



Task Force -4  
**Refuelling Growth:  
Clean Energy and Green Transitions**

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IRADe Action for Development



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# CHALLENGES AND OPPORTUNITIES OF SUSTAINABLE ENERGY TRANSITION

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### G20/T20 WORKSHOP

## CHALLENGES & OPPORTUNITIES OF SUSTAINABLE ENERGY TRANSITION



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Prof. Jyoti K Parikh

Executive Director, IRADe

## Preface

India's Energy narrative has been characterised by inclusivity and sustainability, with an emphasis on investment in renewable energy and commitments to energy transition. As India assumed the presidency of the G20, it is at the forefront of discussions on priority areas for energy, both domestically and internationally.

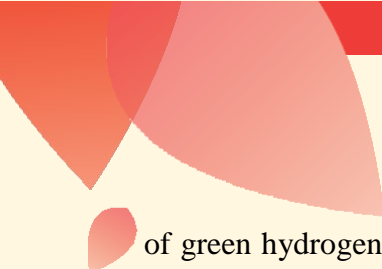
This document outlines the challenges and opportunities associated with sustainable energy transition in India and around the world, as discussed by speakers at the G20 Workshop "Challenges and Opportunities of Sustainable Energy Transition" organised by Integrated Research and Action for Development (IRADe) on 4th July 2023. It offers insights into India's energy narrative and its role in leading global discussions on climate change mitigation and energy transition.

The demand for energy in India has grown significantly and is projected to account for 11% of global demand (by 2040), up from the current 5% (2016). This presents a wealth of opportunities for energy companies to invest in India's energy transition. The Union Budget 2023 allocated INR 350 billion as a priority capital investment towards energy transition, in line with the government's goal of achieving net-zero emissions by 2070 (India Energy Week, 2023).

A sustainable energy transition should involve all stakeholders, be inclusive, and consider the unique path of each country. Energy security is important, and countries need to devise short-, medium-, and long-term plans to achieve net-zero goals. A holistic approach is necessary for a successful and sustainable energy transition.

There is already a prioritisation of transition to renewable and non-fossil energy solutions. In addition, electrification of industrial processes, biomass-based energy solutions including waste, and regional integration through cross-border grid interconnections are important for facilitating the energy transition of smaller countries in a cost-effective manner. Access to technologies and low-cost finance is a prerequisite for making energy transition in developing countries affordable. Developing local supply chains, setting up appropriate institutions at national and provincial levels, and making the energy transition people-centric are also important considerations. Energy efficiency plays a significant role in reducing electricity demand and should be prioritised.

India also has ambitions to become a global centre for the production and export of green hydrogen. Under the National Green Hydrogen Mission, INR 194 billion have been allocated for the production



of green hydrogen, to produce 5 million tonnes of green hydrogen annually by 2030. (India Energy Week, 2023). Technological improvements to bring down the cost of green hydrogen will take time, and low-carbon hydrogen can be prioritised to get hands-on experience.

Energy efficiency and demand-side management are crucial for all countries since they will account for 40% of actions to achieve net zero. In emerging and developing economies, clean energy investment is primarily dependent on public finance. A broader focus on policy reforms, concessional finance, new financial instruments, and local capital markets is required to mobilise private finance. A seven-fold increase in clean energy investment in emerging economies is required over the next 10 years across all fields.

Through its leadership in the G20 Energy Transitions Working Group, India is committed to finding solutions to global energy challenges and collaborating with other nations towards a sustainable energy future. The focus is on providing affordable, secure, and sustainable energy for all.

**Prof Jyoti K Parikh**

**Executive Director, IRADe**



# **Challenges and Opportunities of Sustainable Energy Transition**





## Challenges and Opportunities of Sustainable Energy Transition

### Background

G20 countries account for 75% of the global energy demand and at the same time have the potential to meet this energy demand from Renewable Energy (RE). Energy transition refers to the shift from fossil fuels to renewable energy sources. This includes three major fossil fuels; Coal, Oil and gas which affect several sectors like power, transport and infrastructure industries. The energy transition is a critical issue for the G20 countries, as they work towards a sustainable and equitable future.

The pathways to transition need to ensure that neither the economies of G20 nor the progress toward achieving Sustainable Development Goals (SDGs) is derailed by the Net Zero Goals. An important aspect of the energy transition is ensuring that it benefits all people. This means that everyone must have access to clean, affordable, and reliable energy. Sustainable Energy Transition is highly dependent on enabling policies and access to technology, financing and capacity building of the stakeholders in developing countries.

The transition also promises opportunities to harness renewable potential in solar, wind, hydro and bioenergy resources. It also promises affordable energy and energy security for

economic growth while enabling energy access for millions of people in India. There is also potential to create new sunrise industries like Zero Emission Vehicles, renewable energy and digitisation which would create millions of new green jobs. In addition, a road map is required to prepare the world for a post-transition world, new sunrise industries such as renewable energy, Zero Emission Vehicles (ZEVs), digitisation etc.

Wide-ranging stakeholder discussions could ensure the challenges of jobs, land use, finance and green growth. G-20 has the opportunity to drive a sustainable energy transition that is just and inclusive. IRADe engaged with a cross-section of stakeholders to discuss and deliberate on the key challenges and opportunities for sustainable transition and the required strategies and policies for an accelerated transition.

# **Recommendations to the G20**

## Key Recommendations for Sustainable Energy Transition

We present the key policy recommendations that emerged from the T20/G20 workshop on Challenges and Opportunities of Sustainable Energy Transition.

### 1. Energy Transition Pathways

Sustainable energy transition should consider all stakeholders at various stages of the transition aspiring to leapfrog to a clean energy future that is just and equitable. Every country would need to pursue its unique path to energy transition. For some countries, it can transform economies. The process of transition should be inclusive, involving people across genders, income groups and regions. Energy Transition pathways have to ensure energy security. The countries need to devise short-, medium- and long-term Energy Transition plans to achieve Net Zero goals. Medium-term plans could include steps like clean coal technologies, and decarbonising coal transport through conveyor belt systems instead of diesel-based mobility.

### 2. Decarbonisation of Industrial Processes

A stronger focus is required on the electrification of industrial processes to enhance demand for renewable sources-based electricity. Biomass-based energy solutions have significant potential in various demand segments which need to be tapped more aggressively. Emerging efficient technologies

should be scaled up and made more economically viable.

### 3. Regional Integration and Grid Interconnections

Regional integration through cross-border grid interconnections is important for facilitating the energy transition of smaller countries in a cost-effective manner. Cross-border grid interconnections can also reduce the requirement of setting up expensive storage facilities for intermittent RE electricity.

### 4. Worldwide Large scale RE Investments

Most of the new RE investments are happening in China, the US and the EU. There is a need to accelerate RE investments in regions that are going to see rapid growth in demand for energy like Asia and ASEAN. In emerging and developing economies, excluding China which accounts for 2/3rd of the world's population, the share of the total clean energy investment is only 15%. To increase investments in such countries, the cost of capital for clean energy projects should be brought down with low-cost finance. Currently, the cost of capital for clean energy projects in emerging economies outside China is two to three times higher than in developed countries.

## **5. Access to Technology and Low-Cost Finance**

Access to technologies and low-cost finance is a prerequisite for making energy transition in developing countries affordable. For energy transition, the issue of accessibility of technology and its modifications required to suit local circumstances need to be addressed. These should be considered global public goods so that the issue of accessibility is dealt with. Public finance can be leveraged by providing the same through multilateral and development banks (MDBs) to hedge the risks of private finance. Historical emissions from 1990 to 2023 that are parked in the global GHG parking space can be charged a notional fee of one dollar per tonne of carbon dioxide to mobilise finance for the energy transition.

## **6. Developing local supply chains**

Local manufacturing of RE project equipment needs to be expanded to avoid increased import dependence and job losses in the process of transition from fossil fuel-based energy supply to RE-based capacity expansion.

## **7. Institutional Mechanisms**

Just Energy Transition requires a holistic approach across various sectors of the economy. Therefore, it is recommended that appropriate institutions are set up at national and provincial levels to plan and oversee timely actions for Just Energy Transition. These institutions need not


wait for a comprehensive national plan and should start working on the approach of building blocks.

## **8. Consensus Building**

Energy Transition should be people-centric. The energy transition can be successfully implemented only if consensus is built among various stakeholders in the country. Federal Governments need to handhold and support provincial Governments in implementing less painful energy transitions in their geographies, with due attention to state-specific circumstances.

## **9. Energy Efficiency**

Energy efficiency plays a significant role in reducing electricity demand by approximately 40-50%, highlighting its substantial impact that should be prioritised. Buildings are consuming a lot of energy today which is going to go up further as we urbanise. In platinum-rated energy-efficient buildings, we have reduced energy consumption by 85%, Out of this 85%, only 15% could be attributed to architectural redesign of the building, while significant impact comes from efficient Heating, Ventilation and Air Conditioning (HVAC), equipment efficiency, better management and so on. Hence, a well-directed push for energy efficiency programs for air conditioners and other types of equipment is needed. Artificial intelligence can also be incorporated so that



energy-efficient equipment is used even more efficiently. Also, at least 50% of new buildings to be built by 2030 and beyond must be more than 50% more efficient than the conventional building stock. The cooling sector should be considered an emerging hard-to-abate sector. We are yet to penetrate efficiency in cooling and it needs further attention. If we aspire to attain sustainable development goals and the Paris Agreement target, the efficiency agenda should be pushed.

### **10. Smooth Transition**

Technological improvements to bring down the cost of green hydrogen and to make it economical will take time and till then, blending of green hydrogen can be prioritised. Hydrogen-based technology can be applied not only to heavy-duty trucks but also to international shipping and air travel.

### **11. Demand-side Management**

The programs and policies from the demand side are key factors for decisions related to the energy transition pathway, hence more emphasis is required on demand management. Different countries might have different pathways. However, demand-side management will remain crucial for all since it will account for 40% of actions to achieve net zero.

### **12. Mobilising Finance**

In emerging and developing economies, clean energy investment is primarily dependent on public finance. High dependency on a particular type of finance is not feasible and all sources of finance such as private, public, concessional, etc. are required to meet investment targets. A broader focus on the following levers to mobilise private finance is required –

- a. Policy reforms and strengthened institutional capacity
- b. Increase in concessional finance to the tune of at least 80-100 billion dollars each year. Currently, for every dollar of public money, there is an additional mobilisation of only 30 cents of private money. This ratio has to be reversed and the focus has to shift towards de-risking private finance.
- c. New financial instruments and platforms such as carbon markets, and green and sustainability-linked loans need to be developed.
- d. More emphasis on local capital markets and financial systems which can help mobilise domestic finance is required.

Various areas such as low-emission fuels, energy efficiency, grids and storage, and low-emission power need to be addressed. A seven-fold increase is required in clean energy investment in emerging economies over the next 10 years across all fields.



# **Summary of Proceedings**

**Prof Jyoti K Parikh**

**Executive Director, IRADe**



The energy transition has been happening over the centuries. The first transition from solid biofuels to cleaner fossil fuels started even before the 20th century. Even today, this transition is not complete for 2.3 billion people (SDG7). The current transition needed from fossil fuels to renewables is not the first transition and nor would it be the last energy transition.

Today, concerns for climate change and energy security have compelled us to move away from coal and fossil fuels, which is a new challenge for energy transition. Therefore, in the 21<sup>st</sup> century, we have pinned our hopes on unlimited Nature-based energy sources such as solar, wind, hydro and biomass. They are guaranteed to be there for decades and centuries, with no price attached and more equitably available to most countries. Renewables like wind and solar power have a low gestation period, are readily available, and can make the path to transition just and

inclusive. Large and small-scale solutions are required to replace fossil fuels with non-fossil sources such as nuclear, hydro, solar, wind etc. along with thrust on energy efficiency. However, the limitation of space required, intermittent availability for a short duration, locations and raw materials are limitations to exploiting these resources. The innovations in energy storage solutions, liquid biofuels, Hydrogen, and batteries need to continue and later even nuclear fusion perhaps. Therefore, along with technological solutions, it is important to emphasise lifestyle changes at personal, societal, and national levels.

**Dr. Jeffrey D. Sachs Director**

**Centre for Sustainable Development, Earth Institute, Colombia University, US**



Public investments can indeed play a significant role in the transition towards a sustainable future, surpassing the potential impact of private investments. Countries must devise long-term plans spanning 25-30 years, which align with their Nationally Determined



Contributions (NDCs). These plans should serve as clear pathways towards a sustainable future, with a primary goal of achieving zero-carbon emissions. To effectively implement these pathways, it is crucial to combine them with a comprehensive policy framework. Financing and regional integration are two pivotal elements that must be integrated into these plans. Given the historical responsibility of developed nations, their contributions should be proportionate, helping to fund the transition process. Multilateral development banks, such as the World Bank and the Asian Development Bank (ADB), possess the resources and expertise to play a crucial role in facilitating these transitions through their investment and financing mechanisms.

Additionally, regional connectivity plays a pivotal role in transitioning towards a sustainable future. To ensure the successful integration of renewable energy sources, it is imperative to develop interconnected grids with neighbouring countries. This will facilitate the smooth absorption and distribution of renewable energy, accentuating its impact across the region.

In conclusion, public investments wield significant potential in driving the transition towards a sustainable future. By employing long-term plans aligned with NDC commitments, countries can pave the way for a zero-carbon emissions future. The integration

of robust policy frameworks, adequate financing, and regional connectivity will further strengthen these pathways, ultimately leading to a sustainable, greener future for all.

**Mr. Auguste Tano Kouamé**  
**Country Director, World Bank**



Transition is a global issue that requires the participation of both developed and developing countries. While developed countries often take the spotlight in discussions about transitioning to renewable energy, it is important to recognise the crucial role that the global south plays in this process. Developing countries currently have relatively low levels of energy consumption per capita, with India's consumption being just one-third of the global average. However, these countries are experiencing rapid growth, which will inevitably lead to an increase in energy consumption. If this growth is not accompanied by a shift in energy sources, it will be impossible to achieve the goals set out in the Paris Agreement, specifically the objective of



limiting global warming to below 1.5 degrees Celsius.

Thankfully, the cost of renewable energy technologies has significantly decreased, making them more accessible to developing countries. However, more investment is needed in order to effectively transition to these cleaner energy sources. Public finance plays a vital role in regulating investments and ensuring their productive use. The World Bank has recognised the importance of energy transition in the global south and is actively working to support these efforts. They have outlined five key pillars of support for the South Asia region, including:

1. Mainstreaming renewable energy sources
2. Promoting efficiency on the supply side
3. Improving demand-side efficiency by encouraging market-based approaches
4. Prioritising decarbonisation in key sectors such as industry and transportation,
5. Supporting the transition away from coal in a just manner.

Ultimately, energy transition should not only address environmental concerns but also have positive socioeconomic impacts. It should create jobs, opportunities, and growth, benefiting individuals, communities, countries, and the global economy as a whole. By

recognising the unique challenges and opportunities faced by developing countries, we can ensure a more inclusive and effective transition towards a sustainable future.

**Mr Tarun Kapoor**

**Advisor to PM, PMO, Govt. of India**



The energy transition is a critical global issue, with two key concerns being energy security and affordability. After the price increase of natural gas following COVID-19, affordability and energy security have become major concerns. While developed countries can afford to import fuel at high prices, countries like India face challenges in purchasing energy. To avoid artificial deficiencies and price hikes, it is crucial for energy sources to be under domestic control. India's per capita energy consumption is among the lowest globally and is expected to continue growing for the next 15 to 20 years. Developed countries have almost reached their energy requirements and now focus on transitioning to cleaner sources. However, developing countries like India must prioritise supplying sustainable and reliable

energy, preferably within the country, to reduce long-term dependence on imports. Currently, 85% of India's energy resources are imported, including 25% coal and 50% natural gas. However, renewables and large hydro contribute around 24% of the energy, and the grid accounts for 18%. Given the significant reliance on coal, transitioning will take time, but it is necessary due to increasing energy demands and the need for energy security. The transport and industry sectors present the biggest challenges in energy transition. Renewable energy adoption in transport is less than 4%, with hydrogen showing promise. For industries requiring high temperatures, alternatives like biomass and hydrogen are viable options to reduce coal dependence. At the household level, India has over 320 million Liquefied Petroleum Gas (LPG) connections, with more than 50% sourced from imports. Promoting and adopting electric or solar-based cooking can be beneficial.

**Mr Alok Kumar**

**Secretary, Ministry of Power. Govt of India**



India is faced with the challenge of meeting its growing energy demand while transitioning to more sustainable sources. To tackle these issues, we must explore multiple pathways. There are six key priorities that India should focus on:

1. Energy transition through addressing technology gaps
2. Low-cost finance for the energy transition
3. Energy Security and diversified supply chain
4. Energy efficiency, industrial low-carbon transition and responsible consumption
5. Fuels for future
6. Universal access to clean energy

Investing \$150 Million can help resolve existing technological gaps. It is crucial for us to implement small-scale technologies like Advanced Carbon Composite Batteries, Carbon Capture Usage and storage, Electrolysers, and High-capacity fuel cells. However, we must find a way to balance all these sub-topics in an integrated manner. Taking a bottom-up approach, we need to encourage domestic stakeholders to adopt sustainable practices and streamline the transition process. This will simplify the integration of sustainable solutions. By bringing down the cost of battery energy storage, we can propel the Indian power sector

towards an effective energy transition. Additionally, we should invest in future fuels, such as Biofuels rich in ammonia. Decentralising the deployment of renewable energy to local communities will empower them and speed up the transition. Cross-border grid connections can ensure energy security and economic growth, leading to a low-carbon future.

To accelerate universal energy access, we must establish global alliances for biofuels and promote renewable energy through voluntary actions in developing countries. Ultimately, India aims to build a consensus on these crucial matters. By implementing these strategies, we can make significant progress in adopting sustainable energy practices, including the widespread adoption of Electric Vehicles. In conclusion, focusing on these priorities will pave the way for a more sustainable and secure energy future for India.

**Ms Gauri Singh**  
**Deputy Director General, IRENA, UAE**



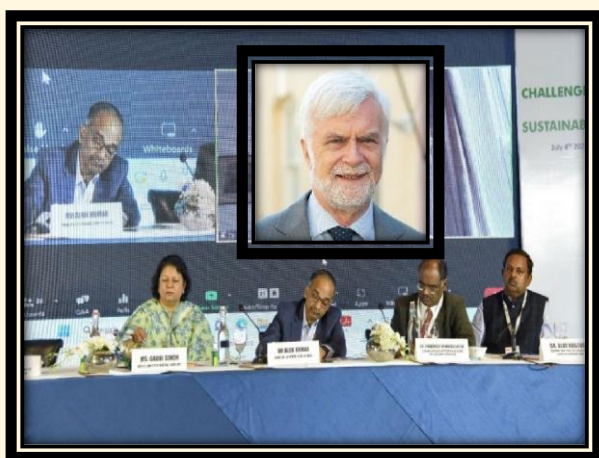
In 2022, global Renewable Energy capacity grew by nearly 300 GW, accounting for 83% of total capacity additions. This brought our total Renewables in power generation to 40%. However, deployment of RE remains limited to certain regions like China, the US, and the EU, which make up 75% of the deployment.

While there has been a decline in RE technology costs, Africa has seen a surge in spending on oil and gas, contributing to global greenhouse gas emissions. There is a growing investment gap between the global north and south, including within the G20 countries. Brazil and Uruguay have adopted cross-border grid connections, emphasising the job aspect and diversification to hydrogen-based renewables. South and Western Africa face conflicts due to resource limitations, and rely heavily on public funds, which are soon to be depleted. Thus, FDI is needed in these regions.

In ASEAN, energy demand is expected to rise due to economic and population growth. Currently, fossil fuels meet 85% of primary energy supplies, with only 28 GW of RE consumption. Solar PV and electric vehicles will play a key role in the short-term transition. Latin American countries heavily depend on hydro and need to diversify their energy mix. Central America has attracted significant investments due to well-interconnected grids and a robust electricity market. Africa lags behind with a 46% electrification rate and a

focus on development. The region generates more electricity than it can transmit and distribute, creating a bottleneck. Additionally, investment in Africa is concentrated in a few countries. The grid infrastructure needs about 600 billion USD annually to accommodate more variable renewables. International cooperation must prioritise regional integration, planning, and action.

**Dr Jim Skea**  
**Professor of Sustainable Energy, Imperial**  
**College London, UK**



In the local context, the definition of Just Transition remains uncertain. The recent IPCC report underscores the importance of studying and assessing the social and employment impacts of climate policies at an early stage. To achieve this, it is crucial to engage in social dialogue and democratic consultation with stakeholders and social partners. This includes the establishment of decent jobs, active labour market policies, and ensuring workers' rights. Additionally, investments should be made in

low-emission and labour-intensive technologies and centres. It is imperative to implement practical training and retraining programs that lead to decent work opportunities and economic diversification through low-carbon investments.

While the era of coal usage is now in the past, the consequences of an unjust exit strategy from this industry are still visible in economically disadvantaged communities grappling with high levels of unemployment. Scotland, once a significant offshore oil and gas producer, must now confront new challenges. However, there are substantial opportunities in the renewable sector, such as repurposing the skills developed for offshore oil and gas to offshore wind. Employment prospects in carbon capture and storage and hydro industries also exist for the current workforce. Moreover, it is crucial to emphasise that the transition presents not only risks but also significant economic opportunities.

Turning to the Asian context, the incentives for rapid economic growth necessitate the exploration of alternative resources. However, it is essential to shift the focus towards global support for clean energy and improve its grid infrastructure. Expanding research and development efforts by establishing more research institutes and separate ministries is integral to achieving this goal.



**Dr Anbumozhi Vankatachalam**

**Economic Research Institute for ASEAN  
and East Asia, Jakarta, Indonesia**



Indonesia heavily relies on coal for energy production, making it unsuitable to completely eliminate the coal-oriented energy sector. Transitioning to renewable sources can create social injustice and unemployment issues, and the energy transition itself is a costly process with potential negative impacts. However, in order to achieve positive outcomes, cooperation at regional and international levels is necessary. A proposal similar to Germany's approach could be considered, which involves the diversification of energy-using industries based on natural sources like sun, wind, and water. Indonesia shares similarities with India in terms of affordability, access, and transition challenges. It exports good quality coal to other countries and will likely continue doing so. The energy transition represents a trade-off between growth and clean energy. Indonesia has opportunities for solar PV, offshore wind, hydro, geothermal, biomass, nuclear, and hydrogen in the renewable energy sector.

Nevertheless, the country's numerous small islands lack electricity access making grid connection difficult. The elimination of coal would impact both social and economic growth, with estimates suggesting a potential 30% negative GDP growth.

In this context, several pathways can be explored, including the need for increased renewable energy penetration and cross-border power trade for effectiveness. Efficiency improvement, carbon trade possibilities, and the distribution of coal phase-out effects must also be considered. Co-benefits can be achieved through these pathways, but there is no singular solution. The government should incentivise research and development in renewable energy technologies and strive to make the grid more flexible.

**Dr Ajay Rastogi Chairman**

**Task Force, Sustainable Just Transition,  
Jharkhand, India**



The energy demand in our country is projected to increase by over 3% annually by 2047.

Jharkhand, a state that holds 40% of our nation's mineral wealth and meets 30% of its energy demand, heavily relies on coal for 98% of its energy requirements. The state lacks a developed solar energy technology sector, presenting a need for economic diversification plans that align with the necessary energy shift. However, this transition poses a challenge due to the direct dependence of coal-operated steel, iron, and medium-scale industries in 13 out of 24 districts. With around 0.35 million workers employed by Coal India, the livelihoods of numerous informal workers are threatened by any disruption to mining activities in these areas.

Given the complexity of the coal ecosystem in Jharkhand, achieving a short-term shift will prove difficult. However, there are potential mid-term options to explore, such as cleaner coal conversion, coal gasification, and harnessing Coal Bed Methane and other innovative technologies. Utilising decommissioned mine wastelands, uncultivated land, and other available areas for biofuel crop cultivation could enhance energy security in the state. Transitioning to a green economy goes beyond environmental sustainability and requires consideration for the employment opportunities of those associated with the coal sector once mines are phased out. Biofuel presents a promising alternative in the clean energy sector, while sustainable mining

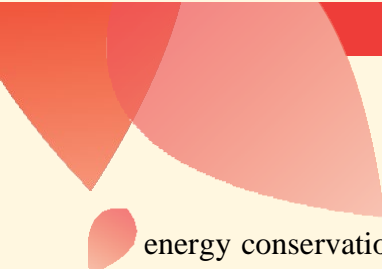
practices and plans for critical mineral extraction are essential.

Additionally, opportunities exist in the green hydrogen sector, particularly for hard-to-abate industries like cement and steel. Regional cooperation among states will play a crucial role in achieving a Just Transition. While examples from countries like Germany, the United States, and Africa offer valuable insights into Just Transition practices, these models cannot be directly replicated due to the unique geography and inherent challenges of Jharkhand. Instead, we can adapt and customise policies based on their experiences and adapt them to our local context.

**Mr Abhay Bakre**  
**Director General, Bureau of Energy Efficiency (BEE)**



After the Paris Agreement in 2015, energy efficiency and demand-side management gained significant importance. In India, the Energy Conservation Act has transformed



energy conservation into a broader movement known as energy transition. It is crucial to recognise that positive actions from the supply side are driven by the demand from various sectors. While installing new capacity and power plants is an option, it is essential for the economy or different sectors to ultimately utilise the electricity. Storing electricity incurs additional costs, making consumers reluctant.

Therefore, the programs and policies from the demand side will play a significant role in determining the energy transition pathway. Although different countries may have different approaches, demand-side management will remain critical. In fact, achieving net zero emissions will heavily rely on energy efficiency and demand-side management, accounting for 40% of the necessary actions. This aspect is often overlooked.

Maintaining other variables, the economy naturally gravitates towards high-carbon pathways. Energy transition aims to shift the economy towards a low-carbon pathway. Detaching economic growth from emission growth is crucial, and energy efficiency, coupled with renewable energy sources, facilitates this decoupling. Recognising the importance of energy efficiency in enabling a just energy transition, we have identified five sectors and pillars for focus:

**1. Buildings:** By 2030, over 50% of new buildings must comply with building codes and be more than 50% efficient compared to conventional building stock.

**2. Industry:** The industry poses a significant challenge, especially with hard-to-abate sectors. Promoting technologies like Carbon Capture, Usage and storage (CCUS) and green hydrogen is necessary, but existing technologies can also be deployed. The hindrance lies in profitability and high costs that need to be addressed.

**3. Transport:** Despite a recent increase in the adoption of electric vehicles (EVs), the transport sector still faces challenges. From 2005-2016, total emissions in the transport sector increased by 180%, warranting immediate attention. Besides EVs, exploring options like biofuels can contribute to reducing emissions.

**4. Appliances:** Efficient cooling remains an area that requires attention in the appliance sector. Currently, only 8% of households use air conditioners in India. Without addressing cooling as a hard-to-abate sector, it could become a concern by 2040, similar to steel or cement.

**5. Behavioral Change:** Focusing on responsible consumption is essential to drive behavioral change in energy usage.

In conclusion, energy efficiency plays a pivotal role in facilitating a just energy transition. By implementing targeted programs and policies from the demand side, we can overcome challenges in various sectors and accelerate progress towards a low-carbon economy.

**Dr Rajan Sudesh Ratna**  
**Deputy Head and Senior Economic Affairs**  
**Officer, Subregional Office for South &**  
**South West Asia, UNESCAP**



India's G20 presidency has the potential to be a game changer, particularly when it comes to addressing policy imperatives. However, one challenge is that the non-binding nature of G20 declarations has led to a lack of implementation in the past.

The targets outlined in Sustainable Development Goal 7, which focuses on affordable and clean energy, have been falling behind in South Asia. Only target 7.1.1 is on track to be met by 2030, while targets such as clean energy reliance (target 7.1.2) and

renewable electricity capacity per capita (7.b.1) are lagging far behind. Additionally, there has been a negative trend in the share of renewables in the energy mix from 60% in 1990 to less than 40% in 2022 for South Asia.

Another crucial issue is the uneven distribution of critical raw materials worldwide. G20 countries are major producers and consumers of these materials. Lessons learned from countries like Australia, China, and Turkey should be implemented globally to improve the critical raw material supply chain.

Cross-border electricity trade is another important area that requires discussion. Regardless of whether energy is derived from renewable or non-renewable sources, it will continue to be traded as a commodity. Therefore, a regulatory framework should be established to facilitate this trade. Additionally, the varying levels of development and unique challenges faced by island and landlocked countries must be taken into consideration when developing policies and providing capacity-building support.

In conclusion, India's G20 presidency offers an opportunity to address these critical energy-related issues. By developing a global framework, implementing lessons learned, and fostering collaboration, progress can be made towards achieving sustainable and affordable energy for all.



**Dr Tim Gould**

**Chief Energy Economist, International Energy Agency (IEA)**



Finance and investment are crucial factors in the transition towards clean energy. It is important to identify the key drivers that can increase investment in renewable sources. When examining historical data on fuel investments, it is evident that upstream oil and gas investments have not reached the levels seen in 2019, despite the industry's record revenues in 2022. This highlights the uncertainty surrounding the future demand for fossil fuels and the challenges associated with long-term, capital-intensive upstream projects.

In contrast, the power sector has witnessed a significant increase in investments in low-emission sources, such as renewables and nuclear energy. Around 90% of the investment in power generation is currently directed towards these cleaner alternatives. Additionally, investments in clean

electrification include modernised smart grids and storage systems in select countries.

While investments in clean electrification are rising steadily, a focus on energy efficiency is necessary. Increased borrowing costs and a lack of rapid investments in efficiency measures are hindering progress in achieving sustainable development goals and meeting Paris Agreement commitments. Therefore, greater attention should be given to promoting energy efficiency investments.

Advanced economies have been leading the surge in clean energy spending. However, emerging and developing economies, excluding China, which account for two-thirds of the world's population, only represent 15% of total clean energy investment. Nonetheless, promising investments in solar energy, energy efficiency, and clean energy projects are emerging in countries like India, Brazil, Latin America, and the Middle East.

Various factors contribute to this disparity, including macroeconomic issues like rising borrowing costs and sector-specific challenges related to grids, creditworthiness, and land acquisition. India's establishment of the Solar Energy Corporation of India serves as a successful model in addressing these specific challenges, subsequently inspiring other countries like Cambodia.

These challenges, though diverse, all contribute to increased capital costs. The cost of capital for clean energy projects in emerging economies (excluding China) is two to three times higher than in developed economies. To achieve the ambitious sustainable development and climate goals outlined in the Paris Agreement, a sevenfold increase in clean energy investment in emerging economies across all sectors is necessary.

The mobilisation of all sources of finance, including private, public, and concessional funding, is crucial for achieving these targets. Currently, public finance contributes 20% in advanced economies but increases to 50% in emerging and developing economies. Therefore, a greater emphasis on private finance is essential.

Four levers can help mobilise private finance:

- Policy reforms and institutional capacity-building
- Increased concessional finance of at least \$80-100 billion annually
- Development of new financial instruments and platforms, such as carbon markets and sustainable loans
- Greater focus on local capital markets and financial systems to mobilise domestic finance, an area currently undeveloped.

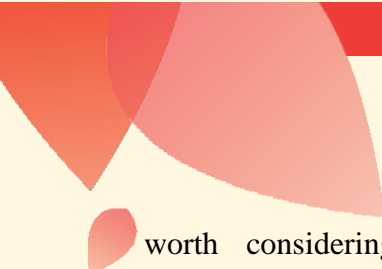
It is imperative to reverse the current ratio, where for every dollar of public money, only 30 cents of private finance is mobilised. De-risking private finance should become a priority.

In conclusion, addressing the challenges associated with clean energy investments requires a multi-faceted approach. It is crucial to promote policy reforms, increase concessional finance, develop new financial instruments, and shift the focus towards domestic and private finance. By doing so, we can unlock the necessary capital to accelerate the transition towards clean and sustainable energy sources.

**Dr. Vibha Dhawan**  
**Director General, TERI**



The new Energy Conservation Bill and its amendments have successfully prioritised energy efficiency in new buildings. However, it is crucial to question whether these regulations can also be applied to existing buildings. It is



worth considering the implementation of regulations that require existing buildings to meet a portion of their energy needs through renewable sources. Although some corporations and hotels may voluntarily adopt these practices, the government should also enforce binding regulations.

Solar rooftop technology has been extensively discussed in recent years, but its practical implementation is yet to become a reality. The main challenge lies in the fact that consumers are reluctant to sacrifice valuable space for little or no returns, especially considering the significant initial investment required. Therefore, we must devise a system that ensures consumers benefit from solar rooftop technology from day one without a burdensome initial cost.

The concept of energy transition holds different meanings for different groups of people. For rural communities, it implies access to clean energy, while for corporations, it involves entirely different considerations. Additionally, climate change remains a prominent concern. Many young individuals attribute climate change to industrialisation in advanced economies. However, it is essential to recognise that we have all benefited from industrialisation and that placing sole blame on this process is misguided. It is crucial to acknowledge that we were previously aware of the unsustainability of this type of

development, but chose to ignore it. We must now prioritise sustainable development while continuing to pursue progress.

India has the potential to become a global leader in sustainable development. The key element in this journey is technology. Unfortunately, most new technologies are not readily available in developing countries. Intellectual Property Rights (IPR) have become more important than securing our collective future. Therefore, it is imperative to not only ensure access to technology but also promote collaborative technology development. The Indian industry differs significantly from that of developed nations, and we may not require the same level of technological sophistication. It is crucial to understand our unique needs and progress accordingly.

In the context of India, it is vital to ensure that technology is accessible to medium and small enterprises, which account for 60% of the country's production. One concerning aspect is the shipping industry, as the quality of fuel used for shipping transport is critical for trade. The government's initiative to establish National Centres for Excellence of Green Ports and Shipping is commendable and represents a step in the right direction.

To achieve a successful energy transition, it is crucial for different industries and ministries to collaborate and develop a roadmap. All

ministries must work in tandem to prioritize sustainable development. By doing so, India can set an example for the world in achieving a sustainable future.

**Dr Ritu Mathur**

**Senior Consultant, NITI Aayog**



The energy transition is a complex process that involves energy security, affordability, and sustainability. Currently, India is heavily dependent on fossil fuels, with 83% of its energy coming from this source in 2020. However, in order to achieve our net zero targets, we need to reverse this trend and achieve 85% non-fossil dependency by 2070.

To accomplish this, we must prioritise energy efficiency. Cleaner alternatives also play a crucial role, some of which already exist while others need to become commercially viable. Although there is no one-size-fits-all solution, we can develop a blueprint outlining our goals. This planning should take into account the unique challenges and opportunities of

different regions and subnational contexts. It is essential to have a flexible approach and tailor solutions to each state's specific circumstances and societal needs.

Even after electrification, certain industries will require advanced technologies like green hydrogen. It is important to prioritise funding for these technologies while remaining open to new solutions that may emerge in the future. Flexibility is key in the medium to long term.

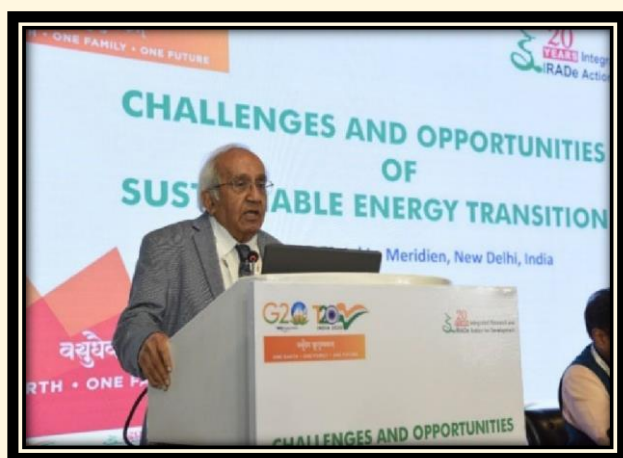
A Just Transition is a central focus for India. The use of coal will not disappear overnight, and we must consider the impact of the energy transition on the millions of people employed in fossil fuel-dependent industries. It is crucial to include these individuals in the transition and address the revenue generation concerns of coal-rich states. This requires a comprehensive approach that integrates these communities into the energy transition agenda.

Furthermore, we need to consider the geographical concentration of the fossil fuel industry in India. The districts where the industry is concentrated often face the greatest challenges in transitioning to clean energy. Many of these districts also have a high proportion of below-the-poverty line population. Therefore, it is imperative to ensure the inclusion and support of these communities throughout the energy transition.

When approaching the energy transition, it is vital to consider not just the changes within individual sectors, but also the integration of various sectors and resources. The implications on material, land, and water use, as well as overall resource efficiency, must be carefully examined.

In conclusion, India's energy transition requires a comprehensive and flexible approach. We must prioritise energy efficiency, develop cleaner alternatives, and consider the unique challenges and opportunities of different regions. A just transition that includes all stakeholders and addresses the impact on communities and revenue generation is essential. Additionally, we must carefully assess the implications of the transition on material, land, water use, and overall resource efficiency. By doing so, we can successfully navigate the complexities of the energy transition and achieve our net zero goals.

**Dr Kirit Parikh**  
**Chairman, IRADe**




Every country will have its unique path to energy transition. Also, a more holistic approach is needed that takes into account factors across various sectors. For example, when talking about phasing down the use of coal, not only the impact on people employed in the coal mines should be taken care of, but also the consequences for the whole coal ecology should be considered.

We have observed that technology plays a crucial role in energy transition. Thus it is also vital that the issue of accessibility of technology is addressed. The energy transition working group has identified five key sectors and pillars for increasing energy efficiency. Technologies for these five pillars - Buildings, Industry, Transport, Appliances, and Behavioural Change - should be developed jointly by countries or at least be considered as global public goods so that the issue of accessibility is dealt with.

The second learning that emerged is that it is not enough to look at the big countries that are getting some climate finance but it is equally important to focus on the large number of other countries. For example, we know that most countries in Africa are not at the receiving end of financial inflow. Similarly, small island countries confront different problems. All of this needs to be handled together and G20 can and should take a lead in making energy transition universal.





The third point that was discussed at length was raising adequate climate finance. Finance has been a very pertinent issue and the major question that arose in the session is the source of finance. Developed nations who promised to provide 100 billion dollars a year have not even lived up to that pledge. Now, the ask has increased from 100 billion dollars to 1 trillion dollars every year.

Perhaps one possible solution that one can think of, is leveraging the money that comes from public finance by providing it to multilateral and development banks (MDBs) and asking them to use this money to cover the risks of private finance. This can be a game changer and multiply the private finance that is available by maybe a factor of 5 or 10. MDBs will have credibility and hence more private finance can be mobilised.

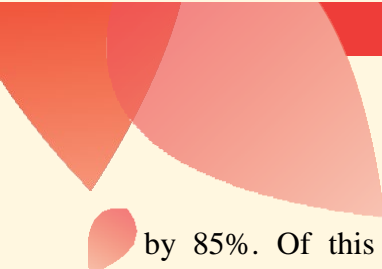
Regarding finance, another interesting solution that can be thought of is that the contribution from public finance to multilateral banks should in some way relate to the past emissions of different countries. Cumulated emissions from 1990 to 2023 that are parked in the global GHG parking space can be charged a notional parking fee of one dollar per tonne of carbon dioxide every year. This will help us mobilise around 700 billion dollars a year. Around 80% of it can be given back to the country itself for its expenditure on mitigation and adaptation.

Another key argument that emerged is that we cannot restrict sustainability to just technology or resources and we have to take economics into account. A lifecycle analysis is a must and we also have to worry about the social implications of the whole process. Energy transition has to be sociologically sustainable. If the gap between the rich and the poor widens then there will be an instability of a different kind which can disrupt all actions.

Another crucial point that was made regarding energy transition is that, if India has to achieve it, it has to take the path which increases energy self-reliance. We are currently importing around 25% of coal, 50% of gas and 85% of crude oil. Hence, energy self-reliance is highly crucial to sustainability.

Energy efficiency is another extremely important point. Energy efficiency has a massive role to play in cutting down electricity demand. Electricity demand can be cut down by energy efficiency to the tune of 40-50%. While EVs will increase electricity demand, it will be still less than if we didn't have energy efficiency.

Regarding energy efficiency, one additional point is that buildings are consuming a lot of energy today. When we were involved in the low carbon strategy for inclusive growth report in 2013-14, the platinum-rated buildings claimed to have reduced energy consumption



by 85%. Of this 85%, only 15% could be attributed to what we can consider as due to the architectural redesign of the building. The remaining change is ascribed to HVAC, equipment efficiency, better management and so on. Hence, it can be said that we need to push for well-directed energy efficiency programs for air conditioners and other types of equipment. Artificial intelligence can also be incorporated so that energy-efficient equipment is used even more efficiently.

Another interesting idea that came up is to focus on low-carbon hydrogen now instead of waiting for green hydrogen to be economical, which is very expensive at the moment. Technological improvements to bring down the cost of green hydrogen and to make it economical will take time. Hydrogen can substitute batteries. We will require a lot of batteries for EVs and storage in the absence of

hydrogen. We can think of having fuel cell-driven vehicles powered by low-carbon hydrogen for now. And once green hydrogen is available, we can substitute low-carbon hydrogen with that. This can be applied not only to heavy-duty trucks but also to international shipping.

As far as batteries for storage are concerned, lithium is not easily available and is concentrated in a few selected countries. Hence, lithium will also increase our dependence on imports. Fortunately, alternative battery technologies are available. However, they happen to be quite large and heavy. They can be used for stationary applications since it is economical and the raw material is also locally available.

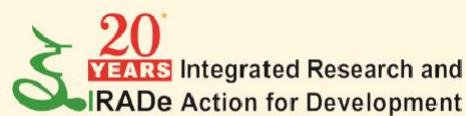
Hence, with low-carbon hydrogen, we can switch to low-carbon pathways sooner and then eventually move towards our target of net zero.





## About IRADe

IRADe is an independent advanced research institute that aims to conduct research and policy analysis to engage stakeholders such as government, non-governmental organisations, corporations, and academic and financial institutions. Energy, Climate Change, Urban Development, Poverty, Gender Equity, Agriculture and Food Security are some challenges faced in the 21st century. Therefore, IRADe's research covers these, as well as the policies that affect them. IRADe's focus is effective action through multidisciplinary and multi-stakeholder research to arrive at implementable solutions for sustainable development and policy research that accounts for the effective governance of techno-economic and socio-cultural issues. Learn More: [www.irade.org](http://www.irade.org)



## About T20

Think20 (T20) is an official Engagement Group of the G20. It serves as an “idea bank” for the G20 by bringing together think tanks and high-level experts to discuss policy issues relevant to the G20. T20 recommendations are synthesised into policy briefs and presented to G20 working groups, ministerial meetings, and leaders’ summits to help the G20 deliver concrete policy measures. Learn More: [www.t20ind.org](http://www.t20ind.org)



## About G20

The Group of Twenty (G20) is the premier forum for international economic cooperation. It plays an important role in shaping and strengthening global architecture and governance on all major international economic issues. India holds the Presidency of the G20 from 1 December 2022 to 30 November 2023. The G20 Presidency is responsible for bringing together the G20 agenda in consultation with other members and in response to developments in the global economy. Learn More: [www.g20.org](http://www.g20.org)



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 **20**  
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