




ReNew

STRENGTHENING THE  
**INDIA-US**  
COLLABORATION ON  
**CLIMATE  
ACTION**





A series of thin, white, wavy lines that flow across the page, creating a sense of movement and depth. These lines are contained within a white rectangular frame.

**DECODING  
THE GREEN  
TRANSITION FOR  
INDIA**







The world needs to adopt a two-pronged strategy: first, nature and climate-friendly innovation, and second, environment-friendly lifestyles.

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**Shri Narendra Modi**

Hon'ble Prime Minister of India





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## Binaya S. Pradhan Consul General of India, New York

Year 2023 was the warmest year on record, climate change's impacts—extreme weather, biodiversity loss, and ecosystem collapses—highlight the urgent need for a global response in a coordinated manner. India and the US, as major economies, have a unique opportunity to lead in addressing this crisis. Their partnership in clean energy and India's commitment to green energy are crucial for mitigating and adapting to climate change.

The need for energy in India is going to increase manifold, given we are targeting to become a developed nation by 2047. A number of challenges confront India's development agenda, including that of climate change. India's contribution to global warming is minimal. India's per capita consumption of energy and contribution to greenhouse gas emissions is insignificant compared to OECD countries.

Nonetheless, India is committed to combating climate change, by making development choices that ensure growth and development of the economy along low carbon pathways towards net-zero by 2070. Recognizing that climate change is a global collective action problem, India is committed to addressing the challenge with firm adherence to multilateralism based on equity and the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC), as enshrined in the United Nations Framework Convention on Climate Change (UNFCCC).

The global and domestic context, including equity and the need for sustainable development, will guide India's national objectives in the rational utilization of fossil fuel resources, with due regard to India's energy security.

India is already making considerable efforts at undertaking climate actions across its entire economy. India's renewable energy sector has witnessed remarkable growth, primarily driven by solar and wind capacity installations.

While India will pursue low-carbon growth and development strategies, this transition will be in accordance with national circumstances and at a pace and scale that is nationally determined, without compromising development futures.

At the Leaders' Summit on Climate in 2021, India and the US launched a new high-level partnership, the "US-India Climate and Clean Energy Agenda 2030 Partnership," which envisages bilateral cooperation on strong actions in the current decade to meet the goals of the Paris Agreement. Through the Agenda Partnership, both countries firmly committed to work together in achieving their ambitious climate and clean energy targets and to strengthening bilateral collaboration across climate and clean energy. This focus on green growth was reaffirmed in the 2023 G20 Delhi Declaration, emphasizing their joint dedication to advancing climate and energy priorities.

# Foreword





The US-India partnership is crucial for advancing clean energy, including solar, wind, and green hydrogen technologies. The expertise, technologies, innovation of the US could assist in the holistic energy transition of India.

To achieve the ambitious targets, India has launched various schemes like Transmission schemes to integrate renewable generation into the grid, National Green Hydrogen Mission, Carbon Credit Trading Scheme, Development of Solar Parks and Ultra Mega Solar Power Projects, Promoting Renewable Energy through Green Energy Open Access Rules, Offshore Wind Energy Lease Rules and LiFE Style for Environment program.

Key priorities between India-US clean energy partnership include innovative investment platforms, decarbonizing transportation, and advancing energy storage and efficiency. Building critical mineral supply chains and setting proactive trade policies are also crucial for global climate action. This cooperation is in line with India's energy goals and economic growth. Their deepening cooperation on climate action reflects two decades of joint efforts to meet growing clean energy demands and advance decarbonization goals. Going forward the India-USA partnership in clean energy has the capacity to have global positive impact.





# India-US Climate Engagement Over the Years

**2005**

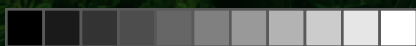
US - India  
Energy Dialogue  
gets Initiated

**2006**

Both countries sign  
a Civil Nuclear  
Cooperation  
Agreement

**2009**

The U.S.-India  
Partnership to Advance  
Clean Energy (PACE)  
gets launched



## 2015

- India and the US sign an MOU to establish a \$7.9 million PACEsetter Fund
- India launches the International Solar Alliance (ISA) on the sidelines of the 21<sup>st</sup> Conference of Parties (COP21) held in Paris in 2015

## 2016

US and India sign the Paris Accord

## 2018

U.S.-India Strategic Energy Partnership (SEP) gets launched

## 2021

- Both countries align to launch the Clean Energy Agenda 2030 Partnership
- SEP gets relaunched as SCEP with clean energy as the main focus
- The US-India Hydrogen Task Force formally launched

## 2022

India joins a public-private partnership initiative called First Movers Coalition, launched by President of the USA and the World Economic Forum (WEF) at COP26

## 2023

The U.S. Department of Energy (DOE) and the Ministry of New and Renewable Energy (MNRE), Government of India launch the new U.S. - India Renewable Energy Technology Action Platform (RETAP) under the Strategic Clean Energy Partnership

# Pathways and Opportunities for the India - US Collaboration on Clean Energy



**ReNew 400 MW Site**  
Jaisalmer, Rajasthan

# Sumant Sinha

## Chairman and CEO, ReNew

The world is bouncing back from the long shadow of the pandemic and the war in Ukraine. 2024 has so far been promising and positive, with immense opportunities and renewed focus. There is a sense of optimism, not just in the news around us but in our daily routine of existence. As I look around, I feel we are heading in the right direction. Key themes which give me hope, are shared below:

- I. **We are witnessing a booming economic recovery:** According to the World Bank's report, the global economy is stabilizing for the first time in 3 years and is projected to hold steady at 2.6% this year. Emerging economies have taken the mantle of driving global growth, with India looking at a growth rate of 6.5% to 7% in 2024-25. India's real GDP is set to be 20% higher than the pre-COVID levels.
- II. **Global Food Security is Advancing:** The latest estimates by FAO (Food and Agriculture Organisation) suggest that global food security conditions are stabilizing slowly, with commodity market prices returning to more moderate levels in 2024.
- III. **The clean energy transition is for real:** The clean energy transition is happening faster than ever. In 2023, we witnessed a 50% surge in new renewable capacity additions, reaching a total of 510 gigawatts. For the first time, the combined investment in renewables and grids outpaced investments in fossils globally. Few countries, including Bhutan, Suriname, Guyana, Gabon, and Panama have declared themselves carbon neutral already.
- IV. **Digital Transformation:** The rapid digitalization of services, from education to business operations, has improved efficiency and accessibility, bridging gaps and creating new opportunities. These trends are helping to shape a more resilient and connected world.
- V. **Lastly, we are witnessing a high-bound momentum in climate finance:** Global climate finance has almost doubled in the last decade, with more than 1.7 trillion going only to clean energy. We are not only witnessing investments flowing into both mitigation and adaptation measures but also a rise in green bonds and carbon markets, a step up by the financial sector.


While these are stories of hope and we have made

real progress towards the 'New Normal', we must acknowledge that this is just the beginning of our long journey, and challenges remain, especially when we focus on the climate crisis.

Climate change remains our reality and its amplifying effects are becoming more prominent year after year. The year 2023, was not only the warmest year since modern record-keeping began, but estimates suggest that the goal of limiting global warming to 1.5°C is now practically unreachable; even "well under 2 degrees" is in danger.

As climate action continues to be a top priority for all, the power of the world's two greatest democracies coming together positions us well to lead the way towards a more sustainable and resilient future. I propose four big initiatives as part of this partnership, building on the extensive co-operation already between the two countries.

- **A joint India-US initiative on supply chains, with the EU as a partner:** Given the head-start certain countries have, a more co-ordinated approach among key nations is required to effectively match their competitiveness, innovation capabilities and trade practices. India and the US must lead this initiative, by synergising their efforts and not competing among themselves. They must bring the EU as well, as the third partner. Together, these geographies have a big enough size of the market (accounting for well over two-fifths of global clean energy deployment in the next 10 years). They have the manufacturing ecosystems, technological expertise, innovation ecosystem, and the collective fiscal heft. We must work to leverage these in a way that allows respective comparative advantages to be fully leveraged and therefore competitiveness to be achieved, particularly in the mid-value chain stages, like manufacturing polysilicon, ingots, wafers for solar; cathodes, and anodes for batteries; membranes for electrolyzers, to name a few. We also need this initiative to focus on developing expertise early in emerging supply chains like that of green steel, carbon capture, green building materials, and sustainable fuels so that we are not playing catch-up again.
- **Partnership on Corporate De-carbonisation:** Many countries including India, the US, the EU, and Singapore, have announced mandates on emissions reporting by corporates. This is

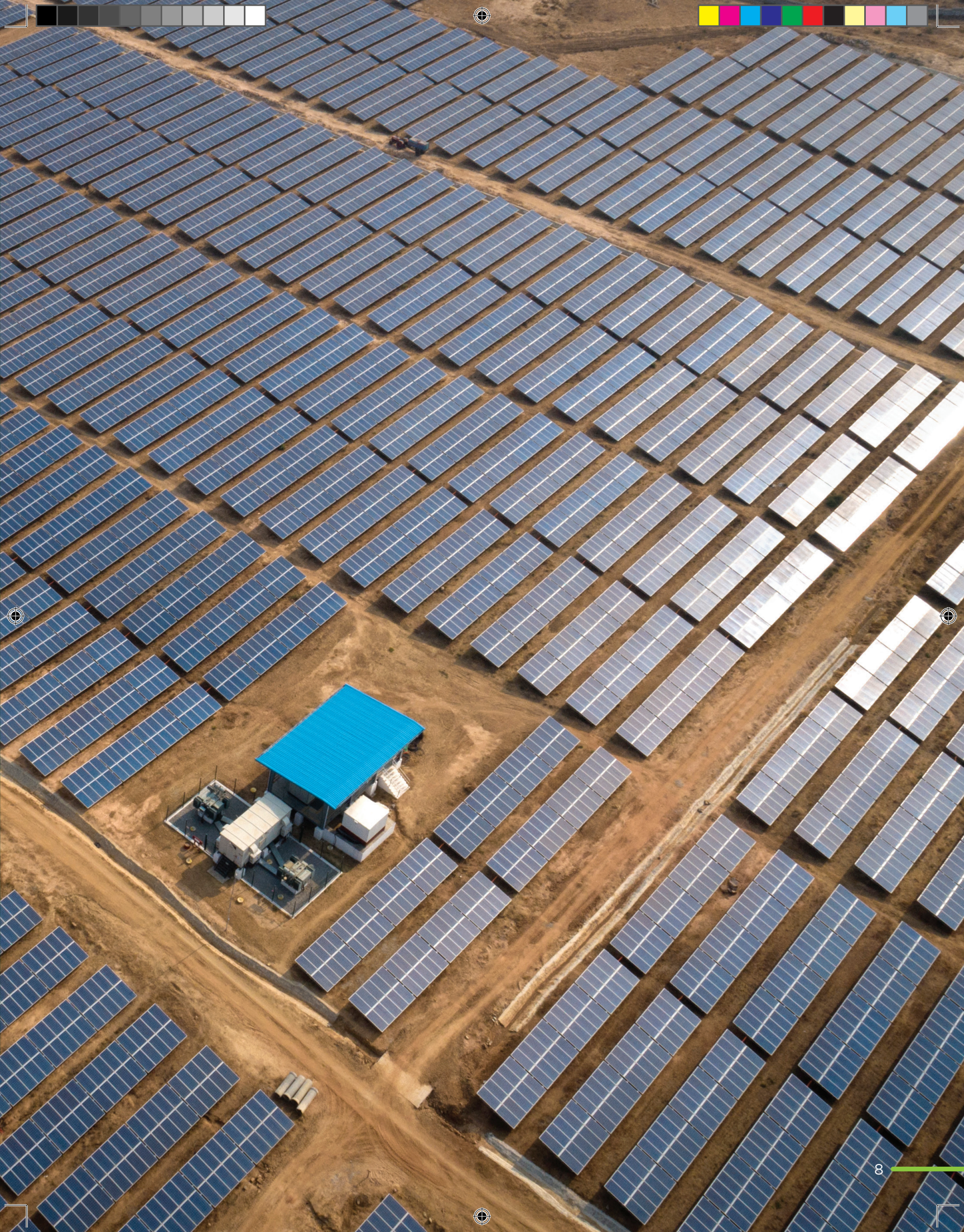


a good first step. It may not be sufficient though, as these unilateral mandates are limited in geographical scope, vary in their coverage across Scope 1, 2, and 3 emissions, and have different time-frame. We need a more international process, at least for the major economies. The US and India may put their weight behind reviving and enhancing the process initiated by the UN Secretary General through the High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities. The report by the Expert Group lays out recommendations in four key areas - environmental integrity, credibility, accountability, and the role of governments. There is enough thinking in place, the need now is to get going for stronger action.

- **Partnership on Carbon Markets:** There is general consensus that when approached in the right way, carbon markets are an integral piece in the global climate change puzzle. The US was a pioneer in the use of market mechanisms to address environmental concerns, most notably on controlling acid rains. The carbon markets are the market-based instruments to address climate threats. Many countries as an alternative, UNFCCC process, have gone on with introducing their own versions. The corporates have leaned on voluntary markets. The US and India, as two of the large players representing the two biggest and most influential groupings in the UNFCCC, must come together to facilitate quick finalization and rolling out of Article 6.4. This should ideally take the form of the global and unified carbon market we talk about – that enables emission reductions to be achieved at the lowest possible costs and towards initiatives that result in the most material impact on emission reductions.

- **Policy platform on fossil fuels phase-out:** A roadmap to phase out all fossil fuels by 2050 was agreed to be prepared as an outcome of COP29 in Dubai. ‘Equitable’ will need to be a key word for the phase out, to minimize its economic and social costs. More than forty nations are currently developing new oil and gas production sites. Each of them is trying to benefit from producing and selling their resources for the longest period possible. It’s the same with coal. We need to build a stronger co-ordination mechanism to agree on a common approach for a collectively managed transition that is as cleanest, cheapest, and fairest. Numerous countries would need financial support to phase out earlier than the planned lifetimes of their resources. This will need the creation of financial mechanisms. The US is the world’s largest oil producer and India is the world’s second-largest coal producer. As important players in this conversation, the two countries may take the lead in kick-starting it through the different fora they are part of viz. the IEA, the G20, the Clean Energy Ministerial, the Major Economies Forum, or any others.

India and the US have a strong partnership on climate, which has evolved in the last two decades, and that has already helped to catalyze clean energy in both countries. We now have an opportunity to leverage it, for achieving scale and competitiveness. 2024 is as good a time as there will ever be to strengthen our collective climate impact.





# Forging a Green Future: Priority Areas for the India - US Collaboration









## Mobilizing the regulatory landscape in India and the US

### The Industry View

The clean energy sector in both India and the United States is going through a period of rapid evolution, both in terms of perpetually rising demand for clean energy as well as regulatory advancements. As large energy markets, these two countries are slated to have a role in shaping the global policy landscape in this area.

India and the USA are developing their renewable energy sectors with evolving frameworks of regulation to drive the twin objectives of growth and innovation. Some initiatives which have defined the frameworks for industry in India have been the National Green Hydrogen Mission and the Production-Linked Incentive (PLI) scheme<sup>28</sup> These are critical to expanding domestic manufacturing.

At the state level, Renewable Purchase Obligations (RPOs) are driving localized investments in clean energy, advancing India's renewable agenda<sup>29</sup>. Earlier, RPOs were under the Tariff Policy 2016, which were merely guidelines, however with the amendment of the Energy Conservation Act, these RPOs have become mandatory under its rules. This has been to improve compliance.

However, challenges around land acquisition and permitting persist<sup>30</sup>, prompting efforts to streamline these processes and encourage greater private sector participation. International collaborations will accelerate technological development and

investment in the sector, especially as India's regulatory environment increasingly aligns with global standards.

Through providing tax credits for solar, wind, and new technologies, the Inflation Reduction Act (IRA) advances renewable energy. This is supported by the Grid Modernization Initiative, which reforms infrastructure to handle increasing levels of clean energy. Even federal agencies like the Department of Energy (DOE) are investing heavily in research and development (R&D) for new technologies like green hydrogen and battery storage. Even the high upfront cost of new technologies can be abated with standardized financial incentives such as India's National Green Hydrogen Mission and the USA's Inflation Reduction Act (IRA).

This underpins a sturdy foundation for scaling up renewables<sup>31</sup>. It is true that grid congestion and interconnection delays are prevalent; still, efforts to streamline processes are being made for renewable energy projects across the country<sup>32</sup>.

Furthermore, to mitigate investment risks and high capital requirements for investors, it is important to promote innovative climate financing mechanisms which can raise money such as green bonds. India's National Clean Energy Fund (NCEF) as well as masala bonds and the USA's Climate Innovation Fund are examples of risk-mitigation mechanisms.

The major taskforces constituted such as the US-India Clean Energy Finance Task Force and the Strategic Clean



Energy Partnership focus on technology transfer, and co-investment. They emphasize regulatory alignment, enabling smoother cross-border investments and fostering innovation. This partnership is growing in several critical areas, however there is also a clear, common direction in which the two countries are heading in terms of initiatives. This is evident from a few notable examples such as:

While there is agreement on the broad principles, how the India-US renewable energy partnership shapes up will depend upon separate areas of collaboration:

- **Expansion of Efforts:** First, R&D efforts must be expanded in all areas. An established institution such as the US-India Clean Energy Finance Task Force should be expanded to create joint research centers.
- **Cross-Border Investments:** Second, similar regulations can increase cross-border investments. Whether it is carbon pricing or environmental regulations for the private sector, a stable and well aligned atmosphere will help growth.
- **Joint Training:** Third, there is a skills gap between workers who will transition into the clean energy sector and the existing capacity of clean energy workers. Training programs and capacity-building initiatives will strengthen skills. There should be joint training sessions for engineers at manufacturing sites and other industry technicians along with a common framework on certifications. Emphasis on these areas can engender better regulatory environments for both countries.
- **Demand-Side Coordination:** Political agreements could provide a strong push to boost demand for newer technologies, such as green hydrogen, within respective jurisdictions. For instance, implementing green hydrogen purchase mandates or mechanisms like Carbon Contracts for Difference (CCfD), as seen in Germany, can make green technologies more

attractive for energy-intensive industries. In this model, industries are compensated for the additional costs of transitioning to green production.

- **Domestic Content Classification:** To lower the costs of the clean energy transition, more flexible frameworks around domestic content classification are needed. One example is pooling subsidies or establishing 'carve-outs' for solar power generation. India could efficiently produce polysilicon, wafers, and cells through its PLI Scheme, while the US could focus on manufacturing solar modules. Products made in India could qualify for full IRA incentives if integrated into module production in the US
- **Free Trade Agreements with Developing Nations:** The US Inflation Reduction Act (IRA) mandates that by 2027, 80% of critical minerals used in EV batteries must be sourced domestically or from Free Trade Agreement (FTA) countries. This underscores the need for stronger trade agreements with developing nations, which can help secure the supply of critical minerals and materials essential for the clean energy supply chain.

The constantly evolving regulatory landscapes of India and the US, are paving the way for a more sustainable future. The emerging areas of energy transition underscore the importance of regulatory innovations in addressing future challenges and accelerating global climate action.

<sup>29</sup> PIB (2022), "India's Stand at COP-26", Available [here](#)

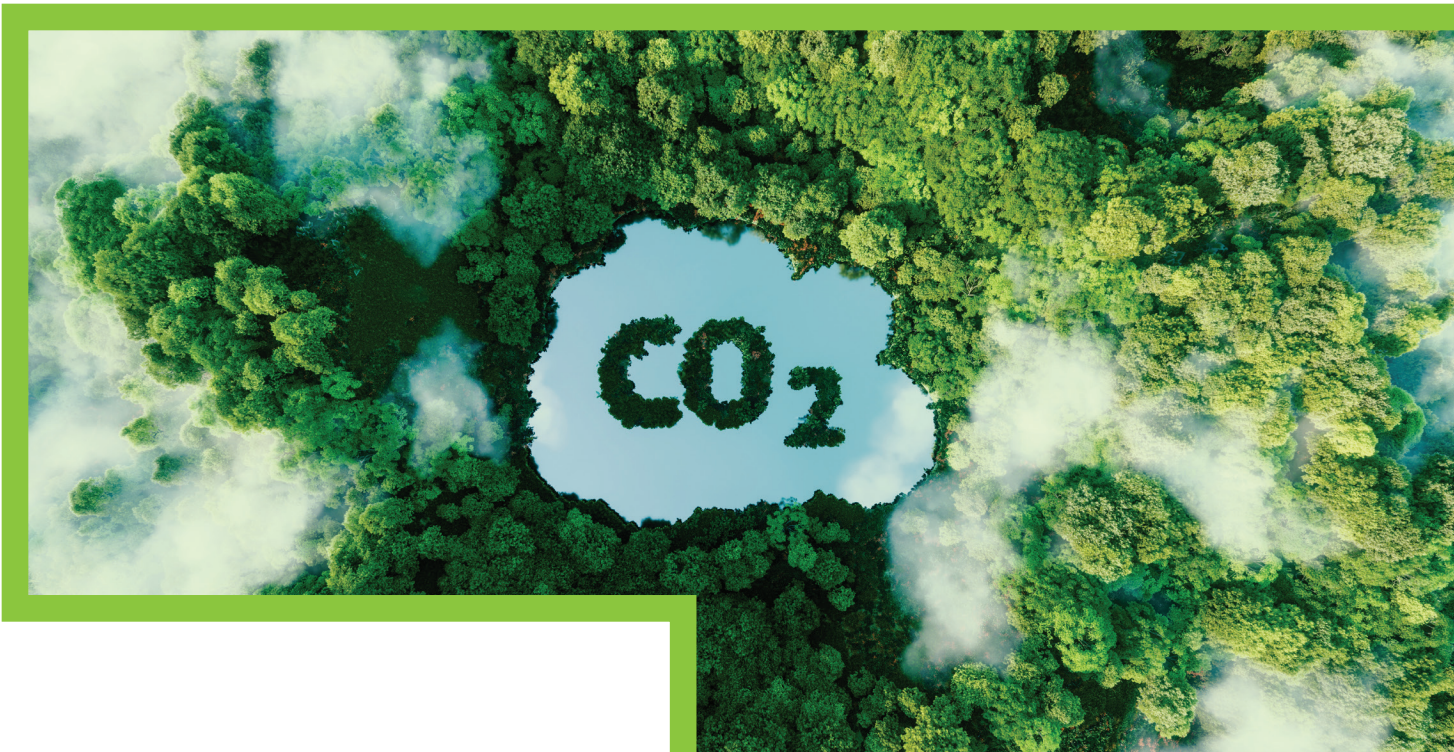
<sup>30</sup> Singh, Raj Pratap (2024), FSR Global, "Renewable Purchase Obligations: Ambitious or Arbitrary", Available [here](#)

<sup>31</sup> Ray, Kalyan (2024), Deccan Herald, "Union Budget 2024 | Economic Survey Points Out 'Land Challenge' for India's Transition to Green Economy", Available [here](#)

<sup>32</sup> Ravichandran, Dhyanesh (2024), ETN News "US DoE grants \$62 mn for 20 projects to support hydrogen infrastructure", Available [here](#)

<sup>33</sup> Pavia, Nicole (2024), Clean Air Task Force, "Future-fitting the grid: How to accelerate federal transmission permitting", Available at [here](#)





## India - US Partnership on High-Impact Initiatives

Lord Adair Turner, Chair of the Energy Transitions Commission

Global temperatures over the last 12 months have been 1.5°C above pre-industrial levels and the effects of climate change are obvious in extreme floods and drought: but carbon emissions continue to increase. We are running out of time to limit global warming to well below 2°C.

But the good news is that key clean technologies have developed far faster than we dared hope just 10 years ago. Solar PV costs have fallen 90% since 2010 and 99.9% since the 1970s. Innovation in battery chemistry has delivered LFP batteries which remove the need for expensive nickel and cobalt inputs, and energy densities continue to improve; battery storage costs have fallen dramatically over the last year; sodium-ion batteries will deliver further cost reductions.

As a result, solar plus batteries is becoming cost-competitive with fossil power generation in many countries; and the COP 28 target to triple global renewable capacity by 2030 is easily attainable. And despite a slowdown in EV sales in some markets, particularly the US, at the global level progress is unstoppable: available EV ranges continually increase, and in China EVs now cost less than the equivalent internal combustion engine vehicles (ICEVs).

As for the heavy industry, we now know, as we did not 10 years ago, the technologies which will enable

us to produce steel, cement, and chemicals in a zero-carbon fashion<sup>8</sup>.

India and the US must embrace the great potential of this technological progress. Doing so will require an effective and positive response to China's leadership in key technologies and Europe's in carbon pricing.

China produces around 85% of the world's solar PV modules and cells, over 80% of batteries, and over 60% of EVs<sup>9</sup>. This is not just because of subsidies but reflects the economies of scale and learning effects created by massive domestic deployment, plus technological excellence in relevant science and engineering.

In response India is seeking to develop domestic supply chains through production-linked incentives and some tariffs: the US via the IRA's subsidies and local content requirements, plus significant tariffs in many areas. The challenge is to ensure that these policies create cost-efficient domestic supply, minimizing the cost penalty of cutting off Chinese imports, and ensuring technology transfer from China where possible.

Bold ambition is crucial to achieving this combination. India has a target to achieve 500 GW of renewable deployment by 2030, and will install about 20 GW of solar and 4GW of wind in 2024.<sup>10</sup> But China will build well over 1000 GW of wind and solar between now and 2030, providing a massive stimulus to innovation and cost reduction.<sup>11</sup> Much higher Indian RE targets for 2035 and 2040, set well in advance, are needed to enable India to



meet rapidly growing electricity demand in a zero-carbon fashion, and to develop domestic supply chains with the scale required to match Chinese costs.

As for batteries, India is today sensibly allowing the import of low-cost Chinese batteries to combine with RE generation, but in the long term it should develop battery and EV manufacturing on a scale in line with India's huge domestic market and become a leading producer of electric 2 and 3 wheelers for the domestic and export markets. This requires aggressive targets and policies to force a rapid shift from ICEVs to EVs, of the sort which have made China the current technological leader.

As for the US, the stated goal of zero-carbon electricity generation by 2035 is crucial. To achieve it the US must fix inadequacies in grid capacity and coordination – one area where India, with an effective national grid, starts with an advantage. And India's innovative “round the clock” renewables contracts, which require auction winners to deliver zero carbon electricity for a high percentage of all annual hours, may be an example from which the US can learn.

But achieving zero-carbon power by 2035 will put the US 10 to 15 years ahead of a feasible Indian target, though five years behind the UK, which is committed to getting there by 2030.

This will require the integrated deployment of multiple storage technologies, including batteries, compressed air, pumped hydro, iron -air and hydrogen, together with demand management business models which incentivize consumers and industry to shift electricity demand away from peak hours. Demonstrating that these tools can balance supply and demand in zero-carbon power systems with high RE shares is one of the most important contributions rich countries can and must make to the global energy transition over the next decade.

As the US and European countries drive these vital developments, Indian companies with growing expertise in the integration of generation and storage may find business opportunities there, and India should aim to be a fast follower in its domestic power system, learning from developments in the US and Europe; complete power decarbonisation by 2047 could be a powerful motivating objective. In getting to zero carbon power, there is no reason why the US and India should not be leaders rather than China.

That is also true in heavy industries such as iron and steel. Arcelor Mittal and Tata, with large businesses

in both Europe and India, are as well placed to lead in zero carbon iron production –for instance via use of hydrogen as a reduction agent - as are leading Chinese companies like Baowu Steel, or POSCO from Korea. And in the chemical sector, there is no reason why Indian, European or American companies should not lead in the application of new zero carbon technologies.

But unlike in the case of solar PV and EVs, where the “green cost premium” is rapidly disappearing, decarbonising heavy industries will likely entail some cost penalty for several decades, and decarbonisation will therefore only occur if countries use carbon pricing or regulation to create a level playing field between the new clean and the old dirty technology.

Europe already has the key policies in place, with an emissions trading scheme which by the early 2030s will impose a price of over €100 per tonne of CO2, with no free allowances for heavy industry, and with a Carbon Border Adjustment Mechanism (CBAM) to ensure that decarbonisation in Europe does not simply result in production and emissions moving to other countries still using the old technologies.

Ideally, the US should introduce a broadly equivalent carbon price, but if that remains politically impossible, regulation to require decarbonization will be essential, and the US will need to introduce its own CBAM or apply regulations to imports as well as domestic production.

India must decide how to respond. Opposing CBAMs as protectionists will be both utterly unconvincing and ineffective and will lock India into old technologies, ceding technological leadership in heavy industry to Europe, the US, and China. Instead, India should plan for its own carbon pricing or regulation, driving technology developments which enable India to become a major producer of low-carbon steel and chemicals for domestic consumption and export.

Indo-US cooperation on this issue, bilaterally and in global climate debates, would be a fruitful area for discussion in the forthcoming roundtable in NY.

<sup>8</sup> Energy Transitions Commission (2018), [Mission Possible: Reaching net-zero carbon emissions from harder-to-abate sectors](#)

<sup>9</sup> Energy Transitions Commission (2023), Better, Faster, Cleaner: Securing clean energy technology supply chains [ETC Barriers SupplyChains Insights Briefing](#)

<sup>10</sup> Bloomberg [NEE](#)

<sup>11</sup> Bloomberg [NEE](#)





## Unlocking the potential of Green Hydrogen

### The Industry View

The global energy landscape is at the threshold of a profound transformation, with green hydrogen emerging as a game-changer in the race to a net-zero future. Both India and the United States, two of the world's largest energy markets, have recognized the potential of green hydrogen to decarbonize hard-to-abate sectors and are driving forward with policies and investments to harness its benefits.

In the United States, owing to a series of important legislative measures, green hydrogen is rapidly gaining prominence. Overall, over \$9.5 billion has been allocated for hydrogen-related projects under the Inflation Reduction Act (IRA) and the Bipartisan Infrastructure Law. Among these funds, \$8 billion has been set aside for regional clean hydrogen hubs, while \$1 billion is dedicated to advancing electrolysis technologies, which are key to producing green hydrogen from water using renewable energy<sup>3</sup>.

One of the most significant catalysts for green hydrogen in the US is the clean hydrogen production tax credit, which offers up to \$3 incentive per kilogram of hydrogen produced. This credit is expected to reduce the cost of green hydrogen production by 50%-75%, making it far more competitive against traditional grey hydrogen (produced using natural gas)<sup>4</sup>. Such incentives point to an obvious federal-level commitment to

exponentially increase green hydrogen projects across the country.

However, challenges persist. The cost of producing green hydrogen remains highly variable depending on regional electricity prices, and the US still relies heavily on grey hydrogen, which accounts for 95% of its production<sup>5</sup>. Despite that, there is a clear foundation laid for a pathway towards cleaner, better alternatives. The strict standards tied to the federal tax credits, requiring projects to minimize carbon emissions across the entire supply chain, might slow down project development but, more importantly, it establishes sustainable hydrogen production as a precept.

India, with its ambitious goal of achieving net zero by 2070, and as of July 2024 having achieved 197 GW already of its 500 GW target, views green hydrogen as a crucial aspect of its strategy to scale up renewables. India's climate is amenable for renewable energy sources such as solar and wind, provide a solid foundation for green hydrogen production<sup>6</sup>.

India's National Green Hydrogen Mission, launched in 2021, is the impetus behind this. Beginning with an investment of ₹19,744 crore (roughly \$2.5 billion), the Mission includes initiatives such as the Strategic Interventions for Green Hydrogen Transition Program (SIGHT), which is designed to provide production-linked incentives and foster the development of green hydrogen hubs.





ReNew is actively developing green hydrogen projects. One of ReNew's flagship ventures—a green ammonia project—is set to begin operations by 2028 and will meet the stringent carbon reduction requirements of the European Union's Renewable Energy Directive II (RED II). These projects, which seek to reduce carbon intensity by at least 70%, signal India's potential to become a global hub for green hydrogen.

Yet, like the US, India faces significant hurdles. Scaling up renewable energy capacity, developing supply chains, and securing investments are critical challenges. The cost of green hydrogen is much higher and is predicted to be higher than grey hydrogen. According to a report, green hydrogen cost will sit between USD \$8/kg, whereas grey hydrogen will cost around \$1.50 - \$4/kg by 2050<sup>7</sup>. This chasm makes it challenging to scale production without government backing and international agreements to secure long-term offtake. In the absence of these assurances, attracting the level of investment needed for green hydrogen will be difficult.

The green hydrogen plans of both countries present a strong opportunity for projects. However, realising the full potential of this clean energy source needs a multi-pronged approach:

- I. **Incentivizing Demand Creation:** Going beyond production is crucial. For the US, offtake of green hydrogen for hard-to-abate sectors such as fertilizer and steel could stimulate demand, while India can ensure similar mandates for refineries and export-oriented industries.
- II. **Public-Private Partnerships:** PPPs can be important for scaling green hydrogen. ReNew's collaboration with Indian Oil Corporation Limited (IOCL) and Larsen & Toubro (L&T) typifies how public and private sector interests can come together to meet domestic demand while positioning India as a key exporter.

III. **Competitive Financing:** Offering US dollar-denominated financing options for Indian projects could spur investment on the global stage, in light of India's ambitions to become an export hub.

IV. **Technology transfer:** Industry-academia partnerships between both countries for joint research and development in areas like electrolysis, hydrogen storage, and transportation solutions will be crucial. Both India and the US can benefit from shared expertise and optimize costs by advancing technology at scale.

V. **Supply Chain Development:** The two countries should focus on developing the global supply chain for green hydrogen, including the establishment of necessary infrastructure such as ports and shipping equipment to facilitate international trade.

The path to scaling green hydrogen is challenging, but the benefits are self-evident. Collaborating in these areas has the promise to move the burgeoning hydrogen economy forward. This can ensure not just the decarbonization of both countries' domestic industries but also create jobs and advance their shared climate goals.

<sup>3</sup> US Department of Energy (2023), "US Department of Energy Hydrogen Program 2023 Annual Merit Review", Available [here](#)  
<sup>4</sup> US Department of Energy (2023), "Financial Incentives for Hydrogen and Fuel Cell Projects", Available [here](#)  
<sup>5</sup> Epstein, Paul (2021), "Hydrogen's Present And Future In The US Energy Sector", Available [here](#)  
<sup>6</sup> Ministry of New & Renewable Energy (2024), "Physical Achievements", Available [here](#)  
<sup>7</sup> Parkes, Rachel (2024), Hydrogen Insight, "Price Gap Between Grey Hydrogen And Low-Carbon H2 Will Still Be 'Significant' In 2050, Warns US Government Advisors", Available [here](#)





## Harnessing the RE Manufacturing Potential in India and the US

### The Industry View

The past decade has witnessed a seismic shift in global clean energy supply chain manufacturing, both in terms of the geography of production and the geopolitical dynamics of the sector. A sector that was once balanced and diversified, with operations in Europe, Japan, and the United States is now heavily concentrated in China. Today, China accounts for over 95% of new facilities within the global solar PV supply chain; it is also home to the Top 10 suppliers of Solar PV equipment<sup>1</sup>. This realignment has resulted in a geopolitical shift, with significant implications for the global energy landscape.

#### India and the US Market - A Turning Point in the Solar Manufacturing Ecosystem

**India and the US have kick-started an impressive solar manufacturing journey.** Both countries have large domestic markets of solar energy, driven by ambitious plans. There is a strong interest in both countries to de-couple their supply chains away from China to protect them from future supply chain shocks. Finally, both countries are strong economies, capable of attracting large-scale investments. We are accordingly witnessing various policies and incentives introduced. The key motivation for these has been to provide the domestic manufacturers in both countries adequate time and support to become competitive with the

Chinese suppliers, who have had the benefit of access to very low electricity costs, ample and low-cost bank financing, and access to low-cost labour.

#### Both countries have done well on modules and cells manufacturing so far:

The Government of India has introduced various tariff and non-tariff barriers like basic custom duty and approved list of models and manufacturers, primarily for modules). Additionally, to support the vision of *AatmaNirbhar Bharat* and homegrown manufacturing, the Government of India introduced a Production Linked Incentive (PLI) scheme with a financial outlay of \$2.87 billion. The country has nearly achieved self-sufficiency in the production of solar modules and panels and is set to reach a PV module capacity of 110 GW by 2026<sup>2</sup>.

On the other side of the world, the US has not only imposed anti-dumping duties on Chinese PV imports but has also introduced the Inflation Reduction Act, providing incentives to encourage domestic manufacturing. Further, the Clean Energy Manufacturing Initiative (CEMI) focuses on public-private collaboration to boost the US clean energy manufacturing competitiveness.

These policy measures by the Indian and the US governments are yielding benefits. According to the IEA, over 120% more new solar PV manufacturing projects were announced in India, the US, and Europe between 2022 and 2023, showcasing clear signs of diversification.

#### Developing expertise and building capacities in



**upstream components manufacturing is a challenge for both countries:** Producing polysilicon, ingots, and wafers is far more challenging than producing modules and cells. Manufacturing of these inputs is more capital-intensive, energy-intensive, and technology-intensive, resulting in greater capital expenditures, operating costs, and technical complexities. The extraction and processing of raw materials like silicon and silver also have significant environmental impacts.

**Innovating while scaling up is also proving challenging:** Increasing efficiencies of solar cells and modules are being achieved in the last few years, as a result of innovations in the integration of smart technologies, and advancements in materials and design. Companies from China are at the leading edge of it, with some of them dedicating 5-7% of their rather large revenues towards R&D. This is challenging for companies in India, the US, and other parts of the world, most of whom are still yet to reach even their nameplate capacities.

#### **Turning Challenges into Opportunities & Way Forward**

Despite the existing barriers, India and the US should focus on addressing the key challenges and leveraging opportunities to capitalize on their growth. As the two countries move towards creating a holistic solar manufacturing ecosystem, enhancing collaboration across the following areas is recommended:

- I. Technology Transfer and Knowledge Sharing**
  - leveraging the US's expertise in advanced manufacturing technologies and India's manufacturing capabilities, coupled with facilitating the transfer of cutting-edge technologies, can accelerate the adoption of clean technologies and sustainable practices. Both India and the US should concentrate on developing and funding collaborative research programs on advanced solar technologies, and next-gen renewables, with a clear focus on

training programs and workshops, to build the necessary human capital. across the value chain.

- II. Joint innovation** - The countries should concentrate on introducing and accelerating innovative technologies and new configurations like tandem cells, perovskites, and dual cells. These technologies not only reduce land requirements by producing more energy but are making clean energy sources better. Research suggests perovskite solar cell panels offer higher efficiency, and lower production costs, creating resilient energy infrastructure.
- III. Energy efficient manufacturing** - As both countries ramp up their renewable energy manufacturing capacities, investing in energy-efficient technologies and integrating renewables in solar manufacturing will help meet the growing demand domestically, reducing emissions, and further creating more jobs in the local economy.
- IV. Financing** - According to CEEW (Council on Energy, Environment & Water) India needs an investment of USD 7.2 Billion by 2026 to promote an integrated solar manufacturing value chain, a huge opportunity for both India and the US to collaborate on and expand financing for solar projects. Both countries should consider mobilizing funds through joint investment funds, green bonds, and other sustainable finance instruments. Additionally, by accelerating collaboration between the private sector and pooling resources, both countries can further reduce the investment risk.

<sup>1</sup> IEA (2022), [Solar PV Global Supply Chains](#), IEA, Paris, Licence: CC BY 4.0

<sup>2</sup> Institute for Energy Economics and Financial Analysis (2023), [India's photovoltaic manufacturing capacity set to surge, IEEFA](#)





## Leveraging Carbon Markets to Catalyze Climate Action

### The Industry View

The global economy's path to net zero necessarily runs through Washington D.C. and Delhi. The United States and India account, in the aggregate, for nearly 20% of greenhouse gas emissions, globally. Under the Paris Agreement, both countries established emission reduction targets. The US aims to achieve a 50-52% reduction in net greenhouse gas emissions from 2005 levels by 2030 and achieve net zero by 2050<sup>18</sup>; whereas India has pledged to reduce its emissions intensity of GDP by 45% from 2005 levels by 2030<sup>19</sup> and achieve net zero by 2070. To achieve these targets, both countries have taken a comprehensive policy approach that includes the use of domestic and international carbon markets to price carbon and drive decarbonization.

The US has a long history of use of carbon markets at the sub-national level. Successful compliance cap-and-trade programs, such as the Regional Greenhouse Gas Initiative (RGGI), which covers eleven north-eastern states and has been in operation since 2009; additionally, California's emissions trading scheme (California ETS), operating since 2012, offers a wealth of experience on market design and carbon pricing to drive decarbonization. The US corporate sector has provided sustained support for the voluntary carbon market (VCM) over the years, procuring recurrently domestic and international carbon offsets. The

US civil society has also had a critical leadership role in building parts of the infrastructure and governance of VCMs, such as in methodology development and carbon registry operations.

This pioneering approach by the US continues to this day. The US government, among other initiatives, has thrown its weight behind the use of high-quality offsets to meet public and private sector decarbonization targets<sup>20</sup> and established the Energy Transition Accelerator (ETA)<sup>21</sup>, a federal government-led initiative to facilitate the global procurement by governments and corporations of high-quality carbon offsets that could mobilize around \$72 billion to \$207 billion in transitional finance by 2035.

India also has a long history of participation and contribution to international carbon markets. It was the second largest supplier of credits under the Kyoto Protocol's Clean Development Mechanism, hosting a large number of projects that have contributed to the learnings on the challenges and opportunities for the generation of carbon offsets at scale. Over the last decade, it has remained a reliable supplier of carbon credits for the voluntary market, supporting US corporates in their efforts to decarbonize.

This leading role also continues to this day. India has been one of the first countries to clearly define a list of projects that will be eligible for exports under Article 6 to attract carbon finance for new technologies, such as battery energy storage systems (BESS), green hydrogen, and



carbon capture utilization and storage (CCUS), among others.<sup>22</sup> Domestically, India has used market initiatives towards “hard to abate” industries, under a nationwide programme called the PAT scheme (Perform Achieve Trade) that will underpin a nationwide compliance emissions trading program (CCTS) planned to start in 2025.<sup>23</sup>

Given both countries’ experiences and initiatives in carbon markets, there are areas of mutual benefit concerning the development of a new generation of carbon markets under the Paris Agreement. Collaboration between the two countries will allow India to tap into advanced carbon market infrastructures and governance models established by the US, and will, in turn, provide the US access to India’s growing pool of carbon offset projects across areas like renewables, nature-based solutions, and community-based initiatives. Our recommendations for specific areas of collaboration include the following:

**I. Participation of India in the ETA offset procurement program**

Early involvement of India in the Energy Transition Accelerator programme would facilitate the alignment of carbon procurement and carbon offset project development between the two countries, provide the US with access to a large potential supply of high-quality credits, and provide India with access to large-scale and long-term demand for offsets to catalyze large-scale investments in carbon offset projects.

**II. Bilateral agreement under Article 6**

Under Article 6 of the Paris Agreement, countries can cooperate in carbon markets to reduce emissions through international carbon credit trading. A well-structured bilateral agreement between the US and India under Article 6, that sets a clear framework and set of principles for the bilateral trading of carbon credits may be a game changer. This should ensure robust credit quality standards, avoid double counting, and create transparent reporting systems that strengthen the trust between the two nations. This could accelerate the private sector engagements to drive large amounts of carbon finance to high-quality offset projects in India that could support US corporations and governments in their net-zero trajectories.

**III. Knowledge sharing and collaboration on carbon markets**

As India finalizes the design of its domestic market, it could leverage some of the learnings and experience of California ETS and RGGI, such as how to best integrate domestic carbon offsets into compliance carbon markets, setting periodically rising market floor prices that provide long-term price signals and establishment of carbon market governance rules to protect market integrity.

**IV. Establishment of a high-level dialogue forum on carbon markets with government and private sector representation to explore opportunities in carbon finance on an ongoing basis**

As there are multiple vectors of collaboration around carbon markets today, and new ones will surely emerge, the creation of a high-level carbon dialogue group between India and the US could be formed to help identify and advance opportunities of mutual interest to both countries. The proposed high-level dialogue forum could also serve as a platform to address evolving risks in carbon markets, including quality of credits, market volatility, and expansion, while facilitating the integration of new-age technologies, such as blockchain, to improve transparency.

To conclude, a much closer and formal collaboration between India and the US in carbon markets would set a new example for partnership between large emitters in developed and developing countries, reinforcing the global leadership role the US and India currently play in addressing climate change and accelerating the pace of change on international decarbonization efforts.

<sup>19</sup> [The United States of America Nationally Determined Contribution](#)

<sup>20</sup> India’s Updated First Nationally Determined Contribution Under Paris Agreement (2022), [Microsoft Word - V5 NDC submission to UNFCCC](#)

<sup>21</sup> The White House (2024), [FACT SHEET: Biden-Harris Administration Announces New Principles for High-Integrity Voluntary Carbon Markets](#)

<sup>22</sup> US Department of State (2023), [United States and Partners Announce Energy Transition Accelerator Framework](#)

<sup>23</sup> [MOEFCC \(2023\)](#), Activities finalised to be considered for trading of carbon credits under Article 6.2 mechanism to facilitate transfer of emerging technologies and mobilise international finance in India.

<sup>24</sup> The Gazette of India (2023), [CCTS.pdf \(beeindia.gov.in\)](#)





## Advancing the E-Mobility Sector as part of the Energy Transition Journey

**Dr. Jon Creyts, CEO, RMI**

The transition to electric mobility will be a crucial component of global efforts to combat climate change and ensure a sustainable energy future. As the world's fifth-largest economy and third-largest energy consumer, India's progress in this area will be vital, not only for advancing electric vehicle adoption but also for driving the broader global energy transition.

India has set ambitious goals and outlined bold strategies to advance rapidly toward a clean mobility future. The country aims to:

- Achieve a 30% share of EV sales by 2030 under the Clean Energy Ministerial EV30@30 initiative
- Attain energy independence by 2047 through the Atmanirbhar Bharat Abhiyaan (Self-Reliant India Campaign)
- Reach net-zero emissions by 2070, as pledged at COP-26

With these commitments and a supportive policy environment, India stands at a pivotal moment in its transition to electric mobility. Last year, EV sales accounted for 7% of the market, and India surpassed China to become the largest global market for electric three-wheelers. In September 2024, 10 GWh of new battery manufacturing capacity was awarded through the Advanced Chemistry Cell (ACC) Production Linked Incentive

(PLI) scheme, bringing the total awarded capacity to 40 GWh. Additionally, the country's electric grid is becoming increasingly cleaner, with over 150 GW of renewables now representing more than 33% of the total installed capacity as of July 2024.

A recent report from RMI - "India at 2047: A Vision for Energy Independence in the Mobility Sector" - found that achieving India's 2047 energy independence goal in the mobility sector could reduce road transport emissions by 87% by 2047, provided that nearly 100% of vehicle sales are electric by 2043. Achieving such an energy-independent scenario would require:

- 1.9 million cumulative public charging stations by 2040
- 275,000 cumulative public battery swapping facilities by 2041
- Over 1,000 TWh of electricity for EV charging in 2041
- More than 1,000 GWh of lithium-ion batteries for EVs by 2047

Achieving a 100% share of EVs in vehicle sales by the 2040s would necessitate disruptive and innovative shifts in the market and by accelerating its electric mobility efforts, India will not only bolster its own energy security but also drive significant momentum in the global transition to a low-carbon future.

**Strengthening the US-India partnership for advancing**

## electric mobility

One key opportunity to accelerate the transition to electric mobility is through the US-India partnership. As two of the world's largest economies committed to reducing greenhouse gas emissions, the United States and India are uniquely positioned to drive significant advancements in this sector.

In 2021, the United States and India launched the US-India Strategic Clean Energy Partnership (SCEP), which, among its many clean energy goals, focuses on enhancing bilateral efforts to decarbonize the transportation sector, evaluate grid-integrated EVs, and support EV financing. This partnership is a strategic move for both nations, addressing global market challenges and fostering mutual benefits in innovation, technology, and manufacturing.

Key areas for further development and strengthening of the US-India e-mobility partnership could include:

- I. De-risking EV Financing Through Innovation:**  
Concerns over EV residual value, operational performance, and perceived risks often results in higher interest rates, lower loan-to-value ratios, and shorter loan tenures. A US-India partnership could introduce innovative business models to mitigate these risks, such as expanding demand aggregation models and creating funds for payment guarantees.
- II. Advancing the Heavy-Duty Vehicle (HDV) Market:**  
The partnership could enhance the HDV market by facilitating collaboration among industry stakeholders

to share lessons from the US market, conducting pilot projects in India, and fostering cross-geography technology advancements and manufacturing opportunities for global application.

- III. Leading in the Battery Circular Economy:**  
The partnership could drive growth in battery manufacturing capacity by leveraging the technology development and manufacturing expertise of both countries. Additionally, they could jointly develop and implement advanced recycling technologies and systems, utilizing their combined insights and scaling solutions.
- IV. Scaling R&D Through Private Sector Collaboration:**  
Promoting private sector involvement through joint ventures, R&D partnerships, and investments in startups could accelerate technological advancements and market growth. Both governments can support these initiatives, benefiting from enhanced technology and manufacturing capabilities.

The US-India partnership has the potential to support an accelerated transition to electric mobility. By combining diverse technical expertise, vast market potential, and innovative approaches, both countries can turn shared challenges into impactful solutions. This collaboration offers a unique opportunity to lead the way toward a cleaner energy future.





## The Call for Climate Resilience: Rise of Resilient Infrastructure

Vaishali Nigam Sinha, Co-Chair, B20 Taskforce on Finance and Infrastructure

2023 marked the warmest year in recorded history, with global mean temperatures 1.45 degrees Celsius above pre-industrial<sup>16</sup>. This alarming reality and a 200% increase in climate-induced economic losses over the past decade demand immediate solutions. Resilient infrastructure is not just a technical requirement but an essential part of safeguarding our economics, livelihoods, and the environment.

Infrastructure is one of the fundamental backbones of the modern civilization. Transport, power, industries, and digital networks, are extremely crucial to human progress. However, much of the world's infrastructure is aging and is insufficiently designed to withstand climate-induced catastrophes. In many regions, especially the emerging economies, fragile power grids, inadequate food systems, and outdated transportation networks make these regions vulnerable to catastrophic risks.

### The infrastructure gap remains a global challenge

Despite its undeniable importance, infrastructure remains a global challenge. The current infrastructure investment gap stands at USD 15 trillion, almost three times the world's third-largest economy. Today, the global infrastructure investment stands at USD 3 trillion per year, but to meet the United Nations' Sustainable Development Goals, the investment must double or triple over the

next decade (KPMG, 2024).

Yet, this gap is not just about building more infrastructure, but about building climate-resilient infrastructure (CRI). Research shows that climate-resilient infrastructure is estimated to have a multiplier effect of 4 over the lifetime of the asset (OECD, 2024). In essence, every dollar invested in CRI not only supports climate action but also saves lives and drives sustainable and economic growth.

### The G20's role in advancing climate-resilient infrastructure

India and the US are key members of the G20. The grouping has a critical role to play in promoting and financing climate-resilient infrastructure (CRI). Since 2000, the G20 region has witnessed a very large number of climate-related casualties and cumulative economic damages, along with the most frequent natural disasters. G20 countries account for 40 percent of the top 10 and 30 percent of the top 20 countries with the highest disaster scores (World Risk Report, 2022). Given that G20 nations represent the most active bloc of global import and export activities, their investment in CRI is critical for mitigating the ripple effects of climate-induced catastrophes.

While the world acknowledges the importance of infrastructure, the dimension of climate resilience remains understated. Various estimates of the infrastructure investment gap do not consider climate resilience as a necessary variable. For instance, the cost of adaptation



for energy infrastructure for developing nations (2015-2030) is estimated to be between USD 9 -17 billion per year (McKinsey,2022). By 2050, the world would need close to USD 9.2 trillion every year for physical infrastructure to reach Net Zero.

**Capital mobilization for climate-resilient infrastructure**

A major catalyst for advancing climate-resilient infrastructure is development finance and the need for capital allocation efficiency. This calls for a renewed focus on multilateralism-enabled climate finance. One such priority area is urban infrastructure. Cities which occupy less than 2 percent of the earth’s surface, contribute 70% of global energy use and 75% of total CO2 emissions<sup>17</sup>. By 2050, more than 70 percent of humanity will live in urban centres making the scale of volume and share of urban finance critical.

Multilateral development banks (MDBs) have historically focused on supporting and finance National Governments, but the fight for Net Zero requires prioritizing urban and subnational climate investment.

Additionally, we need to sharpen our focus on private capital mobilisation for transition infrastructure. Currently, 70 percent of investment in resilient infrastructure is supported by sub-national governments. By 2030, emerging markets and developing economies (EMDEs) will witness a fivefold increase in climate investments. (IEA, 2023). While public sector investment is expected to scale, it will be limited given the diverse developmental needs. The private sector must step up to contribute about 80 percent of the required investment, supported by regulatory reforms and policies incentivizing private capital

One successful example is the Government of India’s National Single-Window System (NSWS), which simplifies the investment process by integrating existing clearance systems of the 31 Central Departments and the 22 States as a one-stop shop for investors, entrepreneurs, and businesses. By reducing red-tapism and fast-tracking

approvals, the NSWs enhances IRRs ensuring an inflow of private capital into climate-resilient infrastructure projects.

**Localised risks and governance**

Climate risks are geography-specific and differ from place to place. The importance of sub-national authorities in climate resilience efforts is multi-fold. Given the federal nature of governance in many regions, a whole-of-government approach is needed to mainstream climate resilience into infrastructure development (OECD, 2024).

By ensuring a multi-level governance and sub-national policy framework, climate considerations can be incorporated into sectoral infrastructure. It allows regional, sub-national, and local authorities to plan, permit, and operate climate-resilient infrastructure.

**The way forward**

Governments, institutions, and the private sector must act quickly to prioritize climate-resilient infrastructure. Blended finance, risk guarantees, and green bonds can help unlock the private capital, much needed to close the investment gap. In parallel, multilateralism such as initiatives by the G20, should continue to provide the necessary leadership to accelerate CRI development as a crucial enabler for climate action.

We stand at a pivotal juncture. The need to build resilience of infrastructure has never been higher. With the climate emergency looming in, it is time to protect and secure the future of our people and the planet.

<sup>17</sup> WMO (2024), [Climate change indicators reached record levels in 2023](#): WMO

<sup>18</sup> Cities Climate Finance Leadership Alliance (2023), [Accelerating Urban Climate Finance in Low- and Middle- Income Countries: An important strategic dimension of MDB reform](#)





## The Global Stock-take for Transition Finance | A Clarion Call for 2030

The Industry View

With six years remaining until the critical climate milestone 2030, a global stocktake is needed. As 2030 marked the warmest year in recorded history, the reality of the 1.5-degree threshold remains grim. This calls for global collective momentum in tune with the drastic and desperate need of the hour. The world's biggest stage for global climate collaboration i.e. the United Nations Framework Convention on Climate Change is a case in point.

As Parties come together for COP 29 in Baku, the call to action is loud and clear. Accelerate the fundamentals i.e. climate finance in action. The current goal on climate finance was adopted in 2009, with developed nations committing to contribute \$100 billion a year till 2020. This goal was met for the first time in 2022, two years past its deadline. Since its genesis, the socio-economic realities have changed drastically over the past fifteen years. The original commitment of USD 100 billion falls acutely short of what developing nations need. While the current financial target was rooted in a political rationale, a new Collective Quantified Goal is being discussed and developed on more 'scientific' grounds.

Another important aspect to note is that the \$100 billion target covers climate action under two categories i.e. (efforts to reduce greenhouse emissions) and adaptation (efforts to build

resilience to climate impacts). The dimension of 'Loss and Damage' which nations will continue to face climate catastrophe intensifies, needs to be incorporated. Thus, the scale of the need for accelerated climate finance needs much more global action.

**Per the Independent High-Level Expert Group on Climate Finance, emerging markets need close to USD 2.4 trillion a year by 2030 to meet climate and nature goals<sup>12</sup>.**

**According to IEA,** more than USD 1.7 trillion was invested in clean energy alone in 2023. However, the supply and demand are highly mismatched. The total estimated climate finance need stands at USD 8 trillion a year today, rising to USD 10 trillion a year post-2030<sup>13</sup>. To uphold the 1.5-degree trajectory, the world needs a **4X increase in just six years.**

**About half of this global transition finance gap needs to be mobilised from international sources of finance.**

Per IMF, growth in public investment, however, will be limited, underlining the need for private capital. Based on estimates, the private sector will need to supply about 80 per cent of the required investment<sup>14</sup>. Despite an upward trend in private capital mobilised, the absolute numbers remain meagre at USD 61 billion (OECD,2022).

Thus, financial markets and private co-financing need a serious step up. Markets are important because blended finance solutions address the stakeholders' specific and unique needs. Markets provide the required room for financial innovation, which is gaining traction in Emerging





and Developing Economies (EMDEs) and is projected to become a pull factor in the coming years. Moreover, investing in climate is good for **business, literally and proverbially. A closer look at the financial markets, and supporting evidence emerges. For instance, when we compare India's top market index NIFTY 50 with its thematic indices NIFTY Energy and NIFTY ESG, both the indices have outperformed with 27.49% and 21.13% over the 19.29% return (Aug 2019 – Aug 2024).**

**While the quantum is important, the direction is also critical. Low and lower-middle-income countries** with a disproportionately high risk of economic losses from climate change are attracting disproportionately low fractions of transition finance. Failure to address their transition and climate needs will undermine global financial stability, and heighten risks to economic development and local populations' health<sup>15</sup>. Currently, less than 3% of total global climate finance goes to or within least developed countries (LDCs) and only 15% goes to or within EMDEs (excluding China).<sup>16</sup> This calls for a conscious reform in the international financing framework focusing on multilateral institutions.

### Way Forward

For the eighth consecutive year, the multilateral development banks (MDBs) reported climate finance by the types of financial instruments. Some interesting trends emerge. More than two-thirds of climate finance for low- and middle-income economies was committed through debt-based instruments i.e. investment loans rather than policy-based financing (14%) and concessional

grants (10%). The mitigation finance commitments to low and middle-income nations are equivalent to those of high-income nations. The MDB climate finance to low and middle-income nations surpasses climate co-financing and it also the financial commitments to high-income nations. For the world to remain steadfast on its Net Zero trajectory, the transition finance landscape needs a conscious reform of multilateralism and a massive scale-up of blended financing.

<sup>12</sup> Alayza, N., Larsen, G. and Waskow, D. (2024). What Could the New Climate Finance Goal Look Like? 7 Elements Under Negotiation. [online] World Resources Institute. Available [here](#)

<sup>13</sup> Finance for climate action. Available [here](#)

<sup>14</sup> Ananthakrishnan, P., Ehlers, T., Gardes-Landolfini, C., & Natalucci, F. (2023, October 2). [Emerging economies need much more private financing for climate transition](#). IMF.

<sup>15</sup> CreditWeek: [What Is The Climate Finance Gap](#)

<sup>16</sup> Buchner, Naran & Padmanabhi et al. (2023), [Global Landscape of Climate Finance 2023](#)





## AI for climate forecasting and disaster management

**Anish De**, Global Head for Energy, Natural Resources, and Chemicals, KPMG

For millennia, human society had been maintaining a balance with nature, and largely extracting locally available resources. The first industrial revolution altered the distribution of economic activity and human settlement. Alongside came significant squalor, misery, and pollution due to urbanization, dislocation, and proliferation of smokestacks, deforestation for supplying wood to build long-distance railroads, and in general a preference of "large over small".

The domino effects of rapid industrialization and the impacts on climate over time have come to be significant. The available carbon budget of the world is close to being breached. Global warming not only needs arresting but also reversal. Simultaneously, it needs to be recognized and acknowledged that people who have not benefited from the gains of industrialization are also the most impacted by the effects of climate change, be it in terms of rising temperatures, extreme weather events, reduction in freshwater availability, crop failures, and so much more. They need help to cope with the impacts of climate change.

Modern science, while at the root of the climate challenges, also has the means to find the answers for mitigation and adaptation questions. It must work to protect the more vulnerable in society. Unfortunately, the distribution of scientific know-

how for this is uneven. The most advanced elements of scientific infrastructure and capabilities are also concentrated and expensive. Often it does not reside where it is most required.

It is in this context that AI is of vital importance. Modern-day AI/Generative AI is transformational and influences much of contemporary scientific activity. Be it for the creation of new/essential drug molecules that are significantly cheaper than what is currently available, developments in crop sciences, advanced weather forecasting mechanisms that help protect people and their livelihoods, AI applications are pervasive. These capabilities need to be deployed at a rapid pace, especially in emerging markets that are witnessing rapid economic growth and simultaneously experiencing structural transformation at breakneck speed.

The AI space is witnessing some positive developments in technology sharing and collaborative development. In August this year, Microsoft Corporation released its AI-enabled model christened 'Aurora', a cutting-edge AI foundation model that can extract valuable insights from vast amounts of atmospheric data. Aurora embodies a new approach to weather forecasting that could transform the ability to predict and mitigate the impacts of extreme events, including being able to anticipate the dramatic escalation of climate events. A key feature of Aurora is its being "open source" and hence usable by others without license costs to build



their own applications on top of this foundational model. It is necessary to have more such capabilities to be widely available for applications that aid climate mitigation and adaptation.

The global nature of climate challenges requires interventions on a global scale. At the least collaboration between large countries is essential, which can trickle down further. It is necessary to make the fruits of the research and collaboration - whether in the public or private space - as freely available as possible, and partially address the historical inequities created by the industrial age and the current digital era. It requires expansion of governmental, scientific, academic, financial, and other partnerships. Partnerships do exist, but they are sporadic and rarely of the scale to solve the existential challenges that the world faces due to climate change. It is a lack of pervasive collaboration that hinders progress towards solving the common challenges.

The United States, with its deep history of research and innovation, continues to be the scientific hotbed. India provides an application space when new capabilities need to be imbibed at scale and rapidity. India, on account of its own recent record of being a home of

frugal innovation at scale, can bring its own AI innovation and that of others, including the US, to bear upon the seemingly most intractable challenges. The collaboration between the countries around modern technology and especially AI can be in the academic and research spheres, but also among industries that are working to solve the climate challenges.

An inter-governmental cooperation agreement that allows for easier sharing of data, technologies, and facilities among institutions in the two countries for climate mitigation and adaptation could go a long way in accelerating collaboration. Additionally, seed/accelerator funding for scaling up climate technologies that address the challenges of vulnerable developing nations, especially in Asia, could be greatly beneficial. It is worth noting that Asia is home to more than half the world's population and is now responsible for more than half of global primary energy consumption and emissions. Together, the US and India can play a big role in bringing modern technology in solving difficult climate challenges in populous and most vulnerable parts of the world.





## Future-Proofing Renewables

## The Industry View

Over the last few centuries, the world has witnessed a global shift in the way it supplies and consumes energy. Starting from the pre-industrial era when people used wood and manure, to the transition to coal - the first energy transition, to the rise of oil and gas in the mid-19th century, and finally transitioning to renewable energy - the ongoing transition. The energy systems have surely transformed.

Today, the world's potential to generate renewable electricity is higher than ever. In 2023, there was a 50% surge in new renewable capacity additions, reaching around 510 GW<sup>24</sup>, with renewable energy sources accounting for more than 30% of the global electricity<sup>25</sup>.

As the global community stays committed to boosting clean energy and pursuing efforts to limit warming, nearly 200 countries have made a collective pledge to triple the world's renewable power capacity, taking it to 11,000 GW by 2030. A big move towards developing clean energy systems, free from fossils.

### India and the US - leading Emitters, leading the Change

India and the US are among the world's largest economies in the world. They are also among the top 3 largest emitters globally. Their actions and inactions are contributing to the future of global

climate change and shaping the vision of clean energy deployment.

In the past decade, India has not only emerged as a significant player in climate action but has successfully demonstrated a double leapfrog - from no electricity to connecting nearly all households with affordable, reliable electricity and expanding renewable energy rollout. The country is now the world's third-largest producer of renewable energy, with a staggering growth rate of over 16% in the last ten years<sup>26</sup>. Today, India stands strong at an installed non-fossil fuel capacity of 197+ GW and is moving aggressively towards its target of 500GW by 2030 of installed capacity of non-fossil-based electricity generation. India's strong political will and the favorable regulatory landscape are helping it stay on track to exceed its NDCs.

The US, on the other hand, has witnessed major legislative wins in the form of the Inflation Reduction Act and CHIPS Act. Currently, the country has a mature renewable sector, with ~380GW of installed renewable energy capacity, and solar reaching record levels. The US has also set a new record in clean energy deployment, visible through the increasing number of solar installations, EV sales, and growing number of domestic manufacturing plants.

While India and the US are at different stages of development, they are both facing similar challenges, spanning supply chain issues, execution barriers related



to land and transmission connectivity, the cost burden of legacy infrastructure and underinvestment in areas like grid and storage.

### Powering the Future – Strengthening India - US Collaboration

Even though rooted in distinct challenges and contexts, both countries have built on their shared vision of ambitious clean energy targets and decarbonizing key sectors through innovation and collaboration. Through the ongoing India-US Climate and Clean Energy Agenda 2030 Partnership, both countries are focusing on accelerating clean energy deployment and mobilizing finance through two main tracks, a technology track (US Strategic Clean Energy Partnership), and a finance track (Climate Action and Finance Mobilization Dialogue), crafting solutions together for a sustainable world.

As we move forward, India and the US should strengthen ties and collaboration across the following key areas –

- I. **Strengthen global and regional cooperation** – both countries should look at strengthening the existing Strategic Clean Energy Partnership (SCEP) and focus on collaborative efforts in areas like green hydrogen, grid management, and energy storage, which will further accelerate technology transfer, investment, and policy alignment. On the regional front, India and the US should continue to lead global initiatives like the ISA to foster international cooperation and greater impact.
- II. **Strengthen policy framework and implementation** – it is crucial to define consistent, clear policies and develop unified state-level policies to avoid

uncertainty for investors. Both countries should focus on advancing interoperability and expediting the permitting processes to support the transition. A ‘One Stop Shop’ approach for climate-related infrastructure projects will not only streamline processes for obtaining necessary permits but will increase transparency and improve project timelines.

- III. **Strengthen Investments and financing** – According to IRENA, annual investments in energy transition technologies need to quadruple to remain on track to achieve the 1.5°C Scenario. India alone needs around USD 170 billion per year to keep track of its goals.<sup>27</sup> To bridge the existing funding gap, both India and the US must explore innovative financing models like green bonds, concessional funding, and risk-transfer instruments (blended finance, insurance, foreign exchange risks, and guarantees). Initiatives like the US-India Clean Energy Finance (USICEF) must be scaled to mobilize capital and drive long-term debt-financing in India. Additionally, the countries should focus on using public finance institutions to increase the availability of concessional funding through instruments such as insurance, foreign exchange hedging, and junior and mezzanine capital.

<sup>25</sup> IEA (2024), [Renewables 2023](#), IEA, Paris, Licence: CC BY 4.0x<sup>1</sup>

<sup>26</sup> EMBER (2024), World passes 30% renewable [electricity milestone](#)

<sup>27</sup> CEA (2024), Report - Growth [summary of transmission lines](#) (June 2024)

<sup>28</sup> IFC (2023), Blended Finance for [Climate Investments in India](#)





## Leveraging the Geopolitics for Climate Action

**Dr. Mukesh Aghi, President & Chief Executive Officer, US- India Strategic Partnership Forum**

India is at a critical juncture in its energy transition journey. With a rapidly growing population and a corresponding surge in energy demand, India faces the challenge of meeting these needs while minimizing its carbon footprint.

At COP 26 in Glasgow, Scotland, Prime Minister Modi set a bold, ambitious, and yet perhaps achievable target of India achieving net zero carbon emissions by the year 2070. Perhaps, it was throwing down the gauntlet, as India sets out to cut emissions while balancing its rapid economic growth and achieving energy security for 1.4 billion citizens. In addition to the 2070 goals, Prime Minister Modi's roadmap emphasizes expanding renewable energy capacity to 500 GW by 2030, reducing carbon intensity by 45% from 2005 levels, and achieving 50% of its energy requirements from non-fossil fuel sources.

New Delhi's vision represents not only a significant leap towards sustainability but also an opportunity for India to become a global leader in clean energy innovation, catalyzing new investments in renewable sectors, investing in next-generation technology, and a market of green job creation. India's focus is full steam ahead on solar, wind, and other renewable energy sources, as Prime Minister Modi's net-zero goals aim to transform India's energy landscape and provide a sustainable blueprint for Global South economies, which have been unfairly on the

receiving end of critiques from G7 countries concerning emissions.

But while India can boldly execute and implement this plan, it can't achieve its targets alone. Ergo, New Delhi's path to net zero will require extensive collaboration, both domestically and internationally, fostering partnerships with like-minded democracies to achieve a more resilient and climate-friendly future. The US-India partnership, while epitomizing shared values of democracy and robust security partnership has also developed into a commitment to sustainable development.

Washington and New Delhi through the US-India Strategic Clean Energy Partnership (SCEP) aim to enhance bilateral cooperation in advancing clean energy technologies and scaling renewable energy deployment, to pave the way for a sustainable and resilient future.

The United States, with its advanced technological capabilities, innovative financial instruments, and a burgeoning clean energy sector, is an ideal partner for India in this endeavor. Along with the SCEP, India played host to a landmark G20 Summit in 2023, which saw the launch of the Global Biofuels Alliance, which focused on accelerating the deployment of sustainable biofuels.

The potential for deeper US-India clean energy collaboration is timely, given how the global energy market is shifting towards renewables, with wind, solar, and hydropower seeing significant advancements. Geopolitically, the oil economy led to a fractious and fraught environment in the Middle East. The launch of



the launch of a \$20 billion India-Middle East-Europe Corridor (IMEC) during the G20, which seeks to promote a multi-pronged network aiming to connect goods and services between Europe and Asia—via the Middle East—also promotes newer sectors, particularly in the clean energy economy. Hence, the need for energy security and reduced reliance on fossil fuels is paramount.

Both Washington and New Delhi have expressed a strong will to combat climate change, as per their commitments to the Paris Agreement and joint-bilateral commitment to the same. The economic potential of a US-India renewable energy collaboration is vast. For India, the partnership means accelerating the deployment of clean energy technologies, attracting foreign investment, and creating jobs for the 12-15 million people joining the workforce every year. Existing sectors won't suffice, hence newer areas of growth are needed to generate mass employment.

For American businesses, India offers both scale and diversity - a perfect testing ground for innovative clean energy solutions. As the fifth largest economy, and soon to be the largest economy by 2030, India presents a massive market for American companies, especially those investing in solar, wind, battery storage, and grid infrastructure. On the battery storage front, the geopolitical competition for critical minerals means countries are adopting a concept of friendshoring, and the US would likely invest and manufacture only in countries that share the same values.

India's push for EVs, apart from adding to the battery market, coupled with initiatives like Make in India and Production Linked Incentives (PLI) offers not only a push to cut emissions but also a boost for India's semiconductor economy.

India's burgeoning market and its significant human capital and demographic dividend of 60 percent between the ages of 18-35 are alluring to American investors. The country's scientific talent, engineers, and entrepreneurs have already demonstrated their capacity to innovate in the clean energy space. It's a propitious time to foster deeper technological collaboration and joint research initiatives, as both countries can spur discoveries,

reduce costs, and create competitive solutions for global markets.

The other focus is on climate financing as both countries must work together to address financing challenges. Renewable energy projects often require significant capital, which can be a barrier in emerging markets. The next challenge is to find innovative ways of financing these projects through green bonds, blended finance, and risk mitigation instruments, which can help mobilize the necessary capital required.

As the US-India Strategic Partnership Forum (USISPF) emphasizes through its endeavors, its public-private partnerships can play a pivotal role in scaling renewable energy initiatives. Governments can't solve all the problems but need private sector investments and need to create avenues of deeper collaboration. By creating a network between governments, companies, startups, and academic institutions, both countries can accelerate the deployment of new technologies.

The US-India collaboration on renewable energy is not just about meeting climate targets, cutting emissions, or boosting economic growth; yes, all three are of paramount importance, but what's at stake is creating a future for posterity. By committing to this partnership, both nations raise the bar and set the stage for the Global South and countries in the Indo-Pacific to adopt cleaner, greener energy solutions.

This collaboration has the potential to go beyond bilateral gains and could transform into a model for international cooperation on climate action, demonstrating that when nations coalesce with a shared purpose, they can move the needle.

As we approach Climate Week 2024, the US and India have set the example for what countries can accomplish together in the pursuit of a sustainable future. In an increasingly polarized world, the US-India partnership on climate and energy stands as a powerful testament to what can be achieved when nations choose collaboration over competition.







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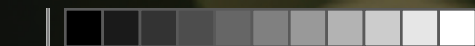
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