



# Accelerating Clean Energy in India (ACE) 2024

## A COMPREHENSIVE SUMMARY OF EXPERTS' VIEWS ON A SYSTEM-WIDE ENERGY TRANSITION

July 22-23, 2024 | New Delhi | Compiled by: Ahona Datta Gupta and Rumpa Banerjee

### BACKGROUND

WRI India organized its annual event, Accelerating Clean Energy (ACE), on July 22 and 23, 2024, in New Delhi. The event is a flagship conference hosted by WRI India's Energy Program.

This year, the discussions focused on delivering an inclusive and equitable energy transition in India through a system-wide lens. Participants deliberated on aspects such as the current state of technological solutions for economy-wide decarbonization and the opportunities and challenges in implementation.

Day 1 (July 22) focused on the advances in new and emerging technologies that aid clean energy transition, while examining the roles of finance, carbon markets, institutional arrangements, and regulations supporting India's energy transition efforts.

Day 2 (July 23) explored policies and strategies to address embodied and operational carbon in buildings.

Energy systems are closely linked with human systems, hence, it is crucial that India's clean energy transition benefits all segments of society. This requires a comprehensive approach to the energy transition that takes into account the broader socioeconomic and cross-sectoral issues related to food, land, transport, and water.

With the Government of India announcing a host of policy measures and targets—including 500 GW of renewable energy capacity by 2030—there is a significant opportunity to link the goal of economy-wide decarbonization with other concerns, such as healthcare, livelihoods, education, and general welfare.

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*These conference proceedings reflect the presentations and discussions of participants and do not necessarily represent the views of WRI India or other participating institutions.*

In its fifth edition, ACE 2024 aimed to drive conversations around these issues, with the objective of providing inputs that India could use to manage the changes required for a just and inclusive transition, while ensuring that everyone benefits from a sustainable economy.

This document synthesizes the key insights and entry points, which emerged from the inaugural session and the four thematic sessions held during the conference.

The discussions featured a diverse array of speakers from government bodies, the scientific community, academia, think tanks, and industry who provided insightful recommendations for driving a system-wide energy transition.

## Highlights

This year, the ACE sessions addressed cross-cutting issues to tackle the challenges of the energy transition, technological advances, sectoral innovations, financing models, best practices, and policy-level opportunities and challenges. The common points raised across all sessions reflect the approaches required to achieve India's energy transition goals. These include the following:

- **Collaboration and coordination:** There was a strong emphasis on the need for enhanced, collaborative efforts among government, industry, academia, and civil society to facilitate India's clean energy transition. Platforms such as ACE can facilitate these conversations by bringing together diverse stakeholders.
- **Investment and financial strategies:** Robust investment strategies, incentives, and subsidies were identified as crucial for mitigating risks and enhancing revenue in the decarbonization sectors. Coordinated financial planning among central government ministries and state governments is essential for long-term success.
- **The role of technology:** The discussions emphasized that the integration of new technologies, such as artificial intelligence (AI) and machine learning, is vital for optimizing clean energy transitions and decarbonizing sectors such as power, buildings, and transport.
- **Focus on inclusivity:** The sessions stressed the need for inclusive approaches to ensure that marginalized communities, particularly women, benefit from clean energy initiatives. Inclusivity could be achieved by addressing barriers to participation and ensuring equitable access to resources.
- **Sustainable practices:** The need for adopting circular economy practices and improving resource efficiency across sectors was emphasized. The discussions also focused on the use of sustainable materials and effective designs to reduce carbon footprints.
- **Learning from best practices:** The speakers highlighted the importance of learning from successful initiatives in various states and sectors to enhance resource adequacy and the financial health of utilities, ultimately improving energy access for all.
- **Policy development:** The necessity for strong national and subnational policies that incorporate the principles of justice and equity in the energy transition was discussed, together with the need for clear guidelines on sustainable procurement and low-carbon materials.

ACE 2024 was significant in driving conversations around a system-wide energy transition in India. By harnessing the insights gained and focusing on collaborative action, stakeholders can work together to create a sustainable energy future that is equitable and inclusive.

## INTRODUCTION

In August 2021, India achieved a significant milestone by reaching 100 gigawatts (GW) of installed renewable energy (RE) capacity. In November of the same year, at the 26th session of the Conference of Parties (COP26) of the United Nations Framework Convention on Climate Change (UNFCCC), India announced its target of achieving net-zero emissions by 2070. Additionally, the Prime Minister of India announced that the country would raise its non-fossil electricity capacity to 500 GW by 2030 while meeting 50 percent of its energy demand through renewable energy.

India has made significant progress toward its 2030 RE targets, some key aspects of which include the following:

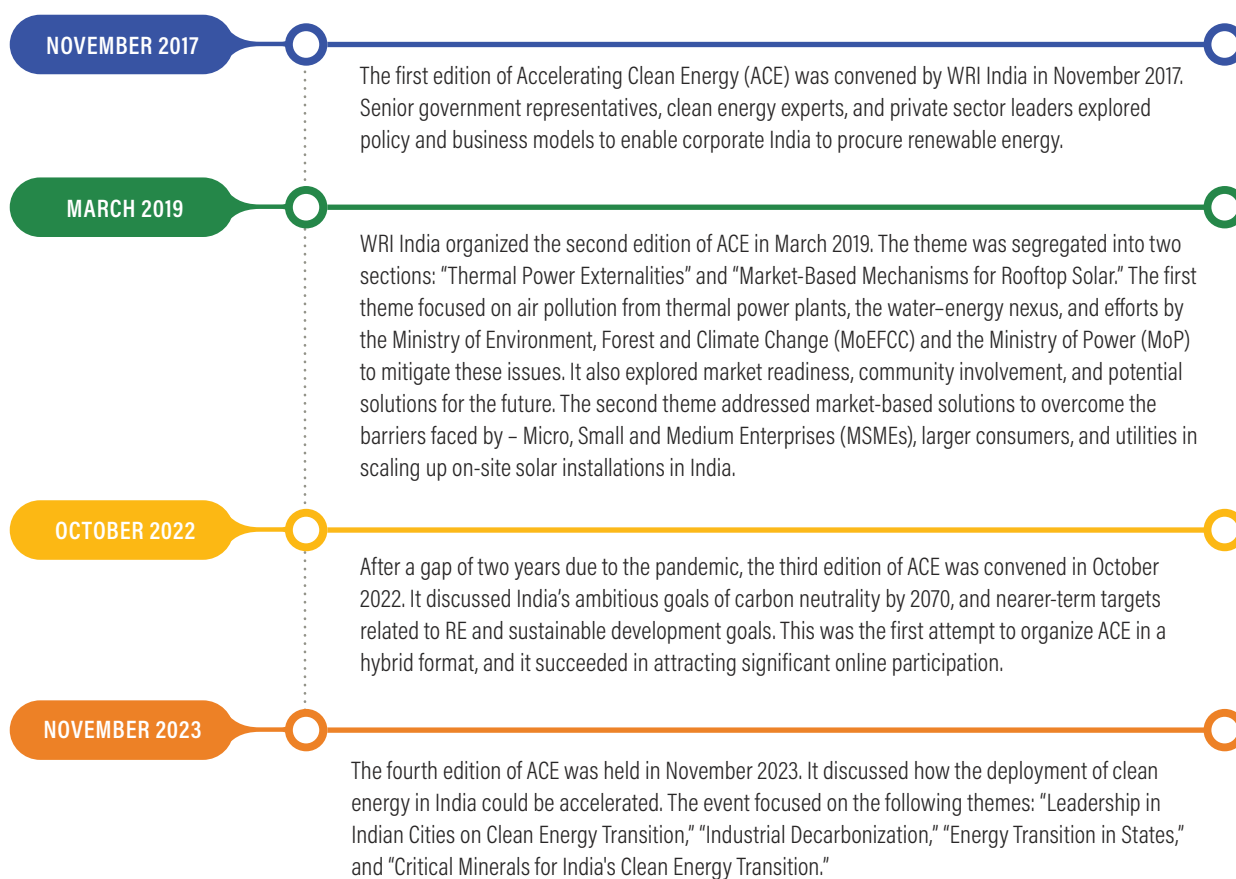
- **Installed capacity:** India has installed approximately 201.46 GW of RE (including large hydro) (CEA 2024).
- **Renewable energy share:** The share of RE in India's total energy generation is over 28.42 percent (CEA 2024).
- **Global ranking:** India ranks fourth in the world for RE installed capacity, fourth in wind power capacity and fifth in solar power capacity (IRENA 2023).

Despite the progress, several barriers continue to hinder the pace of RE adoption in the country. Governance structures and legacy issues of distribution companies, such as their financial situation, affect the adoption of mainstream RE sources such as solar and wind. Several new technologies face high capital costs and challenges in sourcing low-cost funding for scalability.

India needs a comprehensive approach to RE that integrates government policies, technological advances, financial incentives, and community involvement. Currently, the country's long-term low-carbon development strategy is grounded in the principles of equity, climate justice, and Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC). By addressing the current challenges and fostering collaboration among stakeholders, the country can accelerate its transition toward a sustainable and resilient energy future, ultimately setting a benchmark for global efforts to combat climate change.

The ACE conference was conceived by WRI India's Energy Program as a flagship event to discuss key issues related to the energy transition and their solutions by bringing together energy sector experts, policymakers, and practitioners.

**FIGURE 1 | ACE over the years**



Source: WRI India.

## SESSIONS

### Day 1 (July 22, 2024): Inaugural Session

The inaugural session focused on ways to accelerate India's energy transition to achieve positive outcomes for people, nature, and climate. This theme guided the discussions over the next two days, aligning with WRI India's interconnected goals of bringing about sustainable change for people, nature, and climate. Distinguished panelists from India and the global research community, including policymakers, financiers, and energy experts, shared their experiences and proposed solutions to help India meet its net-zero targets.

#### Highlights

- The session focused on addressing various aspects of clean energy and their implications for future demand, such as thermal comfort, irrigation, and power reliability, while ensuring the sustainability of RE value chains.
- Addressing the approaches required to achieve clean energy transitions, the participants discussed the need for increased ambition in setting climate goals, interventions to ensure an affordable energy transition, the significance of data in analyzing energy usage across sectors, and the importance of increased collaboration among stakeholders.
- A focal point guiding the discussions on RE value chains was the importance of the sustainable management of critical minerals. During the session, WRI India launched a working paper titled *Critical Minerals for India's Clean Energy Transition*, authored by Dr. Niharika Tagotra, Nidhi Srivastava,

Dr. Abhinav Sharma, and T.S. Gowthami. The paper highlights the domestic vulnerabilities of India's critical minerals supply and suggests a way forward for the country to secure its critical minerals economy (Tagotra et al. 2024).

- On ensuring an affordable energy transition, the speakers raised the need for a green finance landscape, highlighting the regulator's role in green finance and environmental, social, and governance (ESG) disclosures. They called attention to the importance of credible green projects and third-party verification to build investor confidence. During the discussion, it was pointed out that India has developed a clear definition of green debt that covered climate adaptation, infrastructure resilience and data support, pollution control, and circularity. However, greater sensitization to these issues is necessary to enable the development of suitable legislative and regulatory frameworks.
- The session discussed the necessity for collaboration among industry, academia, and other stakeholders to achieve India's ambitious energy transition targets. The discussions further stressed the use of data, innovation, and investment models and the interconnectedness of goals in achieving a successful energy transition.
- The inaugural session reiterated the need for platforms such as ACE to bring together government, civil society, and researchers to discuss the key issues pertaining to India's energy transition.
- Overall, the session underscored the importance of collaborative efforts, innovative frameworks, and robust investment strategies to facilitate India's clean energy transition and achieve its net-zero goals.

**FIGURE 2 | The ACE inaugural session. Left to right: Deepak Sriram Krishnan, Madhav Pai, Jennifer Layke, Mozaharul Alam, Pramod Rao, and Bharath Jairaj**



*Photo credit: WRI India.*

**FIGURE 3 | Release of the working paper titled Critical minerals for India's clean energy transition. Left to right: Dr. Niharika Tagotra, Deepak Sriram Krishnan, Madhav Pai, Jennifer Layke, Mozaharul Alam, Pramod Rao, Bharath Jairaj, and Dr. Abhinav Sharma.**



Photo credit: WRI India.

### **BOX 1 | India pioneers ESG regulations**

India is among the first countries in the world to introduce a regulatory framework for ESG rating providers.

Source: The Economics Times

## **Thematic session 1: Energy transition for all — Access to resources for inclusive and equitable transition**

India has made notable strides in household electrification over the past decade, but reliable electricity supply remains a challenge, particularly for rural healthcare; education; MSMEs; agriculture; and livelihoods. Energy users, particularly in rural and remote regions, rely on costly and polluting diesel generators or unreliable grid connection, limiting their opportunities and capacity to improve their livelihood and socioeconomic status. Through various policies and programmatic targets, including the goal of installing 500 GW of RE capacity by 2030, the Government of India is creating an opportunity to address unmet electricity demands. However, unpredictable energy demand, influenced by climatic events such as heat stress, makes it challenging for policymakers to make forecasts and integrate clean energy alternatives into energy planning. At the same time, rapidly evolving technologies, accompanied by information asymmetry and the resource-poor users' limited access to capital, hinder the achievement of affordable and reliable energy access for all.

This session explored how India's clean energy goals can foster an inclusive economy that addresses food, land, and water issues while creating jobs. It emphasized the need for integrating climate finance, equitable employment opportunities, and technological advances in healthcare and rural livelihoods with clean energy, and long-term and integrated resource planning to ensure an inclusive energy transition.

**FIGURE 4 | Thematic session on inclusive and equitable transition. Left to right: Sandhya Sundararagavan, Abhishek Acharya, Katie Ross, and Roshan Mascarenhas**



Photo credit: WRI India.

## Highlights

- Marginalized communities in remote regions risk losing income when they take time off work to access hard-to-reach health services. Their access to health care is further limited by the unreliable supply of electricity in the facilities they visit. During the session, the speakers discussed the importance of distributed RE (DRE) systems, and how they can help bridge gaps in accessing health care services.
- Apart from highlighting the importance of DRE solar systems in powering health services, the speakers emphasized their potential to generate local livelihood opportunities by engaging people in installing solar systems and building their capacities in operating and maintaining the systems.
- The discussants also pointed out that climate finance in India has largely failed to help those at the bottom of the pyramid adapt to the energy transition. There is a need for adequate adaptation finance for enhancing the overall effectiveness of climate finance, particularly because marginalized groups including women suffer disproportionately from the impacts of climate-related disasters.
- On the role of MSMEs in the energy transition, the speakers emphasized that these businesses are crucial for the socioeconomic development of the country. However, without adequate financial resources for climate mitigation and adaptation efforts, it will be challenging for these enterprises—particularly those employing women and marginalized groups—to meet the energy transition targets. This underscores the critical role of climate finance in their success.

- It was noted that fostering climate finance requires mutually beneficial international and bilateral partnerships. This requires developed countries to fulfill their commitments to developing countries, considering national circumstances, the quality of finance, and the scope, scale, and speed of financial provisions and mobilization, while adhering to the principles of equity and common but differentiated responsibilities.
- To improve energy planning and determine long-term demand, the speakers highlighted the need for ensuring an optimal energy mix in Indian states through integrated resource planning and resource adequacy planning. This initiative could be supported by generating disaggregated data at the supply and demand sides to support DRE/RE integration. Additionally, because energy demand is dynamic, incubation of new technologies for improving planning processes holds significant potential.
- Engaging diverse and empathetic stakeholders in energy transitions is essential for creating inclusive and equitable pathways. Ensuring long-term sustainability in financing and overcoming systemic challenges, such as market failures and information asymmetry, could be achieved through collaboration between multi-level government bodies, private sector, civil society organizations, and community and farmer groups.

#### **BOX 2 | Global perspective: Energy transition challenges in South Africa**

**Katie Ross, Senior Director, Climate, Economics and Finance, World Resources Institute**, gave an example of energy transition challenges in South Africa, offering a global perspective. She highlighted that, much like India, South Africa faces significant challenges in its energy transition, with an 80 percent reliance on coal and frequent power outages impacting its economy amid high inequality, poverty, and unemployment. To address this, the South African government has committed to a just energy transition, establishing a Presidential Climate Commission to include diverse stakeholders in decision-making. This commission aims to develop a national policy on just transition, emphasizing procedural, distributive, and restorative justice. Although lifting self-generation limits has increased access to renewable energy for some, it has also widened inequality, highlighting the need for equitable policies, economic diversification, and robust government support to ensure that all citizens can transition to new energy solutions.

#### **BOX 3 | Solar energy boosts health and livelihoods in India after the pandemic**

According to panelist **Roshan Mascarenhas, Associate Director, SELCO Foundation**, the COVID-19 pandemic revealed significant energy and technology gaps, highlighting the need for resilient health infrastructure and support for micro-businesses, particularly for poorer communities who suffer income losses from work disruptions. Solar energy offers a viable solution for decentralizing health and livelihood services. During the pandemic, 1,500 health centers in Karnataka, Odisha, and the Northeast were solarized, prompting recognition among communities and state authorities of the importance of expanding such initiatives. This has led to the ambitious goal of solarizing 25,000 health centers across India, with 4,500 centers already solarized in states such as Maharashtra and Gujarat. This initiative has also generated livelihoods through both the installation and regular maintenance of the solar systems.



### Entry points for action

- The Government of India is prioritizing domestic resources for climate adaptation, but adaptation finance needs to be enhanced to effectively support marginalized groups, particularly women employed in MSMEs.
- Key changes in energy planning are essential, including an optimal energy mix, resource adequacy planning, and integrating new technologies. Additionally, negotiations within UNFCCC must address dynamic financing goals.

The development of a national policy on just transition that emphasizes procedural, distributive, and restorative justice advocating for inclusive decision-making and equitable risk-sharing presents a promising pathway for ensuring an inclusive and equitable energy transition.

Significant policy changes and economic diversification are needed to facilitate this transition and create better job opportunities and support systems for those affected. Additionally, because energy demand is dynamic, incubation of new technologies for improving planning processes holds significant potential.

### Thematic session 2: Achieving energy transition – Challenges and opportunities

The second thematic session at ACE 2024 focused on the opportunities and challenges of the energy transition, especially in terms of implementation. The session looked at the role of finance, carbon markets, institutional arrangements, and regulations in India's energy transition efforts. The session also highlighted what the states were experiencing in India's energy transition story and what more needs to be done to help achieve targets. Speakers shared their individual experiences, describing the challenges they faced and how they effectively mitigated them.

**FIGURE 5 | Session on achieving energy transition. Left to right: Tirthankar Mandal, Ashish Tiwari, Ann Josey, Soumya Garnaik, and Ulka Kelkar**



Photo credit: WRI India.

## Highlights

- The risks associated with financing energy transition interventions often compel developers to source external funding through investments. However, potential investors may hesitate to invest due to uncertainties about the long-term returns. A certain degree of lack of accountability and limited women's participation continue to mar government projects. Initiatives such as the e-bus project, for instance, failed to meet the required percentage of female staff due to inadequate supporting facilities. To increase market acceptance and reduce reliance on subsidies, the government could look at successful outcomes from public-private partnership infrastructure projects and apply those lessons to energy transition initiatives.
- The discussion highlighted various developmental schemes in the state of Uttar Pradesh (UP) that align with the energy transition, climate change, and social initiatives. These schemes leverage the state's fertile land and river networks to develop large-scale solar parks, particularly in the Bundelkhand region. Under its Green Hydrogen Policy, UP has promoted agricultural solar projects, pumped hydro storage, agro-forestry carbon financing, and biofuel-based green ammonia initiatives. Additionally, under the Pink Policy, it has supported clean cooking solutions, such as solar cookers and bio-digesters, through women self-help groups in remote areas. This underlines the need for tailor-made, local solutions for the energy transition.
- It was noted that energy efficiency projects that focused on financial viability while collaborating with public sector utilities and state nodal agencies help raise awareness, reduce appliance costs, and mitigate climate change impacts. This in turn facilitates the decarbonization of other energy sectors.
- During the discussion, it was also highlighted that Indian states and union territories should learn from each other's best practices to enhance resource adequacy, RE technology, demand-side management, and the financial health of state utilities, which will ultimately improve energy access for all citizens. However, many states lack the preparedness and long-term vision needed to accelerate RE initiatives. The Maharashtra project provides learnings in terms of encouraging the state distribution company to allocate 30 percent of incentives for farmers, enhancing agricultural power reliability while reducing the financial burden on the state.
- Incentives and subsidies are vital for reducing decarbonization risks such as impacts on business-as-usual scenarios and for boosting revenue. This requires coordinated strategies among government ministries and departments to ensure effective long-term financial planning and risk management. The organized decarbonization industries, primarily medium- and large-scale industries, significantly influence market operations and competitiveness, making government policies impactful.

### **BOX 4 | Driving efficiency: Energy savings and investment returns**

Energy-efficient technologies in the MSME sector save 15–20 percent energy, with investments recovered through savings.

*Source:* Pramod Rao, Executive Director, SEBI

### Entry points for action

- To effectively implement national energy programs, it is essential to start by identifying and supporting a few champion states, which can serve as models for others.
- Successful programs are often widely replicated when they demonstrate effective institutional frameworks. Addressing institutional challenges and fixing the financial issues faced by distribution companies is critical to unlocking benefits from carbon markets.
- Government involvement in decarbonization can go beyond providing subsidies, by establishing public-private partnerships that are supported by long-term infrastructure investments and clearly defined roles and responsibilities. This approach can create sustainable models such as those used in airport and highway projects.
- Understanding state-level preparedness for energy transitions is crucial because it highlights the need for tailored solutions addressing local challenges. The rapid adoption of green open access and direct RE procurement by commercial and industrial consumers is reshaping the utility business model, requiring adjustments in planning and procurement strategies. Additionally, the solarization of agriculture presents a significant opportunity to address daytime energy demands and improve the quality of power supply for farmers.
- Local circumstances are crucial for designing tailored energy transition solutions that consider the higher up-front costs, policy needs, technology adaptation, and regional challenges. Carbon financing can be crucial in this area.

**FIGURE 6 | Session on achieving energy transition. Left to right: Mahua Acharya, Tirthankar Mandal, Ashish Tiwari, and Ann Josey**



Photo credit: WRI India.

## Thematic session 3: Accelerating decarbonization – Opportunities through emerging technologies

The International Energy Agency’s (IEA’s) *Net Zero by 2050* report presents a roadmap for the global energy sector to achieve its net-zero targets by 2050 (IEA 2021). It calls for a fourfold increase in the deployment of RE technologies, including the electrification of transport and industrial processes. This would increase the share of electricity in final energy consumption from the current 20 percent to about 50 percent by 2050. The report also addresses the need for deploying low-carbon hydrogen, bioenergy, and carbon capture, utilization, and storage (CCUS) technologies to reduce emissions from hard-to-abate sectors. In addition, the report suggests creating significant improvements in energy efficiency across all sectors and expanding energy storage solutions to manage the intermittency of RE sources.

The path to net zero will require going beyond current technologies and deploying technologies and measures that are still being developed or are not yet commercially competitive. These new and emerging technologies can improve existing technologies’ performance, reduce costs, and increase efficiency while ensuring the sustainability of the critical minerals supply chains they require. Recent advances in AI and data are also likely to open further avenues for driving the transition by enabling organizations and governments to optimize energy use and balance demand with variable generation. The third thematic session at ACE 2024 explored the future of decarbonization technologies, and the associated challenges and opportunities. The session highlighted the crucial role of collaboration among the government, industry, and academia, and the need for innovative approaches to achieve decarbonization goals.

**FIGURE 7 | Session on accelerating decarbonization. Left to right: Pawan Mulukutla, Dr. Laltu Chandra, Suresh Babu Muttana, Girish Sethi, Dr. Anita Gupta, Dr. Sreedevi Upadhyayula, Dr. Shashi Kumar, Dr. Bipin Kumar Gupta, Dr. Anil Kottantharayil, and Dr. Pratham Arora**



Photo credit: WRI India.

## Highlights

- Following the COP21 agreement in Paris, CO<sub>2</sub>-emitting nations pledged to make major investments in research and development (R&D) to drive green energy innovations (Bennett 2023). India's targets and ambitions make it a focal point of this global effort. Although the government plays a key role in this process, industries, think tanks, and start-ups also play vital roles. The discussants emphasized the need for engaging with industry, which is essential for translating R&D into market-ready solutions.
- The panelists talked about the need for India to identify and collaborate on innovations, developing indigenous capabilities where necessary. Collaborations and partnerships are vital for a successful clean energy transition.
- The session highlighted the significant roles that AI and machine learning are set to play in optimizing and accelerating clean energy transitions. These technologies can help scale up efforts and reduce transition timelines.
- The speakers emphasized that the focus should be on the five Ps—Profit, People, Planet, Purpose, and Policy—to drive forward and achieve clean energy transition pathways. The industrial sector is one of the most challenging to decarbonize, accounting for about 41 percent of the country's total energy consumption, with large industries consuming 60 percent and small and medium-sized enterprises (SMEs) consuming 40 percent of the overall energy. Further strategic investments will play a key role in decarbonization.
- The discussants noted that green hydrogen will play a key role in decarbonizing the transport and industry sectors, particularly in direct reduced iron (DRI) steel production. CCUS will also be crucial, especially for the growing cement sector, because no alternative to cement has been found yet. There was further deliberation on developing indigenous capabilities for these technologies, which would become game-changers for India's decarbonization efforts.

**FIGURE 8 | Session on accelerating decarbonization. Left to right: Pawan Mulukutla, Dr. Laltu Chandra, Suresh Babu Muttana, Girish Sethi, and Dr. Anita Gupta**



Photo credit: WRI India.

## Entry points for action

- Co-creating and forming partnerships, especially in developing indigenous green energy technologies, will be vital for India's clean energy transition. Focusing on strategic investments, energy efficiency, electrification, and adopting emerging technologies such as AI can accelerate decarbonization.
- Investments in technologies, particularly for the hard-to-abate sectors, are essential, because these innovations typically require long gestation periods.
- Additionally, energy efficiency technologies represent a low-hanging fruit in decarbonization, and their development and adoption should be prioritized. Renewable electricity can also be prioritized for applications with lower heat requirements.

### BOX 5 | Innovative pathways: India's global leadership initiatives in clean energy technologies

India's timeline for adopting technologies such as hydrogen and CCUS resembles a sine wave, fluctuating between peaks and troughs. Research and development is essential to evaluate their techno-economic viability and scalability across different sectors.

India is playing a crucial role in Mission Innovation (MI) activities at the global level by participating in eight innovation challenges and co-leading three challenges. India is a member of the MI Steering Committee and co-lead of the Analysis and Joint Research Sub-Group along with Canada. India has set up a Clean Energy International Incubation Center to support start-ups in providing the most impactful clean energy solutions to benefit society.

Source: CEIIC n.d.

## Day 2 (July 23, 2024): Thematic session 4: Decarbonizing India's building sector — Research goals for the future

ACE 2024 concluded on July 23 with a roundtable session on the theme of decarbonizing the building sector. India aims to achieve a net-zero economy by 2070, requiring all sectors to align their development strategies accordingly. The rapidly growing building and construction sector will significantly increase the demand for materials such as steel, cement, and aluminum, with buildings consuming a third of India's total electricity in 2023–24. In 2020, this sector accounted for about 26 percent of India's total greenhouse gas (GHG) emissions, according to the Center for Study of Science, Technology and Policy's (CSTEP's) Sustainable Alternative Futures for India (SAFARI) model (CSTEP 2020). To meet the decarbonization goals, the strategies must target embodied, operational, and end-of-life carbon emissions from buildings. Based on this, the session deliberated on the key gaps in current research on reducing carbon across the whole building life cycle in India.

Before proceeding with the roundtable discussion, researchers from WRI India delivered a presentation on sector decarbonization pathways, addressing embodied carbon, end-of-life carbon cycle, and operational carbon. For embodied carbon, they addressed the importance of improved building design and construction practices, along with the production and use of low-carbon materials. They also shared strategies aimed at reducing embodied carbon through design for deconstruction and reuse, thereby decreasing end-of-life carbon. This involves selecting low-carbon options, standardizing carbon content benchmarks, and researching and testing innovative low-carbon building materials. To tackle operational carbon, the need for optimizing building design, energy-efficient appliances, and clean energy procurement; electrifying heating and cooking; and integrating with a decarbonized, RE-based electricity grid were highlighted.

**FIGURE 9 | Roundtable discussion on decarbonizing the building sector. Left to right: Abhishek Chauhan, Shiv Kumar Batra, Soumya Garnaik, Ashu Dehadani, and Pratima Washan**



Photo credit: WRI India.

The deliberations were divided into two rounds:

- Round 1: Reducing embodied and end-of-life carbon in buildings
- Round 2: Reducing operational carbon in buildings

### Highlights

- The speakers emphasized the need for a whole life-cycle carbon approach covering embodied, operational, and end-of-life carbon to achieve building decarbonization. They highlighted the importance of effective design to maximize carbon reduction potential, advocating for buildings that utilize natural heating and cooling. Key challenges include a lack of standards for low-carbon materials, the low market demand for low-carbon buildings, and a lack of skilled labor for less carbon-intensive construction technologies such as prefabricated construction.
- The discussion also pointed to the need for government incentives and public procurement strategies to promote sustainable materials, as well as the importance of technology transfer and collaboration among stakeholders. Circular economy practices and resource efficiency were stressed, with a call for continuous updates to data and methodologies. The roundtable also stressed the need for partnerships and shared learnings among cities to drive innovation and equitable solutions in the design and construction of buildings.
- The session discussed the progress in R&D at the national and international levels and their usefulness in reducing embodied carbon in buildings. This includes using agroforestry waste in construction, reducing construction and demolition (C&D) waste, improving brick manufacturing by reusing C&D waste, prefabrication, and benchmarking carbon footprints.
- One of the key takeaways from the discussions was that industrial decarbonization remains essential, given that 65–85 percent of embodied carbon is generated from material production, including cement, steel, and aluminum. Addressing emissions from production processes and promoting alternative materials are crucial.

- The panelists shared the insight that improving energy efficiency is a crucial part of reducing operational carbon emissions. A representative from Global Green Growth Institute (GGGI) pointed out that despite the challenges of convincing clients about energy performance parameters, technical specifications, market availability, and quality assurance, the super-efficient air-conditioning (AC) program was a successful initiative in improving building energy performance. They also stated that innovative business models can make these appliances more affordable.
- The roundtable emphasized the vital role that the government could play by developing sustainable procurement policies, public guidelines for low-carbon materials, and codes for alternative materials using C&D waste.

### BOX 6 | CSTEP study projects substantial emissions reduction through building and industry strategies

Projections from the CSTEP study (2024) indicate that emissions can be reduced by 44 percent through buildings-sector-led strategies, 59 percent through industry-led strategies, and 72 percent by combining both strategies.

Source: CSTEP 2024.

### Entry points for action

- Given the building sector's fragmentation and slow technological uptake in India, multi-stakeholder collaboration is essential. This collaboration can be facilitated by identifying the existing knowledge gaps and barriers in the building decarbonization sector, along with improving upon enablers such as policy, research, financing, and capacity-building.
- For decarbonization of buildings, industrial decarbonization can play a significant role by reducing embodied carbon in buildings. Addressing carbon emissions from the cement sector and increasing the market acceptance of alternative cements such as limestone calcined clay cement (LC3) are essential. Globally, 40 percent of the cement and 25 percent of the steel in use are utilized in public sector projects (UNIDO 2021). The public sector, therefore, has a huge role to play in kick-starting the shift away from emissions-intensive cement and steel.
- Raising awareness and building trust in new and sustainable materials, along with capacity-building, are crucial for the adoption of less carbon-intensive construction practices. Policies and pilot projects are needed to demonstrate the robustness of these technologies.
- Behavioral change is crucial, requiring incentives and nudges to create demand from consumers for low-carbon technologies. The context of each project is vital, particularly regarding structural modifications and materials used.

FIGURE 10 | Deepak Sriram Krishnan, delivering the closing remarks at ACE 2024



Photo Credit: WRI India.



## Next Steps

The discussions at ACE 2024 on India's energy transition highlighted the interconnectedness of energy systems with other sectors, with a particular emphasis on socioeconomic needs. A few learnings from the discussion that can be further explored are as follows:

- India's energy transition must prioritize food, land, and water security while creating livelihood opportunities for marginalized groups, especially women in MSMEs.
- A larger number of tailor-made financial resources and tools are necessary for equitable climate adaptation accessible to vulnerable populations. Addressing financial and institutional challenges in distribution companies is also critical for leveraging carbon markets.
- National efforts to bring about a fair, equitable, and just transition must emphasize procedural, distributive, and restorative justice for inclusive decision-making and risk-sharing.
- It is crucial to identify model/champion states for national energy programs, because this can encourage broader adoption of effective strategies.
- Learning from successful projects, the government should consider shifting from subsidies to long-term investments in the form of public-private partnerships (PPPs). Further, customized solutions for local challenges, especially in RE and agriculture, are essential.
- Collaboration among think tanks, academia, start-ups, investors, and other stakeholders is vital for promoting affordable clean energy solutions. Scaling and adoption of emerging technologies are essential for improving efficiency in clean energy applications.
- Urgent action is needed to increase sustainable materials usage, because energy consumption in the building sector is projected to grow significantly by 2050.
- Reducing embodied carbon in construction materials, particularly cement and steel, is critical for emissions reduction. For the adoption of less carbon-intensive construction practices, trust in new materials and building appropriate workforce skills are necessary. The public sector can significantly influence market trends by transitioning from emissions-intensive materials.
- Multi-stakeholder collaborative efforts are needed to address the fragmented buildings sector and leverage policy support, research, and financing.
- Behavioral change is crucial for fostering a sustainable energy future. Steps in this direction need to be initiated.

In conclusion, ACE 2024 highlighted a potential path that emphasized the need for a coordinated and inclusive approach toward India's energy transition. This approach should integrate social equity, innovation, and collaborative governance to achieve long-term sustainability goals.

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## PARTICIPANTS

### Inaugural Session

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**Pramod Rao**, Executive Director, Securities and Exchange Board of India

**Madhav Pai**, CEO, WRI India

**Bharath Jairaj**, Executive Director, Energy Program, WRI India

**Deepak Sriram**, Deputy Director, Energy Program, WRI India

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### Thematic session 1: Energy transition for all – Access to resources for inclusive and equitable transition

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## Thematic session 4: Decarbonizing India's building sector – Research goals for the future

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## ABBREVIATIONS

**ACE:** Accelerating Clean Energy

**AI:** artificial intelligence

**COP:** Conference of Parties (specifically COP 26 in the document, referring to the United Nations Framework Convention on Climate Change session)

**CEA:** Central Electricity Authority

**CBDR-RC:** common but differentiated responsibilities and respective capabilities

**CCUS:** carbon capture, utilization, and storage

**C&D waste:** construction and demolition waste

**DRE:** distributed renewable energy

**DRI:** direct reduced iron

**EESL:** Energy Efficiency Services Limited

**ESG:** environmental, social, and governance

**GB:** gigabytes

**GBCI:** Green Business Certification Inc.

**GGGI:** Global Green Growth Institute

**GHG:** greenhouse gas

**GW:** gigawatt

**IIT:** Indian Institute of Technology

**ICGEB:** International Centre for Genetic Engineering and Biotechnology

**LC3:** limestone calcined clay cement

**MoEFCC:** Ministry of Environment, Forest and Climate Change, Government of India

**MoP:** Ministry of Power, Government of India

**MSME:** micro, small, and medium enterprises

**PPP:** public-private partnerships

**RE:** renewable energy

**RMI:** Rocky Mountain Institute

**SAFARI:** Sustainable Alternative Futures for India

**SEBI:** Securities and Exchange Board of India

**SME:** small and medium-sized enterprise

**UNEP:** United Nations Environment Programme

**UNFCCC:** United Nations Framework Convention on Climate Change

**UNIDO:** United Nations Industrial Development Organization

**UP:** Uttar Pradesh

**WISE:** World Institute of Sustainable Energy

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## ABOUT WRI INDIA

WRI India, an independent charity legally registered as the India Resources Trust, provides objective information and practical proposals to foster environmentally sound and socially equitable development. Our work focuses on building sustainable and livable cities and working towards a low carbon economy. Through research, analysis, and recommendations, WRI India puts ideas into action to build transformative solutions to protect the earth, promote livelihoods, and enhance human well-being. We are inspired by and associated with World Resources Institute (WRI), a global research organization. Know more: [www.wri-india.org](http://www.wri-india.org)



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