



Immersive

# Outlook

**Moving the needle on climate  
change adaptation**

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# Foreword

**'Climate change is real, so is our power to change it.'**

In the latest Climate Change Performance Index (CCPI) report released at the UN Climate Summit COP28 in Dubai recently, India ranked seventh out of 180 countries, up one spot from the previous CCPI, and remained among the highest performers. The country also received a high ranking in the Greenhouse gas (GHG) Emissions and Energy Use categories, but a medium ranking in Climate Policy and Renewable Energy.<sup>1</sup>

Neither geography nor an individual is immune to climate change. The earth and all its inhabitants – rich and poor, young and old – are under a shadow. In India, climate change due to rising temperatures and changing patterns of monsoon rainfall could cost the economy 2.8% of its gross domestic product (GDP) by 2050, as per a World Bank report.<sup>2</sup> Rising temperatures, extreme weather events, sea-level rise, changing precipitation patterns are pressing concerns which indicate that there is considerable ground yet to be covered when it comes to climate change adaptation in India. PwC's 27th Annual Global CEO Survey: India perspective underscores the point. Climate change is an important megatrend which is pressuring CEOs to reinvent themselves. The labour hours lost due to extreme heat and humidity could cost India up to 4.5% of its GDP by 2030, suggests a Reserve Bank of India report.<sup>3</sup>

This edition of Immersive Outlook, **Moving the needle on climate change adaptation**, spotlights the theme of climate change adaptation, looks at the gaps which need to be addressed and provides recommendations to bridge them. It also examines nature-based solutions which could accelerate climate action, and deep dives into technologies that are shaping climate change adaptation and could benefit businesses in the long term. The edition also includes transcripts of insightful video interviews with subject matter experts in this field – **Deeksha Vats**, the Chief Sustainability Officer at Aditya Birla Group, and **Subramanian Sarma**, Whole-time Director and Senior Executive Vice President (Energy) at Larsen & Toubro. The perspectives they bring to the table hold out hope and learnings that can be imbibed to enhance resilience and prepare for a greener and cleaner tomorrow.

<sup>1</sup> <https://ccpi.org/country/ind/>

<sup>2</sup> <https://www.worldbank.org/en/news/press-release/2018/06/28/climate-change-depress-living-standards-india-says-new-world-bank-report5>

<sup>3</sup> <https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/RCF03052023395FAF37181E40188BAD3AFA59BF3907.PDF>

We hope you find the articles informative and relevant. Please reach out to us if you would like to have a more detailed discussion on any of the aspects we have touched upon.

**Vishnupriya Sengupta**  
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# Role of public-private partnerships in climate change adaptation

Effective action on climate adaptation will require multiple stakeholders to collaborate and pool their strengths and capabilities. **Madhura Mitra** and **Peer M. Muna** outline why public-private partnerships are crucial for adaptation action and the imperative for businesses to incorporate climate adaptation into their boardroom agenda.



As extreme weather events become more frequent and intense, and climate variability becomes starker, the impact of climate change will increase multifold, pushing humanity into 'climate hell', the UN Secretary General has warned.<sup>4</sup>

While mitigating climate change by reducing GHG emissions and becoming net zero by mid-century is critical, achieving these targets looks like a distant dream in the absence of ambitious global action. To secure a liveable and sustainable future for all, adaptation needs to be pursued with the same urgency as mitigation. The Paris Agreement underlines this by establishing the 'global goal on adaptation of enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change.' The global stock-take at COP28 in Dubai, however, noted that significant gaps in adaptation still exist across sectors and regions and will continue to grow under the current levels of implementation.<sup>5</sup>

## The adaptation imperative in India

If left unchecked, the repercussions of climate change in India – the most populous country in the world – could be quite alarming. As per the Global Climate Risk Index 2022, India ranks seventh out of 180 countries in terms of the impacts of climate change.<sup>6</sup> But what lies ahead for the country? India faces average annual losses of

USD 87 billion due to extreme weather events such as heat waves, intense cyclones, floods and droughts.<sup>7</sup> Climate change can impact both the society and the economy. The World Bank estimates that about 160–200 million people will be exposed to lethal heat waves annually by 2030, with 34% of the population at risk of losing their jobs due to heat stress-related impacts.<sup>8</sup>

With more than 80% of India's population living in districts vulnerable to climate-induced disasters,<sup>9</sup> and over 75% of India's districts<sup>10</sup> identified as 'hotspots' for extreme climate events, adaptation is a necessity for India. India's updated Nationally Determined Contribution (NDC) recognises this and has included a target to enhance adaptation investments in sectors vulnerable to climate change, particularly agriculture, water resources, the Himalayan region, coastal regions, health, and disaster management by 2030.<sup>11</sup>

Although India has invested in building a conducive policy framework for adaptation through different missions such as the National Mission on Sustainable Habitat, the National Water Mission, the National Mission for Sustaining the Himalayan Ecosystem, the National Mission for a Green India, and the National Mission for Sustainable Agriculture

under the National Action Plan on Climate Change (NAPCC), and allocated financial resources through the establishment of the National Adaptation Fund for Climate Change (NAFCC), there is a long road ahead.

The current adaptation responses are incremental and sector/geography-specific, and are not commensurate with the magnitude of the problem. India's response to increasing climate risk is driven mostly by the government and funded by public finance sources. As a result, resource constraints plague adaptation efforts given the country's huge development needs. Only 8% of the estimated requirement of INR 4.4 lakh crore per annum is being met as per the data available for 2019–20.<sup>12</sup> Some factors that further limit climate adaptation efforts include:

- inadequate data collection or limited data availability which could hamper understanding of climate patterns,
- technological constraints, such as lack of access to advanced monitoring systems or data processing tools, and
- limited institutional capacity, especially at the local level, which means that there may be lack of expertise or awareness to develop and implement initiatives tailored to the needs of the community.

Businesses are not immune to the effects of climate change.<sup>13</sup> Climate variability and extreme weather events are reported to have impacted the financial bottom lines of leading fast-moving consumer goods (FMCG) and automobile sector companies in India in 2023.<sup>14</sup> According to the Reserve Bank of India, climate change could cost the Indian economy 2.8% of its GDP by 2050 and around 3% to 10% of its GDP annually by 2100 in the absence of adequate mitigation policies.<sup>15</sup> These statistics point towards the need for businesses to play a greater role in mitigation and adaptation action.

Despite the increasing interest in climate action among businesses, the needle on adaptation efforts hasn't moved. Some of the key factors that contribute to limited action on adaptation include:<sup>16</sup>

- **Perception that physical climate risk is not a risk or that it can be managed:** Such complacency can stem from a lack of direct experience with extreme climate events or a misconception that technological advancements would fully mitigate those risks.

7 State of the climate in Asia 2020 (World Meteorological Organisation, WMO)

8 World Bank

9 <https://www.worldbank.org/en/country/india/brief/advancing-climate-adaptation-building-resilience-to-climate-change-in-india>

10 <https://www.ceew.in/publications/preparing-india-for-extreme-climate-change-events-and-weather-conditions>

11 India's updated first nationally determined contribution under Paris Agreement

12 Climate change adaptation is the need of the hour

13 India's business community can help move the needle on climate change

14 Indian businesses rate climate change as top threat: Report

15 Reserve Bank of India - Report on currency and finance

16 World Economic Forum, Stockholm Environment Institute, PwC, Taking stock of business efforts

4 <https://www.theguardian.com/environment/2022/nov/07/cop27-climate-summit-un-secretary-general-antonio-guterres>

5 [https://unfccc.int/sites/default/files/resource/cma2023\\_L17\\_adv.pdf](https://unfccc.int/sites/default/files/resource/cma2023_L17_adv.pdf)

6 [https://www.germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021\\_2.pdf](https://www.germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_2.pdf)





- **Emphasis on immediate reduction of emissions:** Continued efforts on the reduction of GHGs overshadow adaptation measures due to their direct cause-and-effect relationship with climate change. A recent study conducted by the Organisation for Economic Co-operation and Development (OECD) demonstrates that adaptation is not given the same priority as mitigation with adaptation investment declining by USD 4 billion (14%) in 2021 and its proportion of total climate finance falling from 34% to 27%.<sup>17</sup>
- **Difficulty in developing an investment case:** Adaptation projects require significant upfront investments while their benefits are often intangible and realised over long periods of time. Since they do not always provide direct investment benefits for the investors, adaptation projects are not the popular choice for investors.
- **Long-term planning requirements:** The long-term planning and investment needed for adaptation projects may be at odds with business cycles that prioritise tangible, short-term gains and outcomes.

## Collaboration for greater action on adaptation

The level of efforts and resources needed for adaptation and the urgent need for action means that no single party – be it government, business, or civil society – can

act alone and deliver the results needed to address the climate crisis. Collective action with strong public-private collaboration should be the way forward. Businesses and other private sector organisations, including civil society organisations, should join hands with the government and public sector and all stakeholders should contribute by capitalising

on their respective strengths and capabilities. The following actions can foster collaboration among various organisations to implement climate adaptation:



**Conducive policy framework:** Governments can create an enabling environment which promotes actions by other stakeholder groups. They can do so by making policies, strategies and roadmaps that identify priority areas, define roles, and establish incentives for action or disincentives for non-action. They can also establish an accountability structure and monitoring and evaluation frameworks.



**Knowledge dissemination:** Academic and research organisations, and think tanks can contribute by gathering and disseminating knowledge on climate risk and adaptation.



**Goods and services:** Businesses can invest in the adaptation of their own operations as well as their value chain, including the communities and ecosystems connected to them. They can provide the goods and services needed for adaptation. They can also contribute by bringing adaptation finance or providing technical knowledge, resources and managerial capabilities. Organisations can leverage their reach as distributors, employers, sponsors, or implementors of community development programmes in different geographies.<sup>18</sup>



**Adaptation finance:** Multilateral development banks, philanthropies, and developed countries can be sources of adaptation finance, which can be structured as grants or blended finance instruments. They can also act as convenors of multistakeholder initiatives. Civil society organisations can implement adaptation programmes and also bring the voice of communities to the climate discourse.

Multistakeholder initiatives on climate change adaptation are already being undertaken but there is a need to scale up. For instance, the India Climate Collaborative (ICC) brings together government, businesses, philanthropic organisations, academia and civil society for designing, financing, and implementing climate solutions. According to the organisation, it is working towards scaling up solutions that employ evidence-based approaches in India to map present and future climate risks, equipping local communities with the tools and information to enhance resilience, and facilitate collaboration among diverse ecosystem actors to collectively respond to climate impacts.<sup>19</sup>

At a global level, another example of multistakeholder collaboration is that of Caribbean Climate Smart Accelerator (CCSA). In 2018, a group of 28 Caribbean Governments, alongside some of the largest global companies, financial institutions, and foundations joined hands to

launch the Accelerator. As per CCSA's website, the objective of CCSA is to fast-track public and private investment opportunities that support climate action and economic growth.<sup>20</sup> CCSA aims to engage the private sector to execute climate projects through cross-sector partnerships and other mechanisms, raise funds for blended financial facilities and work with technology developers and other accelerators on innovative climate solutions.

## The way forward

There are many reasons why collaboration can be beneficial for adaptation, especially in a resource-constrained country like India. Collaboration can enable:

- greater participation and buy-in from stakeholders,
- funnelling of investments towards adaptation initiatives,
- enhanced resilience by leveraging economies of scale, and
- strengthening of policy and institutional frameworks.

As the world unites against the climate emergency, collaboration is the need of the hour and all hands are required on the deck. In India, a good place to start can be encouraging dialogue among various stakeholders in the ecosystem on the need for climate action.

Businesses can take a proactive role and initiate such discussions with each other as well as with governments and international organisations. They can also take the lead in financing and implementing initiatives to enhance the resilience of communities and ecosystems. Businesses can integrate climate risk and resilience into their corporate social responsibility initiatives. By doing this, they can build the resilience of the systems on which they depend for resources while contributing to the Paris Agreement commitments and sustainable development goals (SDGs).

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<sup>17</sup> OECD (2023), Climate Finance Provided and Mobilised by Developed Countries in 2013-2021: Aggregate Trends and Opportunities for Scaling Up Adaptation and Mobilised Private Finance, Climate Finance and the USD 100 Billion Goal, OECD Publishing, Paris, <https://doi.org/10.1787/e20d2bc7-en>.

<sup>18</sup> World Economic Forum and PwC, Accelerating Business Action on Climate Adaptation

<sup>19</sup> India Climate Collaborative, Annual Report

<sup>20</sup> <https://www.caribbeanaccelerator.org/our-work/>



# ‘All our campuses are zero consumption zones, everything is recycled’

A three-pronged approach – which includes reducing consumption, encouraging use of alternative fuels, and proactively preparing for the future – can drive climate change adaptation and resilience efforts in the country, emphasises **Subramanian Sarma**, Whole-time Director and Senior Executive Vice President (Energy) at Larsen & Toubro (L&T) in a conversation with PwC India’s ESG Leader, **Sambitosh Mohapatra**.



Sambitosh Mohapatra (left); Subramanian Sarma (right)

## Excerpts from the interview

### **Sambitosh Mohapatra:**

Welcome to this edition of Immersive Outlook. Today, we have the pleasure of having with us Mr Subramanian Sarma, Whole-time Director and Senior Executive Vice President (Energy) at Larsen & Toubro. A graduate in chemical engineering, he holds a Masters from IIT Mumbai. Mr Sarma has more than four decades of experience, out of which three decades were in the Middle East. He is a subject matter expert on oil and gas value chain and leads hydrocarbon power and green development. Welcome, Mr Sarma. We expect to hear a lot about what L&T is doing for itself and for its clients in the Indian market.

### **Subramanian Sarma:**

Thank you, Sambitosh. Thank you for having me here today.

### **Sambitosh Mohapatra:**

So, to start with, we have been hearing about climate adaptation and climate resilience a lot over the last two decades. But action, it seems, has started just now. How do you see the ecosystem around climate adaptation and resilience developing in our country?

### **Subramanian Sarma:**

I think that since the Paris Accord, which was signed by most of the countries, the countries have held regular meetings about climate change and that has increased awareness. The first step in any movement or any change is awareness – people accepting that there is a problem. I think we have reached that stage. Everyone understands that global warming is now inevitable unless we do something drastic about reducing the carbon footprint and reducing the CO2 emissions. So, I think India is very much part of it and India has done quite a bit after signing the Paris Accord. I see this as a three-pronged approach for our country. India is a developing economy where we have to strike the right balance between affordability, security and clean energy. India has done quite well in moving forward on many of the initiatives. It is a three-pronged approach.

The first, and most important, is the reduction in the consumption of energy per unit of gross domestic product (GDP). That means achieving more with less consumption and that is happening. And how one does that is by improving the efficiency of consumption, use better machines like we recently did. We used a fertiliser plant which is energy efficient, and is far superior to the existing fertiliser plants, with a

40% improvement. Similarly, if you see now there is a huge campaign about using LED lamps. LED lamps consume 40% less energy than normal lamps. I think these are very good steps, which we, as a country, are driving to reduce consumption.

Similarly, decongestion of traffic as the infrastructure develops for travel efficiency and to improve fuel consumption, de-urbanisation, adding more airports, all this is part of creating a space to reduce consumption. I think quite a lot is happening on that front. That is the first approach.

The second approach is how do you find alternative, less carbon-intensive energies? And in that, I think, again, India has made good progress because it has been trying to move from an oil- to gas-based economy. Today, in the Indian economy, gas has a 6% contribution in the energy mix, and you may want to take it up to 12% or 15% because for every calorific value or for every heating input, gas emits 40% less carbon than oil.

So shifting the fuel from oil to gas can reduce the carbon footprint. India has also added a huge amount of solar energy which is growing and there is a plan to take it up to 500 gigawatts, which is quite substantial. Biofuels are also being pushed very hard.





Blending of biofuel in petrol and diesel up to 20% has been mandated by the government. Now if you can find good technology to convert staple agricultural waste into 2G ethanol, that will also contribute a lot to decarbonisation. So that is the second approach.

Third, how do you prepare the country for the future? People are talking about one degree, two degrees temperature rise which is now almost a given. I mean, we cannot get it below that. This is going to have collateral damage in terms of rising water levels and climate change. So, how do you prepare the country? I mean, India is vulnerable in many ways because it has coasts on three sides. We have to get ready for that so that we do not get caught by surprise. How do you build the infrastructure to prevent any natural disasters from hitting us badly? Those actions have to be taken. We also need to prepare for more afforestation, tree plantation, etc. So it is a three-pronged approach – reduction through better efficiency, alternative fuels, and preparing for the future, and I think India is working on all of those fronts.

**Sambitosh Mohapatra:** Well said, Mr Sarma, because at a country level, the policies and regulations are quite supportive of what you are saying. Specifically coming to L&T, you are in the construction space and we understand that the building ecosystem contributes a lot to emissions, isn't it? Similarly, climate has an impact on buildings. So it goes both ways. So what is the specific thing that you do when you are designing, planning and executing projects? How are you utilising technology, for example, to mitigate some of these impacts?

**Subramanian Sarma:** Very good point. Actually, the infrastructure business, particularly when it is getting implemented in very remote places, it is actually a hard business in terms of abatement. I mean, to reduce carbon footprint in this business is not that easy. However, I think L&T has been at the forefront of building the energy infrastructure, and we are quite committed to reducing carbon footprint. We have made a commitment that we will be carbon neutral by 2040. Our effort is more or less similar to what I talked about at the national level, you know, how do I improve efficiency, how do I reduce consumption? We are using a good design mix where less water or less aggregate is used in concrete, so we get the same strength by using less. We are looking at how to use higher efficiency diesel engines and diesel machines so that fuel consumption is reduced. Similarly, in every site and every location, wherever solar power can be used as an alternative fuel, we are installing and using it.

More importantly, we are using digital technology in a big way to improve the overall efficiency of our operations. We are using the internet of things (IoT) based technology – every equipment, every construction equipment has an intelligent chip – and we are measuring their performance, their utilisation and how effectively they are being used. That helps us to bring up the overall efficiency and reduce wastage. When it comes to buildings, we have come up with some good designs which focus on longevity because if you design for 40 years, instead of 25 years, then in a way you are reducing carbon footprint because you do not have to rebuild those buildings. So longevity has been incorporated in design. Then this building you are sitting in, it

is a green building. It is certified as a green building in terms of air conditioning and water usage. All our campuses are zero consumption, everything is recycled. So there are many efforts.

Having said that, I would say that the remoteness of our projects and accessibility issues which we face given that we are working in the extreme corners of the world, including the Middle East, it is not easy for us to implement everything that we want to in all the projects. But we are making our best efforts. I mean, there is no doubt about that.

**Sambitosh Mohapatra:** So I will pick up two strands from what you are saying. The first is that I want to hear more about the people aspect, because in many of the places – you yourself have spent three decades in the Middle East – how do you deal with these extreme weather conditions, which are going to be more aggravated? Are working hours getting changed? What are the facilities you give to people? Tell us about some of this because you have dealt with labour and people from underprivileged backgrounds who one should be worried about.

**Subramanian Sarma:** Again, it is a very interesting point you brought up. Things are changing because of climate change due to which the availability of skilled workforce is becoming a challenge. And for us, I think as an organisation, we have been extremely sensitive to how we treat our people and what kind of welfare facilities we provide, because for us not just as a good, caring organisation, but even otherwise from a business point of view, it is very important

that people are well looked after, only then you can get good productivity, safety and quality – all of them are interrelated.

Wherever possible, we provide a controlled environment and we also have shelters for the workforce. During summer, it is a common practice in the Middle East that the peak hours are silent hours from 10:30am to 4:00pm when you do not work and you start early in the morning or late evening. Similarly, in India, we do this wherever possible.

I think the most important thing is how do we reduce the intensity of labour? We have come up with some very good modular solutions in everything we do, like precast for concrete and precast buildings. I mean even for the trans-ocean bridge we built, a huge amount of prefabricated steel was used. You develop it in a controlled environment and then take it and install. We are trying to reduce worker intensity in harsh conditions in this way.

**Sambitosh Mohapatra:** And the second thing that I wanted to ask was about the market response. As you are trying to go for green buildings, is it cost competitive? First of all, is it more expensive? And second, is there a wave where we believe that the clients are asking for it now? Are they willing to pay more for a green building, for a more technologically or digitally, or what do I say, responsive building?

**Subramanian Sarma:** There are two ways of looking at it. One is capital costs and operating costs. Our industry very commonly uses the life cycle cost analysis. So you not only look at the capital, but you look at the overall net



Subramanian Sarma

present value (NPV) using 15, 20 or 30 years of lifecycle and what is the operating cost. A classic example is electric vehicles (EVs) versus internal combustion (IC) engine vehicles. Today, EVs are more expensive but when you look at the consumption of petrol and diesel over five years, the payback period is very, very short. So the same concept applies to green building also that maybe it is a bit more expensive to build it – though that expense is also coming down – but definitely there is a huge advantage in operating costs.

Second is that now, at least in urban areas, people are becoming more responsible and they would like to have green buildings. They also want to make their contribution to reducing the carbon footprint. So there is a preference for that. If there is a premium to be paid, I think people will be willing to pay because these are all long-term assets. The cost impact is very small.

**Sambitosh Mohapatra:** Sure. And over the last two, three years, have you looked at your products and services portfolio to address some of the emerging climate adaptation or resilience measures that you want to work with your clients on? Is that something that you would want to share with us?

**Subramanian Sarma:** Oh, yes. L&T has been at the forefront of building the energy infrastructure in India and the Middle East. We traditionally started with oil and gas upstream then moved to midstream, downstream and then we had a huge role to play in thermal power plants. And now, of course, with the new technologies coming and availability of clean energy options, we have positioned ourselves well. So, in addition to our conventional capability in oil, gas and power, we have also started undertaking work in the green space, which is basically green hydrogen, green ammonia, blue ammonia, and carbon capture projects. So in that segment we have our conventional engineering, procurement and construction (EPC) offering.





In addition to that, we have also gone into green manufacturing. We have a strong presence in manufacturing, and now we are going to green manufacturing, in the sense, looking at the value chain components in the green value chain, for example, an electrolyser. We produced our first electrolyser in December last year and we are planning to expand on that and be a big supplier of the electrolyser, which is the essential component for green hydrogen. We will add more components, more products in that value chain. More importantly, we have taken on a developmental role. We have formed a joint venture with some major players and together we are looking at building assets for generating green hydrogen, blue ammonia, green ammonia, for both domestic as well as export markets.

**Sambitosh Mohapatra:** So given the large scale challenge of adaptation, how are you engaging with the broader stakeholder ecosystem? For example, while in your operations you can be green, but what about your suppliers? How are they coming together? How many suppliers do you have?

**Subramanian Sarma:** I don't know, maybe more than 2,000 or something like that. It's a large number for sure. Good things have to start at home first. You have to lead from the front. Initially we are trying to do that, our customers are doing that. It's a process and it has begun. You can't expect all the suppliers to come on board immediately. There are many who are voluntarily coming, some we need to nudge and make them aware of how important it is. Slowly, the entire bandwagon will come onboard. It is a process and it will take time, but it is happening.

**Sambitosh Mohapatra:** So typically the journey is that we put in place a code of conduct, then we do some checks and then we invest. Is there a plan to co-invest along with your suppliers on certain technologies?

**Subramanian Sarma:** I think you have to share the knowledge and work together. Vendor development and supplier development have always been part of our value system and ecosystem so wherever we can share the knowledge or share the technology, we will help them. Co-investment has to be on a selective basis. Of course, we do not have unlimited resources to invest with everyone. But we will definitely co-invest, if required, in select areas. I think the whole process, once it begins, will become a necessity, it will not be a choice because at the end of the day, I mean, the community and the society will start judging you. Like today, if something is available in disposable bags, which are organic, I mean, you have an affinity for that, right? You want to reduce the use of plastic and fossil fuels. So I think over a period of time, as awareness increases, I think, everything will get naturally aligned.

**Sambitosh Mohapatra:** You yourself have committed to increasing use of renewable power in your sites by 50% by 2026 and 100% in your operations by 2035 and then be net zero by 2040. Anything in which you want the government regulators or the ecosystem to support you? Or any challenges that you have faced?

**Subramanian Sarma:** I think it is a challenging process because you are trying to strike a balance, as I said, between cost competitiveness, affordability and also being clean. These three aspects have to be aligned and they are conflicting. I mean, today, the cost of doing something clean or environmentally friendly is more expensive than not doing it, right? But at the same time, we have to remain competitive. The customer should be willing to pay more for it. The whole process is evolving.

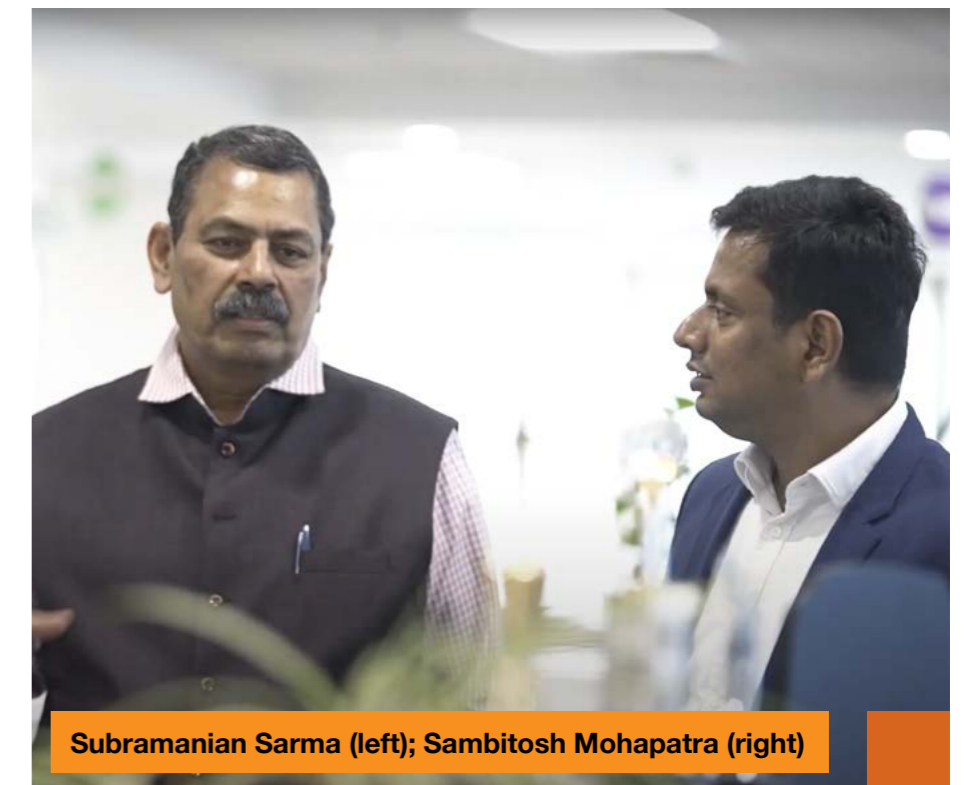
The government has put some very good enabling policies in terms of production-linked incentive (PLI) schemes, they are also giving priority – in terms of land allocation – to green development. I mean, there is also talk about having some enabling policies on the demand creation side. It is not in place yet, but there is a lot of thought going into it and we can see that there is a serious commitment. So once the policies come in and momentum picks up, then I think, people will be willing to pay a premium and people may even stipulate that we want only green and we will not be able to accept a higher carbon footprint.

**Sambitosh Mohapatra:** The last bit, because we talked about people, we talked about technology, the processes, awareness, regulations. Any reflections on financing, in the sense that are you getting financing for these green projects?

**Subramanian Sarma:** I think from everything that I gather from within the industry and the people I speak to, financing by itself is not a problem. I mean, particularly for green, there is a lot of financing you can access. It is having the right solution, the right technology, and the right commitment. Once you have a good plan, you should be able to attract finance. I think that will not be a bottleneck.

**Sambitosh Mohapatra:** Thanks, Mr Sarma for your insights into climate adaptation, what the countries should be doing, what L&T is doing, and what the broader ecosystem is responding to. Thanks a lot.

**Subramanian Sarma:** My pleasure. I enjoyed this conversation.







# Accelerating climate action in India through nature-based solutions (NBSs)

NBSs can be instrumental in achieving India's climate goals. **Madhura Mitra** and **Anjan Katna** discuss how the country can tap NBS projects for carbon credits and explore new financing options to expedite climate change mitigation and adaptation.



NBSs are increasingly being used for climate change mitigation and adaptation. The International Union for Conservation of Nature (IUCN) defines NBSs as actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges (such as climate change, food and water security, and natural disasters) effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.<sup>21</sup> IUCN categorises NBSs into three categories:

**Nature-based:** These solutions utilise existing ecosystem functions to restore degraded systems.<sup>22</sup>

**Nature-derived:** Nature-derived solutions leverage resources such as wind and solar energy.

**Nature-inspired:** Innovative designs and materials that mimic natural processes are developed in nature-inspired solutions.<sup>23</sup>

NBSs could help meet about 37% of climate change mitigation targets required until 2030 to achieve the goals of the Paris Agreement.<sup>24</sup> They use natural processes to provide sustainable, climate-resilient solutions.<sup>25</sup> NBS-related carbon credit projects focus on reducing GHG emissions and improving carbon sinks by reviving natural processes. These credits are fast becoming the preferred type of voluntary credit. Currently, the Gold Standard and Verra are the two most prominent carbon market registries with nature-based carbon credit

methodologies. Take the example of Verra's voluntary carbon market registry where at least 31% of the total credits issued in the registry have been labelled with the climate, community and biodiversity (CCB) standard – a framework that assesses land management projects that address climate change, conserve biodiversity and support local communities.<sup>26</sup> Moreover, 44.15% of the active verified carbon units (VCUs) – those that have not been cancelled or retired – listed in the Verra registry are from agriculture, forestry and other land use (AFOLU), a prominent NBS-specific intervention.<sup>27</sup> Calls to adopt nature-based climate-proofing measures are growing.

NBSs were a focal point of the discussions in COP28, Dubai, held in November–December 2023. Some of the key developments as summarised by PwC's specialists present at the summit were:

- The international community committed USD 186 million to conserve mangroves, forests, land and oceans. A new global ocean treaty will also be rolled out to tackle challenges such as pollution and overfishing to protect marine biodiversity.
- Cities pledged to become 'nature-positive' and make concerted efforts to enhance biodiversity. Some key actions they are poised to take include:
  - developing urban forests,
  - conserving and restoring natural ecosystems,
  - implementing sustainable urban planning practices, and

- engaging with citizens on NBSs.
- Significant progress was made on finalising the Kunming-Montreal Global Biodiversity Framework with a post-2020 global biodiversity plan aimed at halting and reversing biodiversity loss. Key elements of the framework include:
  - protecting at least 30% of the planet's land and oceans by 2030 (30x30 goal)
  - mobilising USD 700 billion per year for biodiversity conservation and restoration
  - mainstreaming biodiversity into all sectors of the economy.
- The global community reaffirmed its commitment to use NBSs to address climate change, focusing on the following:
  - forest restoration projects for carbon sequestration and climate-resilient communities
  - wetland restoration for flood control and water purification
  - sustainable agriculture practices for soil health and biodiversity.
- The critical role that indigenous communities play in protecting and managing biodiversity is increasingly being recognised. Actions that will be taken in this regard include:
  - supporting indigenous land rights
  - ensuring that indigenous communities are involved in decision-making processes related to nature conservation

- investing in indigenous knowledge and practices.

## NBSs are key to achieving India's climate goals

In the Indian context, the adoption of NBS-specific climate change mitigation activities is crucial to achieve the country's climate goals and to facilitate sustainable growth. Being one of the largest emitters of GHGs globally, India has set ambitious climate targets as a part of its Nationally Determined Contributions (NDCs) under the Paris Agreement (2015).

A prominent goal under India's NDCs is LiFE (Lifestyle for Environment)<sup>28</sup> which aims to propagate a healthy and sustainable way of living for every citizen of the country. Furthermore, India is committed to bringing down the intensity of the emissions of its gross domestic product (GDP) by 45% by 2030 (compared to 2005 levels)<sup>29</sup> and achieve net zero emissions by 2070. This includes the targeted creation of an additional carbon sink of 2.5 to 3 billion tonnes of CO<sub>2</sub> equivalent by enhancing forest and tree cover.<sup>30</sup>

NBS projects are a viable option for India to offset its GHG emissions and contribute to climate change mitigation and adaptation. For instance, research shows that if the country were to adopt NBS projects in just three agricultural activities – zero-tillage, fertiliser use and rice-water management – it could provide over 50% of the total

21 Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). Nature-based Solutions to address global societal challenges. Gland, Switzerland: IUCN. xiii + 97pp.

22 IUCN, Guidance for using the IUCN global standard for nature-based solutions

23 Ibid.

24 [https://www.ipbes.net/sites/default/files/inline/files/ipbes\\_global\\_assessment\\_report\\_summary\\_for\\_policymakers.pdf](https://www.ipbes.net/sites/default/files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf)

25 United Nations Environment Programme (2022). Nature-based Solutions: Opportunities and Challenges for Scaling Up. <https://wedocs.unep.org/20.500.11822/40783>.

26 <https://registry.verra.org/>, as on 15 Dec 2023

27 <https://registry.verra.org/>, As on 15 Dec 2023.

28 Press Information Bureau, 2022. Retrieved from <https://pib.gov.in/PressReleaseframePage.aspx?PRID=1847812>

29 Ibid.

30 Ibid.





climate mitigation potential of the agriculture sector.<sup>31</sup> NBS-specific projects are already gaining traction in India. For instance, India's Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI) demonstrates the benefits of NBSs by protecting mangroves for flood control, climate adaptation and community well-being. The five-year scheme covers an area of 540 km<sup>2</sup> across India.<sup>32</sup>

Among land-based interventions, sustainable forest management and reducing emissions from deforestation and forest degradation (REDD+), in particular, those that avoid planned deforestation (i.e. instances where forests legally earmarked for logging are conserved) are prominent. This is because these interventions target issues such as deforestation, and forest and land degradation.

These could potentially curtail AFOLU emissions by 0.4 to 5.8 gigatonnes CO<sub>2</sub>-eq/year.<sup>33</sup> Conserving ecosystems using this approach offers dual benefits of mitigating climate change and providing climate finance for

adaptation-based approaches. This approach helps combat climate change, restores vital ecosystems and brings substantial benefits to the communities that subsist on the same ecosystems for their various needs.<sup>34</sup> India's national REDD+ strategy incentivises forest conservation to achieve climate change mitigation.

Ecological restoration is also a key nature-based solution. Nearly 205 gigatonnes of CO<sub>2</sub> – two thirds of human-generated emissions since the industrial revolution – can be captured over the next 100 years by planting native species and restoring degraded landscapes.<sup>35</sup>

This demonstrates the potential NBSs hold for carbon sequestration. Transparency, however, is crucial when investing in land-based interventions under carbon market mechanisms. For instance, there should be transparency on metrics such as baseline – the GHG emissions projected to occur in the absence of the proposed action<sup>36</sup> – and the reduction of emissions above those that would have occurred in the baseline.

As part of its efforts to mainstream NBSs for climate action, India launched The India Forum for Nature-based Solutions – a national coalition platform – in 2022. The purpose of the platform is to encourage the use of urban nature-based solutions by bringing together government bodies, entrepreneurs and organisations in the NBS space with an aim to:

- drive investment and collaboration
- establish a common language and guide local action<sup>37</sup>
- mainstream urban ecosystem-based services and nature-based solutions through policy interventions.<sup>38</sup>

### Public-private partnerships to meet climate targets

The private sector in India can play a significant role by investing in NBS-specific projects and generating carbon credits either for internal offsetting or for transactions in compliance or voluntary or compliance carbon markets, providing revenue and encouraging further NBS investments. Article 6 of the Paris Agreement provides for voluntary cooperation between two countries to achieve emission reduction targets. Furthermore, while Article 6.2 allows bilateral arrangement, the yet-to-be-finalised Article 6.4 aims to improve upon the erstwhile clean

development mechanism of the Kyoto Protocol.<sup>39</sup> Therefore, Indian entities can participate in the international carbon market under various provisions of Article 6 of the Paris Agreement by selling verified credits arising from NBSs. Moreover, the Energy Conservation (Amendment) Bill, 2022, empowers India to establish a carbon credit trading scheme. Such a framework will foster a domestic carbon market which leverages the country's biodiversity<sup>40</sup> and will provide financing avenues for sustainable development.

Active participation of industries is integral to the success of India's carbon market and private players are increasingly recognising the need to address environmental concerns and fulfill investor expectations in this regard. Businesses are adopting frameworks such as the Taskforce on Climate-related Financial Disclosures (TCFD) and the Taskforce on Nature-related Financial Disclosures (TNFD) that help companies assess and disclose their climate-related risks, and take targeted action. TCFD's recommendations are popular among investors who want to measure climate risks. A PwC analysis of 19 large stock exchanges revealed that:

- In 10 of the 19 large stock exchanges, over 50% market value of listed entities was dependent on natural processes, leaving them exposed to nature-related risks, including physical risks such as weather-related events.<sup>41</sup>
- **63%** of the supply chain gross value added (GVA) of the construction industry – the

largest industry considered in the study – was highly dependent on nature.

- **77%** of the supply chain GVA of agriculture exhibited dependence on nature while the figure stood at 73% for the food, beverages and tobacco industry.
- **85%** of the supply chain GVA of the forestry sector and 88% of the supply chain GVA of the fisheries and aquaculture were highly nature dependent.<sup>42</sup>

The economic value generated by direct operations from these sectors relies heavily on nature. The recent supply chain disruptions due to droughts in the Panama Canal are an example of nature-related dependencies and risks that may have economic impacts at the global level, even for industries that may have a lower proportion of their operations directly dependent on nature.

As the need to accelerate climate action grows, guidelines and frameworks for nature-based carbon credits are constantly evolving. Robust additionality, baseline, and monitoring, reporting, and verification (MRV) frameworks are crucial for the success of NBS-specific carbon credits and to instill confidence in domestic and international markets.

### Addressing challenges in NBS implementation

Widespread implementation of NBS projects would require addressing challenges such as:

- lack of awareness and knowledge gaps
- lack of financing for nature-based projects, and
- land ownership and usage issues.

Encouraging stakeholder engagement and community participation as well as ensuring that the benefits are transferred to local communities can help overcome these challenges. Nature evidently has its inherent complexities and, therefore, using NBSs – be they sourced, derived or inspired – entails figuring out a way to intervene in harmony with the overall ecosystem.

Carbon credits, for one, can incentivise projects that sequester carbon. Developing and implementing supportive regulatory frameworks, providing tax incentives, involving local communities in the planning and execution, and establishing a national carbon market are some of the ways and means of ensuring the success of NBS credits. Therefore, a multidisciplinary approach, effective stakeholder collaboration and management, and adaptive business strategies can ensure the long-term success of nature-based solutions.

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**Anjan Katna** is Associate Director, Biodiversity and Climate Change.

31 Nature-based Solutions. A review of key issues in India

32 <https://pib.gov.in/PressReleaseFramePage.aspx?PRID=1914421>

33 UNFCCC. (n.d.). REDD+. United Nations Framework Convention on Climate Change. Retrieved from <https://unfccc.int/topics/land-use/workstreams/reddplus>

34 Ibid.

35 Fischetti, M. (2019, July 4). Massive Forest Restoration Could Greatly Slow Global Warming. Scientific American. <https://www.scientificamerican.com/article/massive-forest-restoration-could-greatly-slow-global-warming/>

36 Carbon Neutral Protocol

37 <https://pib.gov.in/PressReleaseFramePage.aspx?PRID=1838002>

38 Ibid.

39 What You Need to Know About Article 6 of the Paris Agreement

40 Arun Venkatraman, (2023), Your Story, Can nature-based solutions help conserve biodiversity in India?

41 <https://www.pwc.com/gx/en/issues/esg/nature-and-biodiversity/managing-nature-risks-from-understanding-to-action.html>

42 Ibid.





# Six technologies that are shaping climate adaptation in India

With the effects of climate change becoming more pronounced, adaptation will be as important as mitigation, and that requires investments into climate technologies. **Deepak Mahurkar** and **Shardul Fadnavis** look at six technologies that could offer businesses the opportunity to innovate for climate adaptation and lock in long-term benefits.



Cyclone Michaung that hit Chennai nearly three months back was yet another wake-up call that the impacts of climate change are not distant scenarios but present-day realities. At the recent COP28 summit in Dubai, experts warned that the cyclone was a 'clear sign of climate change' and called for more climate-proofing measures.<sup>43</sup>

Climate proofing then is the need of the hour and while the effects of climate change are becoming more pronounced across the globe, the ramifications may be particularly alarming for India. Extreme heat waves, droughts and unpredictable monsoons threaten to endanger lives and jeopardise the country's agrarian landscape,<sup>44</sup> risking food security for 1.4 billion people. The sub-continent is also poised to see a greater rise in sea levels than higher latitudes due to its proximity to the equator.<sup>45</sup> The consequences of climate change for the economy, too, would be far reaching. The labour hours lost due to extreme heat and humidity could cost India up to 4.5% of its GDP by 2030.<sup>46</sup>

Businesses acknowledge the risks. In a PwC analysis, 100 major businesses said that physical climate risks had had financial impacts on them – equal to about 10% of annual sales and 4% of their market value.<sup>47</sup> But climate risks also offer an opportunity to innovate. Adaptation efforts will generate

43 The New Indian Express, Michaung clear sign of climate change

44 World Bank, India: Climate change impacts

45 Ibid.

46 India Today, How climate change will hurt India's economy

47 World Economic Forum and PwC, Accelerating business action on climate change adaptation

demand for products and services that help businesses, communities and ecosystems adapt and build resilience to climate risk.<sup>48</sup> At least 31 of the businesses reviewed by PwC had identified adaptation-related opportunities. For instance, an insurance company has designed a new type of insurance for adaptation,<sup>49</sup> offering insurance solutions to help clients scale up nature-based solutions for adaptation. Others are developing alternative construction materials, risk modelling tools, climate risk insurance and improved seed varieties.<sup>50</sup>

## Adaptation is as important as mitigation

In the past few years, countries that are party to the UN Framework Convention on Climate Change (UNFCCC) have stepped up efforts to emphasise climate adaptation alongside mitigation.

**77%**

of countries have at least one national-level adaptation planning instrument – a policy, strategy or plan – in place.<sup>51</sup>

**25%**

of countries have developed laws and acts that require national governments to prepare a national adaptation planning instrument.<sup>52</sup>

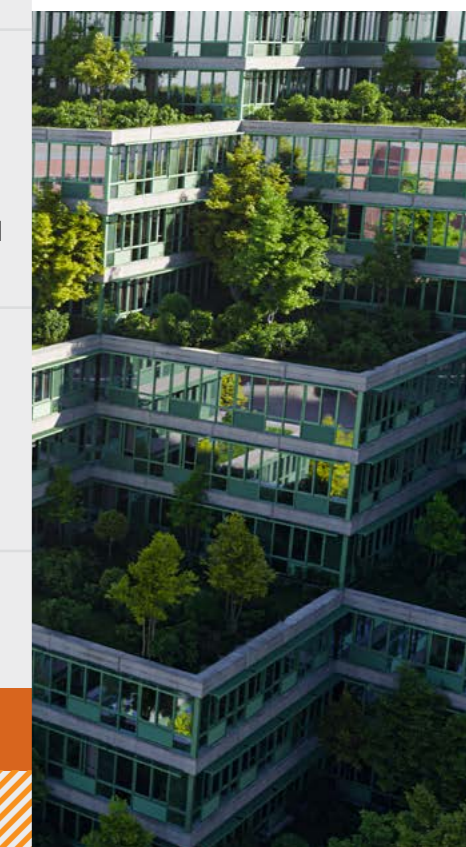
**69%**

of countries have a central administrative body to oversee adaptation action.<sup>53</sup>

**67%**

of countries have allocated domestic finance towards implementing adaptation priorities.<sup>54</sup>

Nevertheless, there is a need for more significant advancements. Progress on climate adaptation is slowing across all fronts – finance, planning and implementation – with the current adaptation finance gap estimated to be USD 194–366 billion per year.<sup>55</sup> Even as adaptation needs are growing, adaptation finance flows to developing countries reduced by as much as 15% in 2021. This is despite commitments made at COP26 in Glasgow that USD 40 billion per year would be provided in adaptation finance support by 2025.<sup>56</sup>



48 Ibid.

49 Ibid.

50 PwC, How climate adaptation can both protect and grow your business

51 United Nations Environment Programme (UNEP), Adaptation Gap Report 2023

52 Ibid.

53 Ibid.

54 Ibid.

55 Ibid.

56 Ibid.





Thus, the need to bolster climate finance and make the right investments – for example, into the right technologies – is imperative to safeguard livelihoods and business models.

## Current trends in climate tech investments in India

### Climate-focused investments are gaining momentum

The climate tech startup ecosystem is still in its early phases in India, but it's growing rapidly. 2021 was a landmark year for the climate tech sector with funding reportedly increasing over four times compared to the previous year.<sup>57</sup> While the total climate tech investment in 2021 was estimated at USD 20 billion,<sup>58</sup> in 2022, it increased to USD 22.5 billion.<sup>59</sup>

In 2022, equity funding for climate tech amounted to USD 4.7 billion.<sup>60</sup> The top three sectors with the largest share of the pie were energy transition at USD 2.25 billion, followed by clean mobility (USD 1.44 billion) and sustainable agriculture (USD 755 million).<sup>61</sup>

Globally, tough conditions in private markets in 2023 have

pushed climate tech startup funding back to the level it was at five years ago.<sup>62</sup>

In 2023, climate tech investments from venture capital and private equity were down by 40%. Notably, this drop was mainly due to macroeconomic factors that led to a subdued outlook. The dip, however, is less severe than the investment in other categories, which reduced by 50%.<sup>63</sup>

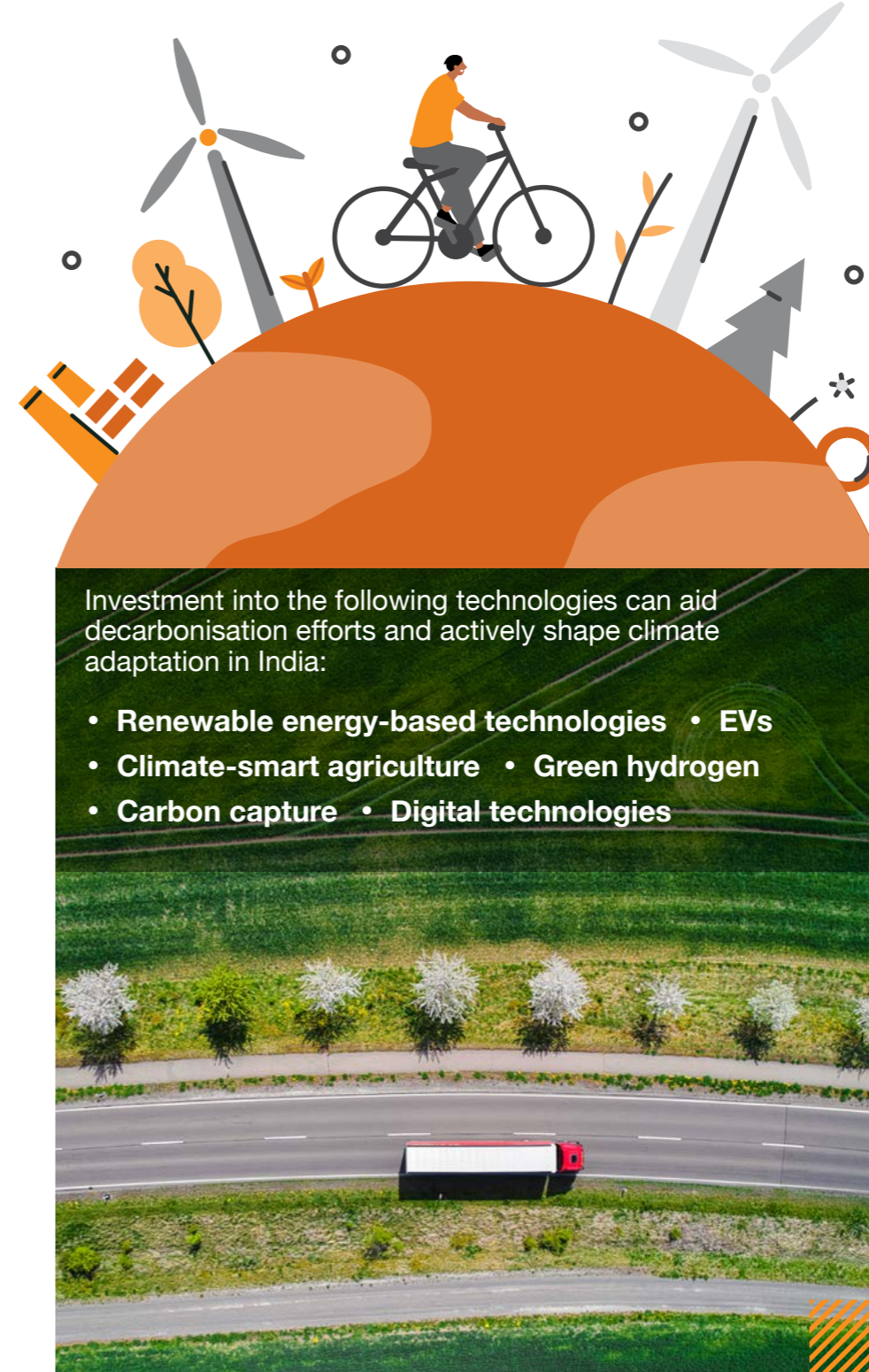
### There is a growing interest in climate tech among new investors

India has a thriving startup landscape, with at least 22,000 startups working on renewable energy, AgriTech and green technologies.<sup>64</sup> Investors, too, have awakened to the threat posed by climate change. In 2022, the climate technology landscape witnessed 130 new investors in India, increasing the size of the equity investor community to over 310.<sup>65</sup> Angel investors are also playing a pivotal role in climate tech investments. In 2022, 37% of climate investments were at the seed stage.<sup>66</sup> Large corporations make up 14% of the country's climate tech funders.<sup>67</sup>

### Investments are moving beyond EVs and renewables

Investment is shifting towards hard-to-abate sectors with higher levels of emissions and towards technologies with greater emissions reduction potential such as carbon capture, utilisation and storage (CCUS) and green hydrogen.<sup>68</sup> India, too, is diversifying its climate technology investments beyond the energy sector. In 2021, electric vehicles (EVs) and energy<sup>69</sup> accounted for a large part of the USD 7 billion raised by climate tech startups, but newer technologies such as green hydrogen have since gained traction. In 2022, funding allocated to waste management and circularity solutions went up by five times, while the AgriTech sector saw a 20% increase in venture funding.<sup>70</sup>

Adaptation is a critical part of India's nationally determined contributions (NDCs) and aims to boost investments in development programmes in sectors and regions at risk of climate change.<sup>71</sup> Climate technologies can tackle environmental challenges while opening up business opportunities in an eco-conscious world.



Investment into the following technologies can aid decarbonisation efforts and actively shape climate adaptation in India:

- Renewable energy-based technologies
- EVs
- Climate-smart agriculture
- Green hydrogen
- Carbon capture
- Digital technologies

### Renewable energy-based technologies

Renewable energy is acknowledged as a measure for both mitigation and adaptation. At least 34% of the 190 countries that had submitted NDCs by the end of 2020 mentioned renewable energy in their adaptation component.<sup>72</sup> India, too, has focused on renewable energy to aid its adaptation efforts. Though, in 2022, India fell short of its renewable target of 175 gigawatt (GW) comprising 100 GW from solar, 60 GW from wind, 5 GW from 'small' hydro and the remaining 10 GW from bio-power – developing 120 GW of renewable energy capacity by the end of the year<sup>73</sup> – the country has seen considerable growth in the sector. It has set an ambitious goal of 500 GW of non-fossil fuel capacity by 2030.<sup>74</sup> Solar and wind energy are expected to draw in significant investment this decade due to their potential to offer sustainable, commercial returns to businesses.<sup>75</sup> India's solar and wind power base is the fourth largest in the world.<sup>76</sup> Hybrid projects have piqued interest as well. For example, a large corporation recently commissioned its third wind-solar hybrid power plant in Rajasthan.

Solar photovoltaics (PV) is among the fastest growing sub-sectors. While an estimated 12.7 million people were either directly or indirectly employed in the renewable energy sector globally

57 Unitus Capital and Climake, The State of Climate Finance in India 2022

58 Ibid.

59 Unitus Capital and Climake, The State of Climate Finance in India 2023

60 Ibid.

61 Ibid.

62 PwC, State of Climate Tech 2023

63 Ibid.

64 Unitus Capital and Climake, The State of Climate Finance in India 2023

65 Ibid.

66 Ibid.

67 Ibid.

68 Ibid.

69 Unitus Capital and Climake, The State of Climate Finance in India 2023

70 Ibid.

71 MoEF, India's NDCs

72 IRENA (2021), Bracing for climate impact: Renewables as a climate change adaptation strategy, International Renewable Energy Agency, Abu Dhabi

73 Ibid.

74 IRENA (2023), Low-cost finance for the energy transition, International Renewable Energy Agency, Abu Dhabi

75 Unitus Capital and Climake, The State of Climate Finance in India 2023

76 Ibid.





in 2021, a third of these jobs were in solar PV.<sup>77</sup> India is also making strides in solar PV, increasing its capacity to 10.3 GW in 2021, up from 4.2 GW installed in 2020. Supportive regulatory frameworks, such as the government's production-linked incentive (PLI) scheme, are giving a boost to domestic manufacturing. India is expected to add an estimated 29 GW of cell capacity and 33 GW of module capacity by 2025.<sup>78</sup>

Despite these advantages, the overall share of renewable energy in the primary energy mix needs to increase to 75% for the world to meet the 1.5°C climate goal of the Paris Agreement. This requires an annual investment of over USD 4.4 trillion.<sup>79</sup> More investments are being made in energy-related climate tech globally. The shift is especially remarkable in neighbouring China, where startup investment in energy-related tech increased to 22.2% in 2023 from just under 2% in 2018.<sup>80</sup>

Technological innovations can extend the benefits of renewable energy-based solutions to non-energy services. For instance, distributed renewable energy solutions – technologies that don't rely on centralised energy generation – are increasingly being deployed in remote regions to provide access to water.<sup>81</sup>

Decentralised solar- or wind-powered water purification systems can be a cost-effective solution in developing countries.<sup>82</sup>

Furthermore, vapour (or fog) harvesting is an emerging technology that collects water in the ambient air. Desert safaris in Dubai are using hydro panels that turn vapour in the atmosphere into drinking water using solar PV and solar thermal technologies.<sup>83</sup>

## EVs

Apart from directly reducing emissions, EVs can aid in climate adaptation efforts by helping build a more resilient transport infrastructure. The market for EVs is a small but growing one. Currently, 591 brands sell EVs in India. Of these, 456 are in three-wheelers alone, making up 53% of all three-wheeler sales.<sup>84</sup> However, the share of EVs in the two-wheeler (5%) and four-wheeler segments (1%) is small.<sup>85</sup>

Technological advancements are required to address the two elements that are crucial for EV adoption at scale – a robust charging infrastructure and lower battery prices. The government has already rolled out initiatives to address both. Under the Faster Adoption and Manufacturing

of Hybrid and Electric Vehicles (FAME) scheme, 862 hybrid/ electric buses had been deployed in various cities by 2021.<sup>86</sup> Under Phase-II of the initiative, charging infrastructure is being developed in the country. The government has also introduced a PLI scheme for manufacturing of advanced chemistry cell (ACC) in the country to enable a dip in battery prices. The private sector, too, is getting on board with EVs. An Indian engineering and construction firm is rolling out EVs across its campuses,<sup>87</sup> while a power company has developed EV charging stations along national highways.<sup>88</sup>

## Climate-smart agriculture (CSA)

CSA is playing a pivotal role in fortifying adaptive strategies to cope with climate change. Soilless farming, bioengineering to make plants more resistant to disease or temperature, and precision farming are all techniques that can help farmers optimise resources. Precision technologies allow farmers to manage different zones of an agricultural field separately instead of applying the same crop treatment to the entire field. This means treatment is automatically adjusted to meet each site's

unique needs.<sup>89</sup> Satellite imagery and drone technology are used in precision farming to take images of the field for timely interventions.

Climate-smart tech is being embraced by farmer communities at the grassroots. For instance, in the drought-prone state of Maharashtra, recent initiatives signal a concerted effort to bring about a positive shift. In affected regions, farmers are adopting smart agriculture practices. To cultivate high-yielding crop varieties, greenhouse farming is being deployed.<sup>90</sup> Farmers have changed their cropping pattern by shifting to less water-intensive crops and are also experimenting with artificial cross-breeding of crops.<sup>91</sup> Elsewhere, farmers have also been adopting climate-resilient strategies to grow heat-resistant varieties of crops.

AgriTech developments are vital to sustain these efforts. Over 1,300 agri startups operating in India are using technologies like machine learning (ML) artificial intelligence (AI), and IoT. Most of these agri startups are concentrated in Karnataka, Maharashtra and Delhi-NCR.<sup>92</sup> To encourage agri startups and to modernise agricultural practices, the government has also announced a new 'Agriculture Accelerator Fund' last year.

## Green hydrogen

The green component of green hydrogen comes from the source of the electricity used, which comes from renewable energy sources. With an eye on becoming the leading producer and supplier of green hydrogen, India launched its National Green Hydrogen Mission in 2022. The country has set an ambitious target of developing a green hydrogen production capacity of at least 5 million metric tonne (MMT) per annum. Along with this, India is aiming at an associated renewable energy capacity of about 125 GW.<sup>93</sup> As part of the mission, regions that can support large-scale hydrogen production will be developed as 'green hydrogen hubs' and financial incentives will be provided to target domestic manufacturing of electrolysers and production of green hydrogen.<sup>94</sup>

The mission will support pilot projects in hard-to-abate sectors like steel, long-range heavy-duty mobility, shipping and energy storage. Currently, hydrogen produced from natural gas is utilised for production of nitrogenous fertilisers and petrochemicals. Replacing this with green hydrogen could pave the way for use of renewable energy in these sectors and bring

down import dependence.<sup>95</sup> Fuel cell electric vehicles (FCEVs) that run on hydrogen fuel will have an advantage over EVs since batteries required for EVs are dependent on imported raw materials like lithium and cobalt<sup>96</sup> while India has the capacity and resources to become self-reliant in the hydrogen fuel cell supply chain.

## Carbon capture

While carbon capture is primarily aimed at mitigation, its associated benefits can aid in adaptation. The market for carbon capture solutions is growing. CCUS, including CO2 removal, is the only category of climate tech globally to show an absolute rise in investment over the past two years.<sup>97</sup> In India, startups enabling carbon credit access for nature-based solutions raised USD 11 million even as industrial-based carbon capture remained minimal, mostly due to significant costs.<sup>98</sup> Another form of carbon capture, direct air capture (DAC) technologies – that capture CO2 from the air – are also at a nascent stage with cost and scale of operations yet to be clearly defined.<sup>99</sup>

Wider adoption of CCUS technologies will require policy support and economic incentives

77 IRENA, Renewable energy and Jobs: Annual review 2022

78 Ibid.

79 IRENA (2023), Low-cost finance for the energy transition, International Renewable Energy Agency, Abu Dhabi

80 PwC, State of Climate Tech 2023

81 IRENA (2021), Bracing for climate impact: Renewables as a climate change adaptation strategy, International Renewable Energy Agency, Abu Dhabi

82 Ibid.

83 Ibid.

84 Unitus Capital and Climake, The State of Climate Finance in India 2023

85 Ibid.

86 PIB, Press release

87 strategy+business, Indian engineering firm mapping new growth

88 strategy+business, Pursuit of a renewable future

89 USDA, Precision agriculture in crop production

90 PwC, Climate, community, cooperation: An Indian approach to adaptation in the Global South

91 Ibid.

92 Inventiva, Agritech in India: An overview

93 PIB, National Hydrogen Mission

94 Ibid.

95 Ibid.

96 Ibid.

97 PwC, State of Climate Tech 2023

98 Ibid.

99 NITI Aayog, CCUS







such as tax or cash subsidy on the captured CO2 and loan guarantee.<sup>100</sup> The captured CO2 can also contribute to a circular economy. For example, conversion of CO2 to various polymers – with applications in laptop packaging and cell phone casings – has been attempted globally.<sup>101</sup> CO2 utilisation technologies are relatively less developed compared to capture technologies,<sup>102</sup> necessitating investment in R&D in utilisation technologies.

### Digital technologies

Digital technology solutions are helping build climate resilience among communities, offering real-time tracking and data-driven decision making. Such technologies include advanced climate modelling, remote sensing and satellite technology, and IoT. In Maharashtra, a cutting-edge IT-driven, remote sensing information system can analyse water resources in real time.<sup>103</sup> Satellites and ML are being used to issue detailed flood alerts while AI is helping detect wildfires and send early warnings.<sup>104</sup> The United Nations' 'Early Warnings for All' initiative plans to use early warning systems (EWS) to protect people against extreme weather events within five years.<sup>105</sup> India is constantly looking to improve its forecasting and EWS system. By 2025, the Doppler Weather Radar

Network is likely to cover the entire country and will predict extreme weather events more accurately.<sup>106</sup>

### Key challenges to climate-tech adaptation

- **Mitigation takes precedence over adaptation when it comes to finance flows:** Mitigation actions are perceived to have more direct consequences than adaptation action. For instance, reduction in carbon emissions can provide a measurable metric for assessing the effectiveness of mitigation action. But the impact of a community-based flood resilience programme is hard to quantify. Therefore, international funding has prioritised mitigation.
- **Lack of integration with business strategy:** Businesses often view adaptation as a corporate social responsibility rather than a business imperative.<sup>107</sup> This requires a mindset change. Businesses need to acknowledge that climate change poses tangible risks to operations and supply chains, and align an understanding of climate adaptation with the broader business strategy.
- **High costs of new adaptation solutions:** Many technologies designed to enhance resilience can have high implementation

costs. Innovative technologies also require continuous R&D so that they can be cost-effective and scalable. There are further challenges to scalability as effective adaptation measures are not 'one-size-fits-all' solutions and need to be customised according to the local context.

### Recommendations

Technological innovations present India with the unique opportunity to catalyse resources for adaptation efforts. Concerted efforts along with supportive policies can help embrace sustainable technologies. Our recommendations include:

- mobilise private finance
- provide global funding for local solutions
- rethink the industrial system.

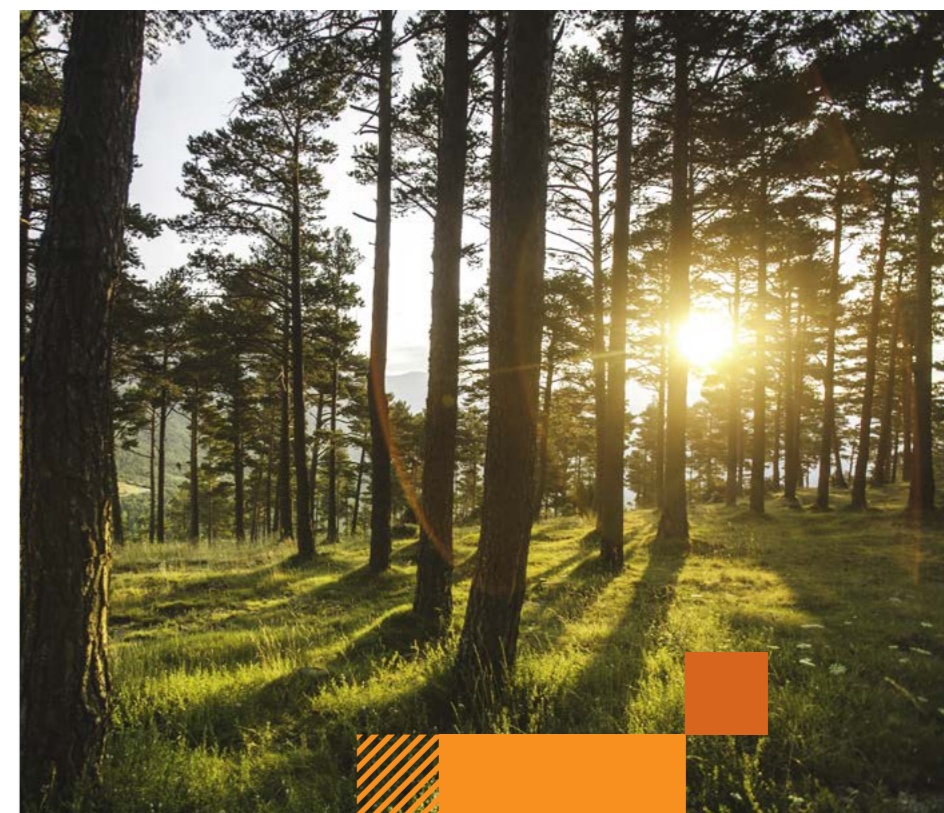
### Mobilise private finance

The major source of adaptation funding in India is domestic, with adaptation measures being funded by Central and state government budgets.<sup>108</sup> To support India's green transition, the private sector needs to play a much bigger role. One way to encourage private investors is strategic transfer of risks linked to commercialisation and deployment of new technologies. While risks can be mitigated through many

risk instruments, existing risk instruments do not adequately cover policy and market risks for climate technology investments.<sup>109</sup> In practice, blended and concessional finance models are frequently employed to shift some of the risk burden from private to public entities.<sup>110</sup>

Initiatives such as the Climate Finance Leadership Initiative (CFLI) – which mobilises private capital for climate solutions – can fast-track adaptation solutions. At COP28, CFLI announced climate finance solutions across e-mobility, green hydrogen, circular economy and renewables that have the potential to mobilise over USD 6.5 billion in support of India's low-carbon, climate-resilient development.<sup>111</sup> Some of the new solutions that private players will be leading include:

- A first-of-its-kind blended finance platform that will encourage e-vehicle adoption among fleet operators by providing specialised counterparty financing options.<sup>112</sup>
- Leasing solutions and loans for EVs with an aim to achieve 10–12% EV penetration by 2030.<sup>113</sup>
- Innovative financing frameworks to enable public-private partnerships (PPPs). Such structures have the potential to mobilise USD 2 billion worth of private capital via PPPs by 2030.<sup>114</sup>



### Provide global funding for local solutions

International investors often face challenges due to lack of in-country presence, local experience and limited financial appetite for small projects.<sup>115</sup> Mechanisms that aggregate smaller constituent assets and projects in developing countries into larger, tradeable assets can draw in larger institutional investors.<sup>116</sup> For example, a fund could be set up to pool in several small-scale renewable energy projects in remote villages in a country, creating a larger, more manageable entity.

100 NITI Aayog, CCUS

101 Ibid.

102 Ibid.

103 PwC, Climate, community, cooperation: An Indian approach to adaptation in the Global South

104 Ibid.

105 PwC, How climate adaptation can both protect and grow your business

106 PwC, Climate, community, cooperation: An Indian approach to adaptation in the Global South

107 World Economic Forum and PwC, Accelerating business action on climate change adaptation

108 Climate Policy Initiative, Landscape of green finance in India 2022

109 UNFCCC, Enhancing access to climate technology financing

110 Ibid.

111 Bloomberg, CFLI India announces climate finance solutions

112 Ibid.

113 Ibid.

114 Ibid.

115 OECD, Scaling up the mobilisation of private finance for climate action

116 Ibid.





Moreover, international financial support needs to converge with grassroots initiatives for meaningful long-term adaptation. By involving local communities in decision making, adaptation strategies can cater to the specific needs of each community.

A great example of community collaboration can be seen in coastal regions which are particularly exposed to climate change. To overcome floods that batter their region every year, the Mishing tribe in the Brahmaputra plains of eastern Assam have re-engineered their housing.<sup>117</sup> The community now resides in houses built on bamboo stilts with mud foundations. The floor height of these structures can be adjusted according to the flood levels. A light raft is also secured underneath the houses.<sup>118</sup> Farmer field schools (FFS) are another success story from the grassroots. FFS include a group of farmers that gather once a week under a trained facilitator to brainstorm sustainable agriculture solutions.<sup>119</sup>

### Rethink the industrial system

To expedite the shift to a sustainable world, ecosystems must swiftly adapt to emerging commercial realities.<sup>120</sup> Technologies that are required to shift to a carbon-neutral industrial system already exist, for example, drought-resistant crops that produce higher yields and solar panels and wind turbines that

provide clean energy at the lowest cost.<sup>121</sup> But multiple factors slow down the change that is required.

Technology adoption is slow due to reliance on existing technologies and high investment requirements.<sup>122</sup> Businesses may want to wait for technologies to mature and offer better returns before making an investment. Therefore, rethinking the industrial system would require organisations to reinvent internally. For businesses, this would mean becoming future-ready by cutting down bad costs and developing differentiated capabilities.<sup>123</sup>

Also contributing to this article were **Vishnupriya Sengupta** and **Ruchika Uniyal**.

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117 UNFCCC, Enhancing access to climate technology financing

118 Ibid.

119 Ibid.

120 strategy+business, The reconfiguration imperative

121 Ibid.

122 Ibid.

123 Ibid.



# ‘Sustainability heads should strive to make themselves redundant’

A collaborative approach among stakeholders to mitigate and adapt to climate risks is an absolute necessity, emphasises **Deeksha Vats**, Chief Sustainability Officer, Aditya Birla Group (ABG), in an online interview with **Madhura Mitra**, Executive Director – Climate Change and Carbon Markets, PwC India.



Madhura Mitra (left); Deeksha Vats (right)

## Excerpts from the interview

**Madhura Mitra:** A very warm welcome to Deeksha Vats, Chief Sustainability Officer, ABG, to this edition of Immersive Outlook. Today’s session will discuss climate change with a focus on climate change adaptation. ABG has been a forerunner when it comes to climate policies, actions, as well as disclosures since the last two decades. So, I’d like to understand what has changed post the Paris Agreement and how has it impacted your vision as a group and your actions?

**Deeksha Vats:** Thank you, Madhura, for inviting me to speak on this topic.

As a group, we’ve been working on various aspects of how climate change is impacting us and how we are impacting climate change. When we talk about sustainability, the terms sustainability and ESG over the last few years are being used interchangeably. I thought it’s important to put this out there that both external factors and externalities need to be taken into account when we talk about any aspect of sustainability. As ABG, we have defined sustainability as our ability to sustain how we will be around in the times to come. Therefore, what could come in the way from a risk perspective, from different megatrends that are

playing out, how they impact us and how we can make a difference in that aspect both in terms of risks and opportunities.

Climate change has started to speak for itself. In the last few years, we can clearly see how the changes are happening closer to home whether it is in terms of flooding, heat stress, and too much or too little water. This has changed one’s understanding of climate change and the way it is being looked at globally.

It was in Paris where climate change started to become more tangible in terms of what was expected and what is now emerging from more formal conversations like the COP28 UN Climate Change Conference in Dubai, at the end of 2023. The tangibility at the global level was converted to tangibility at the national level in terms of regulations, expectations on compliance, consequences of non-compliance, and the opportunities that would come our way if everybody complied. So, that’s how we started to look at it, that we need to be more structured around it. We need to have our own policies, standards and targets. Once you have these policies, standards and targets, it also leads to developing roadmaps with milestones for which you need partners of various kinds – technology partners, partners for

implementation, communication, and partners for policy advocacy. That’s how we look at the whole aspect of climate change.

**Madhura Mitra:** While you touched upon the risks, opportunities and regulations, could you elaborate on the aspects of risk opportunities and the kind of regulations we have as they vary from mitigation to adaptation? Do you consciously, as a group, differentiate between climate change adaptation and mitigation? If yes, at what stage do you bifurcate the two – at the policy level, investment level, or implementation level? Is there a conscious bifurcation between climate change adaptation action and mitigation action?

**Deeksha Vats:** ABG is present in almost 40 countries. We now have close to 2,00,000 employees and are spread across diverse sectors. Given the diversity of sectors and geographies, the part we play in different aspects of the value chain and given that different businesses have been at different levels of maturity in terms of sustainability practices, we use the 4D approach. The four dimensions are sector, geography, position in the value chain, and time. We came up with the fact that sustainability for us would mean looking at the 16 areas





we are focusing on and this is something we made public in early 2021. When we say climate change is a very material issue for us as a group, it is both in terms of how we make and what we make as well as in terms of the kind of products and services which would help economies or some other businesses to become resilient towards climate change. And that's the point where we started to talk about decarbonisation and climate resilience and adaptation. So how do we bring down the carbon footprint? For this we are talking about a longer term goal of being net zero by 2050. We are also talking about the area where we are yet to have a quantitative goal in that sense, which is climate change adaptation. Because the climate has changed. If you look at data, 2023 has broken all kinds of records in terms of the physical risk which is impacting corporations already.

We've been talking about not exceeding 1.5 degrees from the pre-industrial average, but in 2023, temperatures were already 1.43 degrees higher. So coming back to the physical risks, if we are running, say, smelters in areas where the temperatures are high and where temperatures are going to go higher, how would that align to our longer term vision on how we use water? Do we say we are reducing our freshwater consumption and give up our license of the amount of water? Or would people need more water to drink because the temperatures are going to go higher? If we are talking of expanding in certain locations, how is the water availability, temperature profiles, geophysical risk going to be in those locations? So that's how we have started to look at climate

change, how we are mitigating the increase in greenhouse gases both by the way of what we do in our energy consuming businesses, but also by the way of our renewable energy business. So that's an opportunity because we are into the business of solar power. Then, we also look at how we can mitigate climate risk and also help our products companies in managing that risk. So we look at climate change from all those perspectives.

**Madhura Mitra:** Thank you, Deeksha. Companies have mostly invested in mitigation and not so much in adaptation because they don't see the return on investment. What do you think is the trigger for industries to act on adaptation? When should they act, and why? Should they act now or at a later point in time? Is it related to the risk that you talked about, or the opportunity, or is it a combination of both?

**Deeksha Vats:** Madhura, I think in a way the answer lies in the question that you have asked and how climate change is playing out at this time. First let's go with data. How do we make it (climate risks) real? Otherwise, it can feel like something that is in the future. We have 200-plus locations and if we were to include some of our critical suppliers, the number could go up to 300. These are the locations which, at least from a manufacturing perspective, are vulnerable to physical risks from climate change. So, we worked with an organisation to see if they could help us understand through their tool – where datasets are actually coming from IPCC's model – to say if these are the geo-coordinates and this is the

kind of operation that we run there or this is the value at risk in that location, then what is the risk? Can we put some numbers on it? So how would those risks play out, we did that assessment and some of it actually tallied very well with what we've been seeing happening in some of these locations.

So corroborating what we had seen happening in some of our locations with a desk-based study helped us think through that had we known this earlier what would we do differently? Then you consider the actual impact of it and who is responsible for it in the organisation? Then we come to your point to say what is an immediate action versus what is a longer term action and ultimately it is also about costs.

**Madhura Mitra:** Very interesting, Deeksha. Do you see a market when we talk about a new kind of product or a new kind of concrete? Do you see a market already available, or do we need to develop that market, that awareness among people?

**Deeksha Vats:** I would say the latter because these are all conversations. These are thoughts that have emerged and are picked up as a logical opportunity. Similar to what happened with circularity, with time, I think it would happen with concrete, too, since climate change has started to speak for itself. On an internal rate of return (IRR) basis, it may cost less to use climate resilient concrete, than if you were to rebuild everything.

This reminds me of a story in one of the American newspapers or magazines where only one house stood in the whole of Florida coast after a hurricane. When they checked the house,



it was made with a well-thought-out design and the construction material was carefully selected. But back to your question – are people aware? Maybe, somewhere in the subconscious. But is it a commonplace conversation? The answer is 'No'.

**Madhura Mitra:** When we talk about adaptation, at least when it comes to large scale infrastructure, the government plays the most significant role. However, when it comes to a flood or a cyclone, it's not just the location where you are operating but also the entire water basin that is getting affected. So, a large group of stakeholders are involved – the government, the communities which are residing there, and all members of the supply chain. Hence, collaboration will play a very important role going forward.

**If you must act around adaptation, what should be the prior experience? What are the models that we should look at**

**when we start collaborating? Or if you have already collaborated, what is the model that you have used? Do you agree that collaboration is important?**

**Deeksha Vats:** I think everybody needs to collaborate with everybody. In climate change adaptation, it is going to be 'everyone doing everything all at once' which is a very hard thing to do because we don't have any proven models to fall back on. This requires policymakers, industries, finance providers, community leaders – just about everyone to come together. And it doesn't help that we are in some sort of a polycrisis. There are geopolitical conflicts, a pandemic, climate change and there is inequality all around. We will have to come up with newer models which are testable and not worry too much about how quickly we are going.

It would also help if we were to



get a push from the centre on how large-scale procurement will happen and the design criteria to be incorporated. That's what I mean when I say 'everyone, everywhere, all at once', because it requires a multi-dimensional and multi-stakeholder way of working. Fundamentally, both collaboration and patience and maybe a leap of faith would be needed.

**Madhura Mitra:** When it comes to climate change, the ways of working have evolved over time. Earlier, we were looking at energy saving measures, for example, as one of the most important sustainability measures, but now we are looking at more OpEx and CapEx intensive measures where we do not see short-term returns. How do you think the role of the chief sustainability officer has changed over time? Are you looking for a more collaborative governance framework, or a comprehensive framework where you talk to the chief executive officer (CEO) or the chief operating officer (COO) more often, or collaborating with other core stakeholders outside the organisation? Is collaboration inside the organisation important too and, if so, how is it taking place? How should we change the way we operate as an organisation to make this happen?

**Deeksha Vats:** The answer in one word is 'absolutely' because, for one, it brings that integration because you walk the talk. We can't tell everybody to work together and exclude ourselves. What we need to understand here is that the more collaborative we are externally, the more collaborative we need to





become internally since different people bring different skill sets and networks. For sustainability colleagues, it is very important to be a collaborative, empowering and secure individual – someone to deliver the message that the world is changing, both verbally and with the way you carry yourself at work.

Another thing is that the ultimate goal of a sustainability head should be to make themselves redundant. Sustainability must become a part of how teams work, be it procurement, marketing, operations, energy or technology.

**Madhura Mitra:** I have one last question. Since you have been to COP28, I wanted to understand which outcomes of the Summit resonated with you and which ones did not meet your expectations?

**Deeksha Vats:** I went to COP after an exceptionally long time and I'm glad that I went there. Firstly, the fact that there are so many people from diverse backgrounds serves as a reminder of what we spoke about – the need to collaborate. Coming together for conversations like this allows us to understand the diversity of perspectives, expectations and solutions. There is no one problem, therefore, there is no one solution.

The second good thing was that I felt that all voices were being heard. Much like all COPs in the past, there wasn't any definite concrete action and I think it shouldn't be expected either, since it is such a diverse multi-stakeholder conversation against the backdrop of a just transition. What would have made me happier is that while people were speaking a lot of diverse things, if

if they were also listening to all the diverse things because in many conversations I felt that people kept saying what they wanted to say without taking cognisance of what others had to tell them.

For example, saying that some countries need to take faster action, but if those countries don't have the financial resources and have large populations, you cannot force them to act faster. I am hopeful that our understanding in this regard will increase. However, coming together and striving for a change was a positive experience.

**Madhura Mitra:** Thank you, Deeksha. This conversation has been very positive. When you say that adaptation action is not something for the future and that collaboration among stakeholders is an absolute necessity, it gives me a lot of hope as a climate change professional.

**Deeksha Vats:** Thank you for the opportunity, Madhura, and thank you to the PwC team.

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