentives offer a centralised, industry-driven approach. It now leads the country with over 35 GW of renewables. In contrast, Tamil Nadu's emphasis on distributed solar and rooftop programmes, and renewable-linked employment programmes reflect a more decentralised, equity-sensitive strategy. These differences highlight why a one-size-fits-all net-zero definition would overlook the varied starting points, state-specific capacities and policy ecosystems. Also, these efforts from multiple Indian states reinforce the need for a national framework that accommodates differentiated strategies based on states' emissions profiles and development needs.

This geographical variation also brings to the core questions of equity and climate finance allocation. Should India's limited mitigation finance be directed toward industrialised states where decarbonisation is costly but emissions are concentrated, or toward developing states, where earlier support could help leapfrog to low-carbon models before carbon-intensive infrastructure locks in? A balanced approach may seem right,

but this raises further questions about how such support should be proportioned. These trade-offs underscore the need for an equity-based lens in defining the roles and responsibilities embedded in a national net-zero framework.

Emissions in $MtCO_2e$

Economywide emissions at state level. Includes both emissions and removals.



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Sector-wise inclusion

Effective net-zero definitions require clarity on which sectors are included, how emissions are measured, and how inter-sectoral linkages are treated. Globally, most net-zero strategies target high-emitting sectors such as power, buildings, industry, agriculture, and transport. For instance, the UK's Net Zero Strategy outlines clear decarbonisation pathways for buildings, power, and transport, while Japan's "Green Growth Strategy" targets 14 priority sectors including hydrogen, automobiles, and housing. Similarly, Singapore has opted for only sector-specific targets.

Power: The power sector underpins India's decarbonisation. The definition must clarify whether emissions are counted at the generation or consumption or both, especially where states differ in production and use. Cross-sectoral use—such as EVs in transport or green hydrogen in

industry—must be addressed to avoid double counting. The definition may also specify if interventions like renewable energy expansion, grid upgrades, nuclear, hydro, or carbon removal technologies are within scope. International practices—such as the EU's models for consumption-based accounting or Germany's emphasis on storage and rooftop solar—offer useful models for improving attribution.

Industry: In heavy industries like steel and cement, emissions stem from both fuel use and industrial processes. The definition should distinguish between these and clarify treatment of embodied emissions in exports, especially in light of mechanisms like the EU's CBAM. It could also consider whether low-carbon technologies like clean hydrogen, electrification, or energy management systems are included in emissions accounting.

Source: AP photos

MSMEs: India's MSMEs are diverse and often outside formal emissions tracking. The net-zero definition should state whether they are directly covered, represented through sectoral proxies, or temporarily excluded. Equity, feasibility, and administrative load hinge on this choice. The EU's Fit for 55 package shows how simplified reporting, targeted subsidies, and shared green infrastructure can integrate small firms without heavy burdens.

Transport: Defining transport emissions involves developmental choices, such as favouring rail over road. Countries like France and Switzerland are prioritising rail freight. India's definition should specify how such modal shifts are reflected in inventories, and whether zero-emission vehicles,

alternative fuels, and electrified public transport are included. Emissions may be tracked at the vehicle, fuel production, or infrastructure level. For EVs, power sector emissions must be accurately attributed.

Buildings: Buildings emit through electricity use, materials, and construction. India's net-zero definition should specify whether emissions from residential and commercial buildings—including embodied emissions in materials—are included. Other considerations include electrified heating, smart energy systems, and retrofitting. Countries like the Netherlands, Austria, and Germany now use lifecycle building assessments. India can benefit from similar clarity. Inclusion of building interventions depends on whether these sources are in baseline inventories.

Photo by Nav Photography on Pexels

Agriculture, Forestry, and Other Land Use (AFOLU): AFOLU plays a dual role, acting as both a source and sink of emissions. Land-based removals are often temporary and reversible due to degradation, fire, or land-use change. As such, their inclusion in India's net-zero framework must be governed by clear standards on permanence, additionality, and robust monitoring. Methodological challenges also persist, such as discrepancies between national inventories and scientific estimates, and controversies around India's forest cover data—such as conflating plantations with natural forests—undermine credibility. The Land Gap Report (2022) cautions against over-reliance on land-based offsets, warning of perverse incentives like monoculture plantations on community lands.

India's net-zero definition should clearly state whether and how AFOLU emissions and removals are included, under which frameworks, and to what extent they contribute to net-zero targets. International models like Brazil's PRODES and Indonesia's Forest Reference Emission Level (FREL) system offer lessons in combining satellite data with field verification. Moreover, the definition should acknowledge the need for nationally tailored methodologies that reflect India's land use systems while striving for coherence with international benchmarks. Incorporating community-led and indigenous restoration practices into carbon accounting frameworks can further strengthen social equity and enhance the effectiveness of sequestration efforts.

While a full sectoral coverage may not be immediately feasible, a sequenced approach, starting with high-emitting and better-monitored sectors—like power, industry—combined with transparent timelines for integrating others can balance ambition with capacity.

Photo by Amal Abdulla on Pexels

3. Sinks and Offsets

Defining net-zero requires clarity on how residual emissions—those emissions that may remain, even after all technically and economically feasible mitigation efforts are exhausted—are treated. These are typically balanced through carbon dioxide removal (CDR) methods—both nature-based (e.g., afforestation) and engineered (e.g., bioenergy with carbon capture and storage (BECCS), direct air capture (DAC))—as well as carbon capture, utilisation, and storage (CCUS) technologies. The inclusion of such technologies depends on assumptions about their scalability, permanence, cost-effectiveness, and the robustness of associated monitoring and verification systems. India's Long-Term Low Emissions Development Strategy (LT-LEDS) acknowledges a limited role for CCUS in some sectors due to high costs.

From a definitional standpoint, clarity is needed on whether and how CDR and CCUS are to be integrated into India's net-zero framework. Should these be treated as core components, supplementary tools, or contingent strategies for addressing only hard-to-abate emissions? Furthermore, the framework must consider how to distinguish between permanent emissions reductions and temporary offsets, and whether offsetting will be allowed at all, and under what safeguards. These questions are central to ensuring that net-zero definitions avoid ambiguity, greenwashing, and reliance on unproven or non-scalable solutions.

Should offsetting be allowed at all—and under what safeguards? These questions are central to avoiding ambiguity and greenwashing.

Global debates, including the 2024 controversy around SBTi's proposal to allow offsets for Scope 3 emissions, have not only highlighted the risks of over-relying on removals and offsets, but also underscore the importance of defining net-zero in a way that prioritises genuine decarbonisation. In India's context, where MRV systems and institutional capacity are still evolving, the definition must be clear about the limited role of offsets and the standards for permanence, additionality, and verification that any residual emissions strategy must meet.

4. Governance

Periodic reporting, reviewing, and monitoring

Robust governance is central to credibility. The net-zero definition should outline how progress is reported, reviewed, and updated. An important aspect of definition design is whether the net-zero framework aligns with existing global reporting standards—such as Biennial Transparency Reports under the UNFCCC—or incorporates domestic data systems such

as SEBI's Business Responsibility and Sustainability Reporting (BRSR) and other ESG disclosure frameworks or national inventories. Definitional clarity is also needed on whether reporting must be externally verified or independently audited, and whether the definition assumes differentiated reporting obligations by actor type, i.e., government, firm, or sector.

Additionally, the inclusion of dynamic elements within the definition such as mechanisms for periodic revisions—based on new scientific knowledge or mid-course corrections—can further enhance its responsiveness over time. Such adaptability is particularly relevant given the long-term and evolving nature of net-zero trajectories.

Global best practices suggest that digital integration can play a pivotal role in enabling real-time emissions tracking and enhancing system interoperability. Application Programming Interface (API)-based integration between national portals (such as a proposed Net Zero Portal), corporate disclosures (e.g., BRSR), and carbon market registries is one such emerging approach.[1] Experiences under the World Bank's Partnership for Market Readiness (PMR)—such as efforts to connect India's meta-registry to schemes like Perform Achieve and Trade (PAT) and the Renewable Energy Certificate (REC) mechanism—offer valuable lessons on avoiding duplication and improving data compatibility.

Finally, definitions may also incorporate non-carbon metrics—like energy access or livelihood indicators—as part of a just transition framework. Localised MRV systems at the subnational level, supported by digital infrastructure and capacity-building, will be crucial. International technical exchanges—such as those facilitated by PMR between India, Thailand, China, and the EU—can inform the design of such systems. Emerging technologies like blockchain and the tokenisation of carbon credits may also be referenced within definitional frameworks to enhance transparency, traceability, and trust.

Conclusion

India's net-zero commitment for 2070 represents a historic opportunity to align its development trajectory with long-term climate stability. Yet this ambition must rest on a definition that is not only scientifically robust but also socially and institutionally grounded. As this brief has outlined, a well-defined net-zero framework must clearly articulate the scope of

1 API (Application Programming Interface) is a digital bridge that allows two software systems to communicate and exchange data automatically. In the context of India's Net Zero Portal, API-based integration means that the portal can automatically pull or push data from other reporting platforms like SEBI's BRSR filings, corporate ESG databases, or carbon market registries without requiring manual uploads or duplication by companies. For instance, in the above link, EPA offers the Envirofacts Data Service API, which consolidates environmental data from various EPA databases. This API allows seamless access to information about environmental activities affecting air, water, and land in the United States.

emissions, sectoral responsibilities, accounting principles, and monitoring systems, while respecting the diverse realities of states, sectors, and stakeholders involved. Moving forward, the development of India's net-zero definition should be approached as a transparent, consultative, and evolving process anchored in equity, guided by evidence, and responsive to changing national and global contexts. Such a definition will not only underpin effective domestic climate action but also enhance India's leadership and credibility on the international forum.

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