

Vichaar-Vimarsh **JUST** Transition NEWSLETTER

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ENERGY EQUITY: A PATHWAY TO JUST TRANSITION

Message from the Desk of the Senior Director, TERI

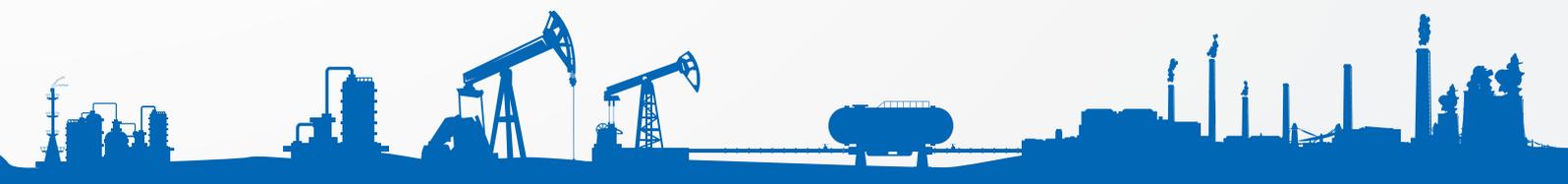
TERI is pleased to announce the release of the seventh edition of Vichaar-Vimarsh: Just Transition Newsletter, themed 'Energy Equity: A Pathway to Just Transition'. This edition brings to light the critical importance of ensuring equitable access to clean, affordable, and reliable energy as India advances towards its net-zero commitments.

In the context of the energy transition, equity must go hand in hand with efficiency and sustainability. Millions across India still lack access to modern energy services, while many others face irregular supply. It is therefore imperative that the transition is not only green, but also just and inclusive. This edition will explore the intersection of clean energy with education, health care, gender inclusion, and governance reforms, offering pathways to align climate goals with developmental priorities.

We hope this edition offers valuable insights and contributes towards enhancing understanding of why energy equity is indispensable for a truly just transition.

A K Saxena

Electricity and Renewables Division
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Pilfered coal is transported over long distances to meet local demand.

A just transition is not about exporting European models—it's about building bottom-up solutions rooted in local realities, capacities, and aspirations.

**- Uwe Gehlen,
Head, Economic Cooperation & Development, German Embassy, India**



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Women map their village using participatory rural appraisal to identify local resources and infrastructure for community planning.



Editorial

As humankind grapples with the pressing challenges of climate change, there is an increasing emphasis on switching to a cleaner and sustainable ecosystem. India being one of the largest producers of coal—a significant contributor to global carbon emissions, is doubly challenged by its increasing energy demands and domestic energy security needs as well as its effort of diversification to meet the decarbonization goals.

It is widely recognized that a meaningful transition towards decarbonization and a cleaner economy calls for adoption of a fair and people-centric transition paradigm, one that addresses climate change mitigation while safeguarding ecosystems, human rights, and local economies.

The 'Just Transition' lens offers an insightful understanding about how one takes a systemic and people-centric view of energy, climate, and development considerations while diversifying to a newer and cleaner economy.

I believe that the narratives built around the crucial theme of 'Just Transition' in the past editions and the thematic focus of the present 'Vichhar-Vimarsh' edition helped elicit varied views of researchers, development professionals, and other experts and create a larger knowledge landscape for further reflections.

- Jayanta Mitra, PhD, Senior Fellow, TERI



ADVANCING ENERGY EQUITY THROUGH GENDER-INCLUSIVE SOLAR IRRIGATION

Angel Konthoujam
Gender and Equality Advisor, GIZ



Women accessing clean water for daily use

Introduction

As India accelerates its transition to clean energy, achieving universal access to affordable, reliable, and sustainable energy (SDG 7) is critical for an inclusive and just transition. While the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM KUSUM)

Scheme has emerged as a promising initiative to promote solar-powered irrigation systems (SIPs) and reduce reliance on fossil fuels, gender disparities in energy access persist. Women farmers, despite constituting a significant portion of the agricultural workforce, face systemic barriers in accessing and benefitting from renewable energy technologies. Addressing these barriers through



targeted policies and financing mechanisms can enhance energy equity and promote a truly inclusive transition to clean energy.

Key Challenges to Energy Equity in Solar Irrigation

1. Gendered barriers in energy access

Women farmers face limited land ownership rights, financial constraints, and lack of technical training, all of which restrict their participation in solar irrigation initiatives. In a recent study led by me in the role of Gender Technical Advisor for the Swiss Agency for Development and Cooperation-funded Solar Irrigation for Agricultural Resilience (SoLAR) Project, 40% of female beneficiaries of the PM KUSUM Scheme reported that men made irrigation decisions despite women being the registered beneficiaries. Additionally, data from field studies indicate that in some states, only 10% of women farmers have direct access to irrigation decision-making, significantly limiting their ability to benefit from energy access initiatives.

FORTY PER CENT OF FEMALE BENEFICIARIES OF THE PM KUSUM SCHEME REPORTED THAT MEN MADE IRRIGATION DECISIONS DESPITE WOMEN BEING THE REGISTERED BENEFICIARIES.

To address these gaps, a baseline survey on the adoption barriers and impact of SIPs under the PM KUSUM B Scheme was conducted, ensuring that gender perspectives were integrated into research and policymaking. As part of this initiative, a 50:50 female-to-male ratio for enumerators was implemented, with 5 of the 8 data collectors being women. Furthermore, gender sensitization training was conducted for all enumerators, and sex-disaggregated focus group discussions (FGDs) were held to assess the specific challenges faced by women farmers in accessing solar irrigation.

2. Financial exclusion and limited access to subsidies

While the PM KUSUM Scheme provides subsidies for SIPs, women's limited control over agricultural finances prevents them from benefiting equally. Sixty-one per

cent of the surveyed women farmers expressed a need for targeted subsidies, while 45% of non-beneficiaries cited financial constraints as a barrier in adopting solar irrigation. Research highlights that despite 40% of smallholder farmers being women, their access to formal credit is 30% lower than men's, limiting their ability to invest in renewable energy technologies. Furthermore, lack of collateral and restrictive banking procedures disproportionately affect women's ability to secure loans, exacerbating financial exclusion in clean energy adoption.

3. Limited awareness and training opportunities

A key barrier to solar irrigation adoption among women farmers is insufficient knowledge and training on the use, maintenance, and financial benefits of SIPs. Studies indicate that 35% of women farmers had never received any information regarding solar irrigation, while 42% lacked confidence in operating the equipment independently. The absence of targeted awareness campaigns and capacity-building initiatives prevents women from fully benefiting from renewable energy solutions.

Localized training programmes and community-led knowledge-sharing initiatives have been successful in increasing adoption rates, but they remain limited in scale and reach. Ensuring that women self-help groups (SHGs) and community-based organizations (CBOs) are involved in knowledge dissemination can significantly improve the uptake and long-term sustainability of solar irrigation technologies.

4. Lack of gender-responsive technology design

Women farmers have specific usability concerns regarding SIPs, with 28% finding existing models too large or difficult to operate. In rural areas, where farming is often carried out by older women, mechanically complex technologies hinder adoption. A survey conducted across PM KUSUM pilot regions found that 35% of female respondents lacked adequate training to independently operate and maintain SIPs, leading to reliance on male family members or external technicians. This dependence not only delays the use of SIPs but also increases costs for women farmers who must pay for maintenance services.

As part of the solar lift irrigation systems for women



SHGs in Mandla district, two SIPs were installed for SHGs from Baiga and Gond communities to promote women-led energy governance. These initiatives highlight the importance of inclusive design and capacity-building measures to improve energy access for marginalized women.

Policy Recommendations for a Gender-just Energy Transition

1. Gender-sensitive financial models

- **Targeted subsidies:** Provide higher subsidy rates for women farmers, similar to the SC/ST subsidies, to improve access to solar irrigation technology.
- **Gender-responsive loan schemes:** Develop low-interest, collateral-free loans tailored to women farmers through microfinance institutions (MFIs) and self-help groups (SHGs).
- **Revolving funds and blended finance:** Establish revolving credit funds where women-led farmer cooperatives can pool resources and access financing for SIP adoption. Currently, only 15% of women farmers access microfinance for agricultural inputs, highlighting the need for an inclusive credit framework.

ONLY 15% OF WOMEN FARMERS ACCESS MICROFINANCE FOR AGRICULTURAL INPUTS.

2. Strengthening women's decision-making in energy access

- **Promote joint ownership models:** Encourage shared SIP ownership between men and women within households to ensure women have decision-making authority. Research indicates that in regions where joint land ownership is promoted, women's participation in decision-making increases by 20%.
- **Women-led water user associations (WWUAs):** Establish and strengthen women's cooperatives for solar irrigation management to improve collective bargaining power and ensure equitable energy distribution.
- **Integrating GESI modules in policy implementation:** Focus on decision-making autonomy, perceived

benefits for female beneficiaries, and adoption barriers in energy programs to ensure policies are gender-sensitive and community-driven.

3. Inclusive technology design and capacity building

- **Women-centric design improvements:** Prioritize smaller, portable, and user-friendly SIP models that align with the needs of female farmers.
- **Localized training programmes:** Implement gender-sensitive technical training using local female trainers to improve adoption and maintenance of SIPs. A study in Gujarat and Madhya Pradesh found that training programmes led by female extension officers increased women's adoption of solar pumps by 30%.
- **Community-led knowledge sharing:** Utilize SHGs and local governance structures to spread awareness and build local expertise in solar irrigation.
- **Expand awareness campaigns:** Develop media-based and peer-learning strategies to reach more rural women and ensure long-term behaviour change in energy adoption.

TRAINING PROGRAMMES LED BY FEMALE EXTENSION OFFICERS INCREASED WOMEN'S ADOPTION OF SOLAR PUMPS BY 30%.

Scaling Up Gender-inclusive Solar Irrigation Models

The integration of gender-sensitive financing, governance, and technology design in solar irrigation programmes has already demonstrated positive outcomes in select pilot regions. By scaling these models, policymakers can ensure more inclusive access to clean energy, enabling women to be equal participants in India's clean energy transition.

One of the most effective models has been the Women-led Solar Irrigation Cooperatives, where women's SHGs collectively manage and distribute water from SIPs. These cooperatives have proven to reduce energy costs, improve crop yields, and enhance financial stability for smallholder women farmers. Expanding such models under PM KUSUM will drive a bottom-up, community-driven approach to renewable energy adoption.





Focus group discussions in Dinajpur and Khulna divisions of Bangladesh studying the needs and preferences of women farmers in the context of SIPs

Conclusion: A Just Transition Must Prioritize Gender Equity

For the clean energy transition to be truly just and equitable, women must be active participants and decision-makers in energy access initiatives. Implementing gender-responsive financing, inclusive governance, and women-friendly technology design will unlock the full potential of solar irrigation as a transformative tool for economic empowerment. By addressing structural inequalities, India can lead the way in a gender-just clean energy future where all farmers, regardless of gender, have equal opportunities to benefit from renewable energy solutions.



THE GLOBAL ENERGY TRANSITION REQUIRES A MISSION-LED SYSTEMS APPROACH

Stella Leona Deppe

Innovation Officer, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)



Stella co-chairing the Frontiers/Engineering X symposium in Medellin, Colombia

In April, I had the pleasure of co-chairing a symposium session in Medellin, Colombia, through the Royal Academy of Engineering's Frontiers programme in partnership with Engineering X and Universidad De Antioquia, that explored challenges in transitioning to an energy system that is fair, safe and accessible.

Despite advances in energy technology in recent decades, around 733 million people worldwide still do not have access to electricity, according to the United Nations Development Programme. Ensuring that low-

and middle-income countries can access reliable and clean energy is a global engineering challenge that intersects with multiple issues, disciplines, sectors and stakeholders.

Addressing global challenges such as the sustainable energy transition can be like opening Pandora's box —tackling one issue may uncover other deeply interconnected problems that need to be resolved. For example, solar photovoltaic (PV) technologies demonstrate huge potential for renewable energy and



reduced greenhouse gas emissions, accounting for three-quarters of renewable energy capacity additions worldwide in 2023. However, electronic waste (e-waste) from solar PVs is now expected to quadruple from 0.6 billion kg in 2022 to 2.4 billion kg in 2030, presenting a new environmental challenge.

AROUND 733 MILLION PEOPLE WORLDWIDE STILL DO NOT HAVE ACCESS TO ELECTRICITY.

Making progress, therefore, means employing approaches that balance the needs of many, often competing, groups and goals, while understanding the wider environmental and social impacts. Systems approaches that consider all elements of a problem, the way each element interacts and the implications to the system as a whole can help to provide practical solutions that consider the needs of diverse communities. Applying a systems approach to the international energy transition can help to identify where action is needed in energy systems and the best ways to minimise trade-offs.

APPLYING A SYSTEMS APPROACH TO THE INTERNATIONAL ENERGY TRANSITION CAN HELP TO IDENTIFY WHERE ACTION IS NEEDED IN ENERGY SYSTEMS AND THE BEST WAYS TO MINIMISE TRADE-OFFS.

Understanding Stakeholder Motivations



Stella working with symposium participants to apply systems approaches to energy challenges

While interests may intersect, different energy systems stakeholders all have unique interests and motivations. For example, while community members may prioritize having access to uninterrupted and affordable energy, policymakers may also be concerned with ensuring the financial and environmental sustainability of energy sources. Investors and businesses may focus on maximizing investments and finding new market opportunities.

A systems approach emphasizes taking time to understand the motivations of all stakeholders involved to ensure that proposed solutions to existing challenges cater to the needs of all stakeholders.

A Mission with a Moonshot

Navigating these stakeholders with differing needs and expectations in energy systems requires inclusive governance. Systems approaches offer frameworks to facilitate this, for example, adopting mission-oriented innovation for energy systems.

This approach means establishing a central, focused, and innovative ‘moonshot’ goal that is specific, transformative, measurable, and timebound, such as the national mission adopted by the UK government to deliver clean power by 2030. Once the mission has been identified, it requires cross-sectoral collaboration, an open dialogue to drive progress and a governmental entity that coordinates the mission. The mission of global energy transition can only be achieved if it strives for systems change.

Many stakeholder groups and organizations play a role in making a mission work. For example, in the case of solar PV technologies, multilateral organizations can help establish and implement universal guidelines to ensure a safe energy transition with minimal environmental impact. Donor organisations can support investments for transitions, especially for marginalized communities that may not be able to afford transitions, to make sure that no one is left behind. Civil society organizations can play a role in advocacy to ensure rights are respected and responsibilities and duties upheld by all parties involved in energy transitions as well.

Systems approaches in action

The Frontiers symposium funded by Engineering X, an international collaboration founded by the Royal Academy of Engineering and Lloyd’s Register Foundation, has connected many researchers and innovators from around the world who have successfully implemented





Symposium participants collaborating to understand stakeholders and their goals in a sample systems approach activity

a systems approach to enhance energy access. One example was EcoSwell, symposium participant Andres Bustamante's project to install a hybrid microgrid energy system in Nazca, Peru. His team faced a multitude of challenges, including the isolated location of the village, the reluctance of investors to support infrastructural investment in the community, and even conflict between community residents and private companies.

Using a systems approach, Andres and his team also identified the key stakeholders and consulted each of them to better understand their views and the impact the project would have on them. This allowed for meaningful engagement between stakeholder groups and the execution of the project in a way that targeted the problems raised.

TAKING A SYSTEMS APPROACH CAN FACILITATE NEW INITIATIVES AND HELP TO BUILD AN INCLUSIVE AND SUSTAINABLE FUTURE.

Applying lessons learnt from multidisciplinary projects like these is crucial for an equitable future energy transition. Adopting a mission, aiming for a moonshot target and engaging all relevant stakeholders is the key

to success. As the world seeks to advance solutions such as renewable energy, a holistic view can help anticipate challenges and avoid unexpected outcomes. Taking a systems approach can facilitate new initiatives and help to build an inclusive and sustainable future.

Learn more about systems approaches for just energy transitions [here](#).

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ENERGY ACCESS AND SOCIAL DEVELOPMENT: THE ROLE OF CLEAN ENERGY IN EDUCATION, HEALTH, AND LIVELIHOODS

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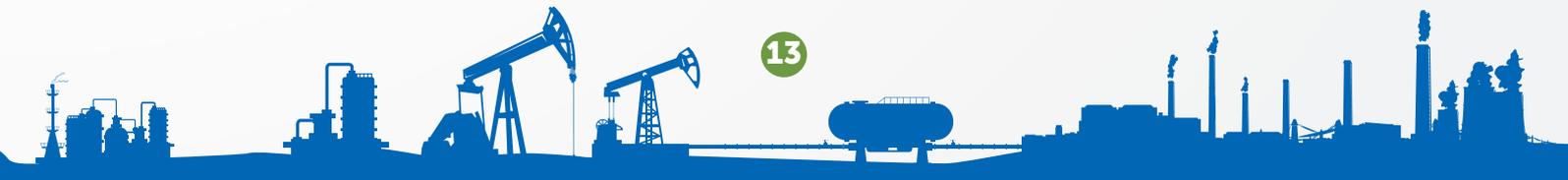
Rooftop panels in a school in Africa

Source: ESI Africa

Introduction

The availability of energy stands as an essential factor which drives the progression of both social development and economic growth (Casati 2023). The provision of dependable clean energy brings both improved life quality together with enhanced productivity and better well-being (IEA 2021). The number of people lacking

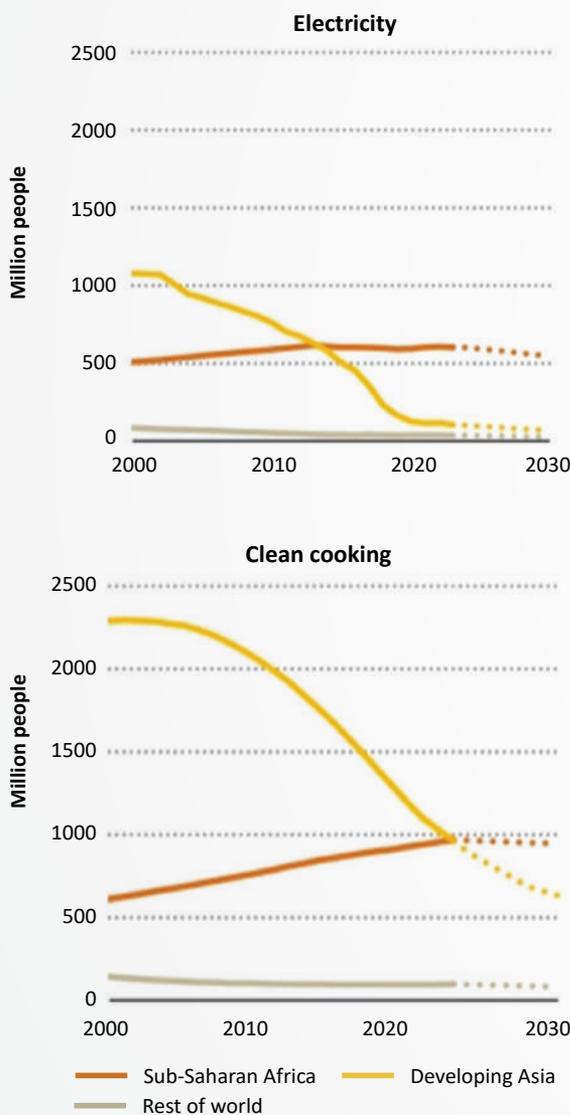
power access reaches 675 million globally and they mostly come from poor nations even with modern technological progress (World Bank 2023). Clean energy availability is crucial because essential services such as health care and education together with income sources suffer from its unavailability. The delivery of health care services and educational digital learning programmes



and future business development require dependable electricity access.

THE NUMBER OF PEOPLE LACKING POWER ACCESS REACHES 675 MILLION GLOBALLY AND THEY MOSTLY COME FROM POOR NATIONS EVEN WITH MODERN TECHNOLOGICAL PROGRESS.

Figure 1 Population without access to modern energy 2000–23 and in the steps to 2030



Major progress in energy access is evident in recent decades; while Asia has been leading the way, sub-Saharan Africa lagged behind
 Source: World Energy Outlook (2024)

The on-going challenge of energy poverty mainly affects rural and underdeveloped areas even after renewable energy technology has spread into these regions. Medical facilities have trouble operating equipment needed for patient care and vaccine storage (WHO 2022) and schools with no power face challenges with digital teaching implementations. The lack of sufficient energy availability stands as a barrier for farms and small businesses which obstructs the rate of economic growth. Sustainable development demands filling these present energy gaps.

A research analysis explores how solar and wind power technologies serve to better economic growth and health care delivery systems and educational infrastructure. The research discusses barriers to energy accessibility together with solutions that need to be discovered. The United Nations Sustainable Development Goals (SDGs) along with all international development goals will succeed when we ensure clean power availability for everyone. SDG 3 remains dedicated to healthy wellbeing whereas SDG 7 targets sustainable and affordable power systems. The study being discussed recognizes how inclusive sustainable development requires funds in renewable energy systems combined with governmental backing.

Literature Review

The availability of energy plays a major role in social development through its immediate impact on three important areas including livelihoods, health care, and education systems. Multiple studies indicate how clean energy technology can transform human lifestyle and boost economic potential (Casati 2023). The analysis explores the research database about energy access and its impact on economic potential in combination with health care delivery and educational systems. Education requires electricity to create decent learning areas with proper electric resources as well as modernize school buildings. Studies conducted by Khandker, et al. (2014) show that rural electrification lets children study for extended hours to achieve better academic results. It was found that Sub-Saharan African schools obtaining solar power managed to increase attendance rates and opened more educational opportunities through online learning. Rural areas face two main obstacles in their path towards energy progress because they lack sufficient funding and have unreliable grid connections (IEA 2022). Access to electricity allows people to obtain clean water that reduces disease transmission from contact with unclean water (Sustainable Energy for All 2021).



ACCESS TO ELECTRICITY ALLOWS PEOPLE TO OBTAIN CLEAN WATER THAT REDUCES DISEASE TRANSMISSION FROM CONTACT WITH UNCLEAR WATER (SUSTAINABLE ENERGY FOR ALL 2021).

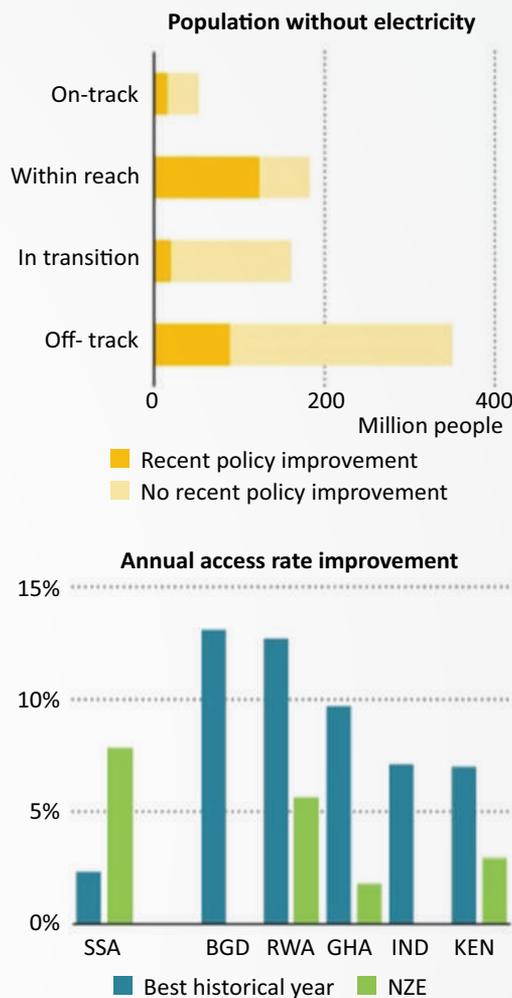
The path to economic empowerment requires access to energy because clean energy enables women to expand their businesses and control small ventures as well as exploiting agricultural potentials. Microbusinesses boost their productivity by using renewable energy resources in rural locations according to Pueyo and Maestre (2019).

Current research confirms the numerous advantages of clean energy but studies are lacking regarding its prolonged socio-economic implications which should be measured for decentralized energy systems. The current understanding of new technology implementation struggles and money and legal barriers remains inadequate (UNDP 2023). A strategic approach requiring research about policies along with community engagement and technological advancements will fill the current knowledge gaps. The available evidence proves strong support for clean energy’s positive influence on people’s survival, health care, and education systems. The implementation of effective financing strategies for energy projects along with legislation execution and sustainable energy models for disadvantaged areas requires further research. Access to clean energy requires more than simple electrical supply because it provides social justice and sustainable development chances.

Energy Access and Education

A steady power supply enables the construction of better learning areas while at the same time supporting digital education programmes and enhancing school architectural facilities. The students can extend their study duration during power availability because paraffin lamps are both dangerous for their health and safety and ineffective (Khandker, et al. 2014). Schools that provide electricity show better results in student performance together with increased student attendance in comparison to institutions without constant power access (IEA 2022). The teaching methods and digital educational systems operating in the present world require persistent electrical power for their functionality. Schools with power maintain access to numerous forms

Figure 2 Population without electricity access in 2023 and historical best versus progress in the NZE scenario by country/region (2024–30)



Significant, but not unprecedented, effort will be necessary to achieve universal electricity access in sub-Saharan Africa, where 80% of people without access live
 Source: World Energy Outlook (2024)

of international information because students learn effectively with computers and projectors alongside internet-based learning systems. Solar-powered educational institutions across remote communities have raised both educational participation and reading skills (Mittal 2025).

SOLAR-POWERED EDUCATIONAL INSTITUTIONS ACROSS REMOTE COMMUNITIES HAVE RAISED BOTH EDUCATIONAL PARTICIPATION AND READING SKILLS.



Solar-powered educational institutions across remote communities have raised both educational participation and reading skills.

The expansion of energy access at educational facilities leads to improved learning environments and sanitary resources thus achieving SDG 4 but also nature-enabled SDG 12. The system supports inclusive learning for children across the world through comfortable classrooms with proper lighting and online education features that benefit teachers.

Energy Access and Health

Access to dependable energy transforms health care delivery across all population settings including low-income areas and rural communities. Without electricity hospitals along with clinics have trouble running vital medical equipment while preserving vaccine safety needs additional care as they provide emergency services (WHO 2022). The IEA shows that medical facilities throughout Sub-Saharan Africa fail to have dependable electricity access which threatens the lives of expectant mothers alongside newborns as a result. The ability to conduct medical procedures together with neonatal treatment with the help of electricity leads to increased patient survival rates in health facilities (Casati 2023).



A health centre in Uttarakhand being powered by solar panel
Source: IIEC

Dependable energy powers the three important health care elements of facility sanitation, water delivery systems and telemedicine services which assist rural areas where doctor shortages exist. People receive protection from hazardous pollutants through the replacement of kerosene lamps with solar lights and they can prevent illness by using solar-powered water filters.

The problem of obtaining affordable sustainable power solutions continues to resist many health care institutions worldwide.

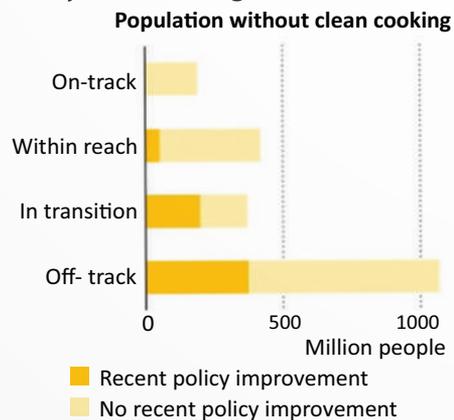
DEPENDABLE ENERGY POWERS THE THREE IMPORTANT HEALTH CARE ELEMENTS OF FACILITY SANITATION, WATER DELIVERY SYSTEMS, AND TELEMEDICINE SERVICES WHICH ASSIST RURAL AREAS WHERE DOCTOR SHORTAGES EXIST.

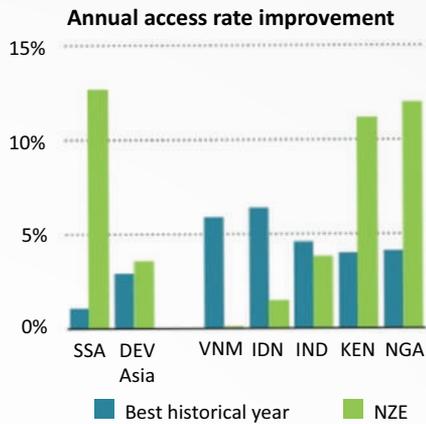
Energy Access and Livelihoods

Community development shows significant results when people get access to reliable electric power because it facilitates business expansion along with job creation while improving productivity levels. For instance, the availability of electricity enables tailors to operate their machines and preserves perishable food so that small businesses can extend their operating hours. Power supplies the capability to establish new rural businesses specifically targeting food processing and handicrafts sectors. Solar-powered irrigation enables farmers to enhance both their agricultural yields and profitability levels.

Empowering women to establish their own businesses and the proper functioning of factories together creates additional jobs (Pueyo and Maestre 2019). Numerous people face issues stemming from high costs together with missing infrastructure. Inexpensive clean energy investments produce transformative effects on nations together with their populations.

Figure 3 Population without clean cooking access in 2023 and historical best versus progress in the NZE Scenario by countries/region





Clean cooking policies and measures have recently improved the outlook for about 630 million people, but much more is needed to achieve universal access by 2030

Source: World Energy Outlook (2024)

Challenges and Policy Making on Energy Access and Social Development

The cost of sustainable energy is the principal barrier in its accessibility. Most low-income groups together with organizations face difficulties paying for renewable energy technologies that include wind turbines and solar panels. Lack of necessary funds combined with credit difficulties force numerous towns to avoid cleaner energy options. Another major barrier comes from untrustworthy power grids and insufficient basic infrastructure. People residing in rural areas with inadequate electricity access must rely on the expensive toxic fuel sources of diesel and kerosene because their electricity supply is non-existent or weak. The constant power outages in electricity-supplied regions happen through poor repair practices linked to out-dated and inefficient equipment.

Rules established by the government are of critical importance when it comes to implementing policies (Elavarasan 2020). Various nations face challenges in renewable energy project investments due to unclear statutes, slow government procedures, and insufficient promotion measures. A lack of dependable electricity access exists for millions of people alongside slow renewable energy development because of insufficient regulatory support. The scarcity of skilled personnel blocks the installation and system operation of renewable energy devices. Technological challenges in project development often become problematic due to insufficient knowledge and experience which leads

to performance setbacks that might cause total system breakdowns.

Solutions for Expanding Clean Energy Access

People in authority need comprehensive policies combined with financial investments to handle these problems. Some of the important remedies are enumerated below:

1. Governments should establish programmes which include tax credits and grants and low-interest loans to lower the cost of renewable energy for small businesses and schools and health facilities.
2. Remote locations lacking connection to the main electrical grid will obtain the most advantages from mini-grids together with solar household systems.
3. A collaboration between public agencies and private enterprise sectors together with international organizations leads to accelerated conversion toward renewable energy through public-private partnerships (PPPs).
4. Clean energy projects will experience increased expansion and investment through better energy-related rules coupled with simpler policies and standardized governmental procedures.

Clean energy access development goes beyond power generation because it improves health care services and education standards as well as overall life quality. The path to sustainability involves both strategic policy and strategic investment decisions which will help bridge the current energy gap.

Conclusion

The choice of clean energy solutions drives both the expansion of inclusive growth and better quality living standards and rapid advancement of the global SDGs. Clean energy access serves as the main catalyst for both social advancement and economic growth which directly changes the way we educate people and treat illnesses as well as sustain families. Reliable energy access in health care institutions supports essential treatments in addition to improving school learning capabilities through electrification. Clean energy activates agricultural growth and generates employment opportunities alongside small business growth which specifically helps rural communities and women owners. The availability of electricity remains restricted because of both expensive

utilities and unstable infrastructure as well as restrictive policy frameworks.

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GENDER AND ENERGY EQUITY: ENSURING WOMEN'S PARTICIPATION AND BENEFITS IN ENERGY TRANSITIONS

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Women SHG members attend a financial literacy session to build resilience and explore livelihoods beyond coal.

Introduction

The sustainable energy revolution has transformed the global power sector because of immediate concerns about both environmental sustainability and fossil fuel-use reduction. The transition will deliver its maximum impact when all members of society have equal opportunity to join and gain advantages. Women make up nearly half of the global population. They play a crucial role in energy consumption, climate change mitigation,

and community stability (UNDP 2021). The energy sector shows little gender diversity, with women being under-represented in managerial, scientific, and leadership roles (IEA 2018). Adopting gender-sensitive procedures in energy transformation is a moral imperative and offers economic benefits to stakeholders (Blanden, Doepke, and Stuhler 2022). Evidence shows that gender-diverse groups boost innovation production while creating superior policies which lead to increased sustainable economic development. The clean energy transition

faces a risk of sustaining inequities because the current challenges will continue if no adequate solutions are addressed. The energy sector recognizes gender equity significance, so different stakeholders create programmes along with policies and financial mechanisms that build female participation capacities. Diverse perspectives in energy management will drive sustainable development and equitable clean energy access. The article examines how gender equity stands essential to obtaining successful clean energy transitions. The analysis provides evidence-based data and practical examples along with mandated policies that demonstrate women in energy need immediate inclusive policies backed by financial backing and training programmes.

THE ENERGY SECTOR SHOWS LITTLE GENDER DIVERSITY, WITH WOMEN BEING UNDER-REPRESENTED IN MANAGERIAL, SCIENTIFIC, AND LEADERSHIP ROLES.

The Gender Gap in the Energy Sector

The essential abilities of women regarding energy control and climate change adaptation within families and communities remain poorly represented in the energy industry workforce. The International Renewable Energy Agency (IRENA) reports that renewable energy companies have only 32% female workers, yet their presence remains scant both in STEM fields and senior management roles (IRENA 2021). Several social traditions together with financial obstacles and insufficient regulatory backing form an impediment which hinders women from becoming owners of renewable energy startups or developing innovations.

Key Challenges Facing Women in Energy

Female individuals encounter specific difficulties when it comes to obtaining both clean energy resources and sector-based employment opportunities.

1. Leadership and decision-making: Less than 10% of women participate in executive positions within energy industry operations, which restricts a wide range of leadership opinions from entering policy

initiatives and corporate strategy development (UN Women 2025).

- 2. Technical and STEM roles:** The renewable energy technical workforce shows gender inequality through its 22% women employment rate because women need better educational opportunities to develop their skills (IRENA) 2019).
- 3. Access to finance:** Women who lead energy businesses lack sufficient financial instruments because gender prejudices prevent them from obtaining investments and credit, which they need for clean energy solution growth.
- 4. Representation in policymaking:** Government institutions lack adequate female representation that would help create energy policies which attend to gender-specific requirements.

LESS THAN 10% OF WOMEN PARTICIPATE IN EXECUTIVE POSITIONS WITHIN ENERGY INDUSTRY OPERATIONS.

Solutions to Overcome the Challenges

- 1. Decentralized energy systems:** Local solar wind power initiatives let rural women obtain sustainable energy while maintaining accessibility through their efforts.
- 2. Training and capacity building:** Women will access better employment opportunities when schools offer training about solar panel installations alongside wind energy maintenance together with biogas system management.
- 3. Financial inclusion:** More microloan programmes, financial literacy programmes, and subsidies must be expanded to assist women who want to begin or expand their clean energy business operations.
- 4. Awareness and policy support:** To support women-led energy businesses, governments and NGOs should execute clean energy benefit awareness campaigns and implement friendly policies.
- 5. Improving infrastructure:** The expansion of dependable electricity networks and internet services throughout rural territories gives women more possibilities to access digital and clean energy solutions.



Expanding the Role of Women in Renewable Energy

1. Education and skill development: The chief obstacle stopping women from participating in the energy sector stems from insufficient programmes that teach technical skills and develop women's abilities. Widening entry points to STEM degrees in addition to vocational training and apprenticeship opportunities for women will help to overcome this deficiency.

Initiatives such as the following can significantly increase women participation:

- Establishing technical training centres exclusively for women.
- Creating mentorship programmes connecting women with industry leaders.
- Encouraging corporate scholarships and government incentives for women pursuing careers in renewable energy.



Women working in renewable energy fields or participating in clean energy projects

Source: Centre for Social and Behaviour Change

- 2. Financial inclusion for women entrepreneurs:** Access to finance remains a key constraint for women-led enterprises in the energy sector. To address this issue, financial institutions must:
- Develop gender-responsive financial policies that cater to women entrepreneurs.
 - Provide low-interest loans and grants for women investing in renewable energy businesses.
 - Strengthen microfinance institutions to support women in rural areas.

Private Sector's Role in Advancing Gender Equity

The private sector plays a critical role in closing the gender gap in the clean energy industry. Key contributions include:

- 1. Corporate gender-inclusive policies:** Before hiring or giving promotions, both organizations and individuals should establish measurable objectives for diversity and must guarantee equal access for women in their selection process.
- 2. Investment in women-led startups:** Corporate social responsibility (CSR) initiatives together with venture capital partners need to focus investment capital on women-led energy companies.
- 3. Training and leadership programmes:** Organizations need to provide unique training together with leadership advancement programmes along with mentoring networks to support female workforce development in the energy industry.
- 4. Workplace flexibility and safety:** Women will be more apt to enter and stay in the energy sector when workplaces establish both safety and inclusion, in addition to maternal support and adaptive work schedules.

Impact of Digitalization and Innovation

Technological advancements are playing a crucial role in increasing women's participation in the energy sector. Some key innovations include:

- 1. AI and blockchain:** Enabling women entrepreneurs to access secure energy trading platforms.
- 2. Internet of Things (IoT) solutions:** Smart energy management tools allow women to optimize energy use in rural businesses.



3. **Digital finance:** Mobile banking and microfinance apps have facilitated women's access to renewable energy loans.
4. **E-learning and virtual training:** Online platforms enable women to acquire clean energy education together with technical training that enables employment access within this field.

Case Studies

Global Level: Women Driving the Clean Energy Transition

Several countries have successfully integrated gender equity into their energy transitions:

1. Zimbabwe: Women Transforming Transport with Electric Tricycles

In Zimbabwe, the startup Mobility for Africa launched an initiative to provide solar-powered electric tricycles to women in rural areas. Since its launch in 2019, this programme has helped over 300 women transition from walking long distances to using sustainable transportation for their businesses. These tricycles, called 'Hamba', run on solar-charged lithium-ion batteries, reducing carbon emissions and fuel dependency. Women use them for agriculture, market trading, and health care services, improving livelihoods while contributing to a green economy (United News Bangladesh 2025).



Image 2 Electric tricycles empower rural women in Zimbabwe
Source: United News Bangladesh (2025)

2. Zanzibar: 'Solar Mamas' Bringing Light to Rural Homes

The 'Solar Mamas' initiative, launched by Barefoot College Zanzibar, has empowered women from low-income

communities to become solar engineers. Since 2015, over 65 women have been trained to install and maintain solar-powered home systems, bringing electricity to 1,858 off-grid households (Eaton 2015).

Previously uneducated women now play a key role in expanding clean energy access while earning a stable income. The project challenges gender norms, positioning women as leaders in renewable energy.

PREVIOUSLY UNEDUCATED WOMEN NOW PLAY A KEY ROLE IN EXPANDING CLEAN ENERGY ACCESS WHILE EARNING A STABLE INCOME.



Image 3 Two 'Solar Mamas' carry equipment from their village workshop to a home in Matemwe to install a new system
Source: The World (2015).

3. Canada: Women in Cleantech Challenge

Canada's Women in Cleantech Challenge addresses the underrepresentation of women in the renewable energy sector by supporting female entrepreneurs. This initiative, launched by Impact Canada, provides financial, business, and technical resources to help women-led startups scale up and compete in the global clean energy economy (Impact Canada n.d.).

By fostering female-led innovation, the programme is creating new opportunities for women in solar, wind, and energy efficiency sectors.

India Level: Women-led Clean Energy Initiatives in India

Through decentralized renewable energy solutions, India has achieved important achievements in empowering its female citizens to participate actively in clean energy initiatives. Moreover, various grassroots initiatives and



operational programmes employ gender-inclusive methods to boost female involvement in the power transition process.

1. **The Solar Saheli Model in Rajasthan:** The Solar Saheli programme in Rajasthan has become a prime example of successful implementation when it trains rural women to establish solar entrepreneur ventures (Renewable Watch 2020). Through this initiative:
 - The Solar Saheli programme provides women with technical training to conduct installation and maintenance of solar lighting and home systems.
 - Remote villages gain improved energy access through solar-powered solutions, which decreases their need for kerosene.
 - The sales of solar products conducted by women entrepreneurs ensure financial independence while creating income streams.

The system creates economic empowerment for women while producing better acceptance of clean energy technologies in remote communities.

2. **SELCO Foundation's women-centric energy programmes:** The SELCO Foundation, a leading sustainable energy organisation in India, has implemented various programmes focused on integrating women into the renewable energy workforce (Selco Foundation u. d.).

Some key initiatives include:

- Training women as solar technicians and entrepreneurs
- Providing financial linkages to enable women-led solar enterprises
- Encouraging microfinance institutions to invest in gender-inclusive clean energy projects

Through these programmes, SELCO has demonstrated that empowering women in clean energy can drive both economic growth and climate resilience at the grassroots level.

Government Schemes Supporting Women in Clean Energy

To promote gender equity in the renewable energy sector, India has launched several initiatives. These schemes provide financial support, training, and employment opportunities for women, ensuring their active participation in the energy transition.

1. Energy Access for Women

1.1. Pradhan Mantri Ujjwala Yojana (PMUY)

- It is a landmark government initiative aimed at providing clean cooking fuel (LPG) to women from low-income households.
- Over 10.33 Crore LPG connections are distributed, reducing dependence on biomass (PIB 2024).
- Significant improvement in women's health by reducing indoor air pollution.
- Enhanced time savings for women, allowing greater participation in education and economic activities.



Image 4 Expansion of LPG Scheme
Source: Business Standard (2024)

1.2. Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

- Aims to provide 24/7 electricity access to rural households.
- Ensures women's empowerment by enabling access to reliable electricity for education, health care, and entrepreneurship.

2. Women's participation in renewable energy

2.1 Women in Renewable Energy Entrepreneurship (WiREE) Initiative

- Supports women entrepreneurs in starting renewable energy businesses.
- Provides financial assistance and technical training.

2.2 National Solar Mission

- Promotes large-scale deployment of solar energy with a focus on job creation.
- Supports skill development and employment opportunities for women in the solar sector.

2.3 KUSUM Scheme (Kisan Urja Suraksha Evam Utthaan Mahabhiyan)

- Aims to promote the use of solar pumps and grid-connected solar energy among farmers.
- Encourages women farmers to adopt renewable energy-based irrigation, reducing reliance on fossil fuels.

3. Financial support and entrepreneurship

3.1. Stand-Up India Scheme

- Provides financial assistance to women entrepreneurs, including those engaged in the clean energy sector.
- Facilitates bank loans between ₹10 lakh and ₹1 crore for starting renewable energy-based enterprises.

3.2 Solar Charkha Mission

- Promotes solar-powered spinning wheels (charkhas) for small-scale industries.
- Generates employment for women in rural areas.
- It links renewable energy with women-led sustainable businesses.

3.3 National Rural Livelihoods Mission (NRLM)

- Supports self-employment and skill development for rural women.
- Helps women integrate into clean energy supply chains.
- Encourages economic independence through sustainable energy solutions.

These initiatives reflect India's commitment to fostering gender equity in the renewable energy sector, recognizing the pivotal role women play in driving sustainable energy solutions.

Future Road Map and Policy Recommendations

To ensure a just and inclusive energy transition, governments and businesses must:

1. **Mandate gender-inclusive policies:** The clean energy sectors must adopt gender-inclusive policies which enforce leadership position quota systems for women.
2. **Expand financial support for women-led energy initiatives:** Advancement of women-led clean energy enterprises should be supported by gender-sensitive funding from targeted investment mechanisms and

proper credit schemes.

3. **Enhance STEM education access:** The organization needs to enhance STEM education access through scholarships and technical training programmes focusing on energy for young women.
4. **Strengthen mentorship networks:** We need better mentorship programmes that will advance female career growth and leadership development inside energy facilities.
5. **Leverage international best practices:** The adoption of gender-equity models used by nations with high female clean energy participation levels can become an effective tool to advance gender equality.

Conclusion: A Path Towards Gender-equitable Energy Transition

A sustainable and just energy transition needs the complete involvement of women throughout organizational chains. Women play a crucial role in energy consumption, decision-making, and innovation. Women encounter multiple structural obstacles which prevent them from achieving leadership positions and technical posts and starting entrepreneurial businesses. The achievement of resilient clean energy systems depends heavily on resolving these barriers. Governments together with businesses and worldwide organizations need to adopt gender-sensitive policies which include leadership quota systems, financial assistance and expanded professional training. Women will gain the power to lead key positions in the energy sector by achieving access to quality education and skill development programmes which create opportunities for diversity and innovation in energy leadership. Women who lead clean energy businesses face substantial challenges when trying to acquire the necessary funding. By improving microfinance institutions through low-interest loan schemes and encouraging more investments in women-led startups, female entrepreneurs will find success in their businesses. Internet finance integration and AI and IoT technologies together create new opportunities for women to participate in energy entrepreneurship, specifically throughout rural areas. The implementation of online platforms for learning as well as virtual education programmes will enhance the skills of women who wish to join the sector. Public-private sector cooperation serves as a key element for the effectiveness of gender-inclusive programmes. Through selective



intervention, Germany, Kenya and India, proved their ability to lift women's involvement levels in clean energy projects. Other countries should use best practices as a model to develop their gender-equity strategies because such strategies lead to a sustainable and fair future. The involvement of women in national programmes will create financial expansion and innovative ideas apart from realizing sustainable development, which will result in a clean, inclusive world.

Achieving gender equity in energy transitions requires urgent policy reforms, targeted financial support, and widespread education programs. Governments, businesses, and international bodies must collaborate to ensure women play a central role in shaping a sustainable energy future.

ACHIEVING GENDER EQUITY IN ENERGY TRANSITIONS REQUIRES URGENT POLICY REFORMS, TARGETED FINANCIAL SUPPORT, AND WIDESPREAD EDUCATION PROGRAMMES.

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COAL, REGION, AND TRANSITION: A CASE FOR ECONOMIC DIVERSIFICATION IN INDIA

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An abandoned mine transformed into a water-filled crater

Overview

The future of India's protracted reliance on coal is facing uncertainty and severe stress against the backdrop of climate action to limit the average global temperature below 2°C. The energy transition is at the core of climate action, marking the shift away from coal and the adoption of renewable-based energy sources. Although the current literature effectively addresses the technical aspects of the energy transition, the social aspects

remain unanswered and unaddressed which affects the sustainability of such transitions (Agrawal, Pathak, Jana, et al. 2024). Social justice is considered as an essential feature of sustainable energy transitions, therefore the design and execution of the energy transition policies have to be sensitive to the social-economic realities. In this context, 'just transition' is a widely used term that refers to "leaving no one behind" in an energy transition.

The discourse on just transition in India is still evolving



and there exists no comprehensive policy to guide energy transition in a just and fair way (Mangang, Swarnakar, and Pai 2024). India has regional pockets of coal production mainly in the eastern states of Jharkhand, Chhattisgarh, and Odisha. These regions need targeted interventions to implement a just transition away from coal, but this requires a holistic understanding of regional coal dependency which extends beyond the formal workforce and encompasses the local communities inhabiting nearby. The blueprint of the spatial footprint of regional coal dependency enables a robust understanding to navigate the energy transition in a just and fair way.

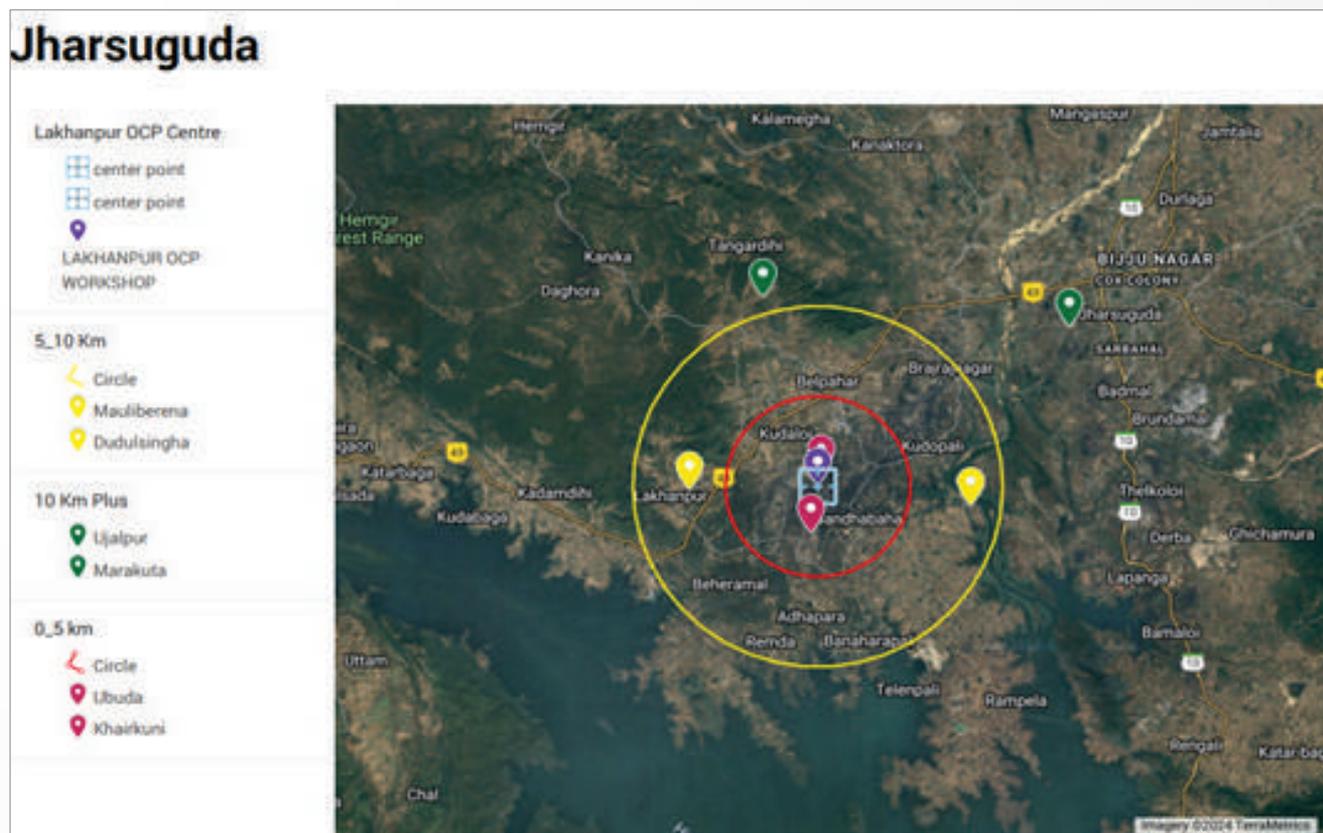
THE DISCOURSE ON JUST TRANSITION IN INDIA IS STILL EVOLVING AND THERE EXISTS NO COMPREHENSIVE POLICY TO GUIDE ENERGY TRANSITION IN A JUST AND FAIR WAY.

region of Jharsuguda district in Odisha. It assesses the spatial distribution of the household-level coal dependency around the Lakhanpur opencast coal mines in Jharsuguda. Around 21% of Odisha’s coal production is based in Jharsuguda district, which also houses the largest operational coal mines in the state (Government of Odisha 2023). The survey area is defined by drawing two concentric circles of radii 5 km and 10 km by taking the centre of the coal mine as the central point. This demarcated the survey into three sub-zones of 0–5 km, 5–10 km, and above 10 km, as demonstrated in Image 1 (Google My Maps, 2023). The households were surveyed in two villages in each sub-zone to assess the coal dependency using primary livelihood source, primary cooking fuel and type of landholding as indicators. A total of 184 households were surveyed around the coal mining region in Jharsuguda district. Image 1 exhibits the names of all six villages where household survey was conducted.

Footprint of Coal Dependency Around the Coal Mine

In this context, this work is based on the findings from field visits and household surveys in the coal extraction

The findings validate and intuitively resonate with the mainstream literature which suggests that the coal



Survey area demarcation reflecting the spatial sub-divisions



dependency decreases with increasing distance from the coal mines. Figure 1 (a) exhibits that the share of households dependent on coal as primary source of livelihood drastically reduces which signifies that dependency on coal for income is primarily restricted to the spatial zone of 0–5 km. Around 50% of households located within 5 km of the coal mine depend on coal for primary livelihood. The households inhabiting 5–10 km and above 10 km have diverse livelihood sources, thereby showcasing their adaptive capacity during coal mine closure. However, the households in close proximity to the coal mine may have to bear the greatest burden during the coal phase-down.

Figure 1(b) illustrates the dependency of households on coal as primary cooking fuel. It is exhibited that among all the spatial sub-divisions, coal as the primary cooking fuel has the largest share in 0–5 km spatial division which decreased as one moves farther away from the coal mine. This is evidently due to easy availability of coal at a much affordable price than other cooking fuels such as liquefied petroleum gas (LPG).

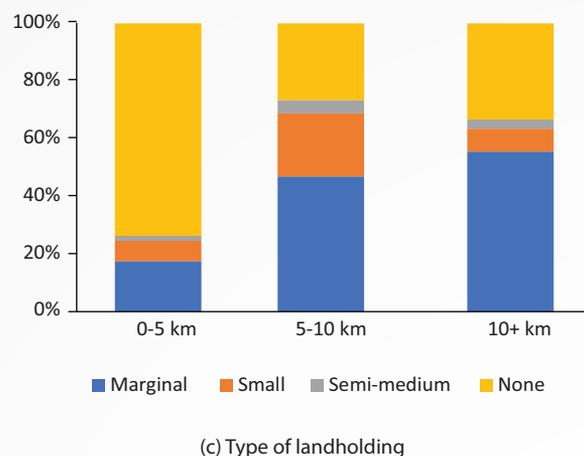
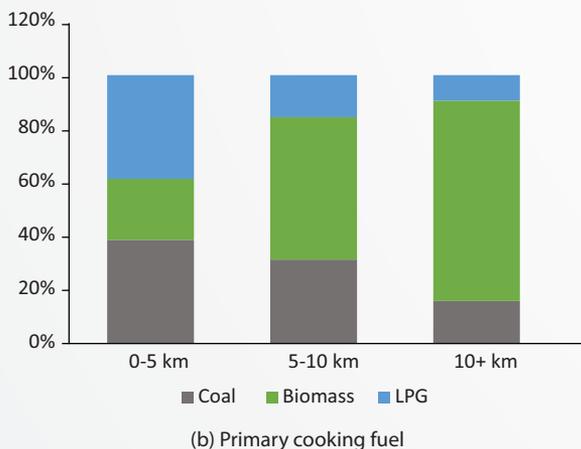
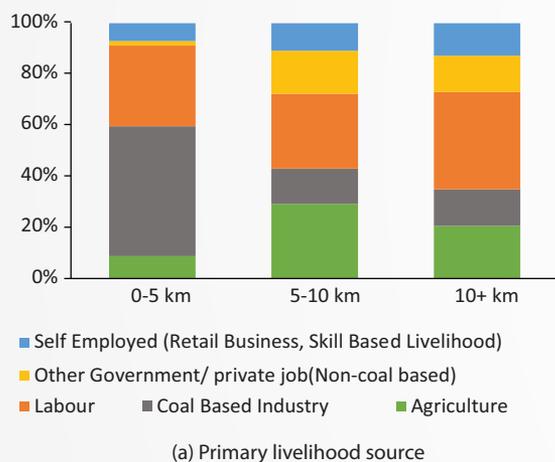


Figure 1 Charts demonstrating dependency across primary livelihood source, primary cooking fuel and type of landholding.

Figure 1 (c) shows the size of landholdings possessed by the households in specific spatial sub-zones. Marginal landholdings refer to less than 1 hectare and semi-medium landholdings cover 2–4 hectares. It is showcased that 73% of households inhabiting 0–5 km spatial zone possess no landholding. The reason is that the coal companies have acquired the lands of these households for mining activities leaving them with no little to no land for agriculture and other activities.

The heavy dependency of households on coal for both livelihood and cooking fuel, coupled with the absence of land ownership, significantly exacerbates the socio-economic vulnerability of these communities during the prospective closure of the coal mines. Lacking alternative income sources and asset-based security, these communities are at heightened risk of displacement, unemployment, and energy poverty. This structural precarity underscores the urgent need for comprehensive just transition strategies that address livelihood diversification, land rights, and access to sustainable energy alternatives.

Economic Diversification as a Key Strategy for a Just Transition

The field survey exposed the vulnerable state of socio-economic realities in the coal mining region. India's energy transition is underway, and the eventual closure of coal mines appears inevitable under current climate action policies (Pandey and Kumar 2025). However, the nation's net-zero target by 2070 offers a critical window to strategically plan regional transformation through inclusive and participatory processes, ensuring diversified



livelihood opportunities, social equity and decent living standards for coal-dependent communities. The just transition of the coal mining regions must commence alongside the early stages of the energy transition. Delaying such policies by 15–20 years from now risks rendering them ineffective, as the social and economic damage would likely be irreversible by then. Justice delayed in this context may amount to justice denied for affected communities.

At the core of regional transformation is economic diversification which emerges as the central pillar, particularly in reducing structural dependence on coal-based industries. As evident in the findings of the households survey, the heavy dependency of households on coal for both livelihood and cooking fuel is unlikely to decline abruptly, rather the transition will need to unfold gradually and systematically, the key for which lies in economic diversification.

As observed during field visit to Jharsuguda district, the coal regions are often characterized by mono-industrial economies, where employment, revenue and infrastructure development are heavily centred on the extractive sector. This structural dependence creates systemic vulnerabilities, especially when coal mining becomes economically unviable due to the exhaustion of mines or environmentally untenable due to the climate change crisis. In the absence of viable alternative, the closure of coal mines could trigger cascading effects such as rising unemployment, reduced fiscal capacities of state and district governments, and social disintegration. Therefore, economic diversification is not merely a developmental aspiration but a necessity for structural resilience and regional stability. Among the critical components of economic diversification of a coal-based region include setting up of alternative industries such as agro-processing, eco-tourism, fisheries, and allied activities and other small to medium enterprises.

One of the critical challenges in the regional transformation and economic diversification lies in re-skilling and up-skilling the coal miners. Coal regions often have a workforce whose skills are primarily rooted in mining and related activities, making them difficult to transfer to other sectors. However, opportunities lie in investing in vocational training, education, and skill development for young workers and next generation. Empowered with these tools, they can access alternative livelihoods beyond coal mining manifesting effective economic diversification.

ECONOMIC DIVERSIFICATION IS NOT MERELY A DEVELOPMENTAL ASPIRATION BUT A NECESSITY FOR STRUCTURAL RESILIENCE AND REGIONAL STABILITY.

Way Forward

The study of the political economy of the coal region indicated that coal is deeply entrenched in the regional landscape. As mapped in this work, the coal dependency is predominantly significant in the spatial division of 0–5 km in terms for livelihood and cooking fuel. The absence of landholdings among the households inhabiting this region exacerbates their vulnerability and decreases adaptive capacity. While economic diversification is central to the just transformation of coal-dependent regions, its effectiveness depends on sensitivity to the spatial footprint of coal dependency. A just transition requires region-specific approaches that address the unique socio-economic and geographic realities of these regions, ensuring equitable and sustainable development for affected communities.

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EVENT SECTION

People Centric Transition for Energy Equity | WSDS 2025 | New Delhi



Launch of Understanding the Implication of Coal Transition: The Scenario in Chhattisgarh, Jharkhand, and Odisha report

The thematic track on People-Centric Transition for Energy Equity at WSDS 2025 was opened by Mr A K Saxena, Senior Director, Energy and Renewables, TERI. He welcomed participants and highlighted the dual realities facing India—being one of the largest coal producers while simultaneously committing to ambitious non-fossil fuel targets. Reflecting on TERI’s decade-long engagement with energy transition, he noted how the institute’s early work began with low-carbon pathway modelling, and later evolved into field-based studies examining the socio-economic dimensions of coal phase-out. Citing TERI’s work in Betul, Madhya Pradesh, Mr Saxena emphasized the need to prepare communities through active engagement, alternative livelihoods, and inclusive planning. He underlined that the goal of the session was to gather diverse insights to guide a transition that is equitable, participatory, and leaves no one behind.

This was followed by Dr Jayanta Mitra, Senior Fellow, TERI, who presented the findings of a multi-year study undertaken in Jharkhand, Odisha, and Chhattisgarh—states responsible for nearly 80% of India’s coal production. Drawing on over 1,000 household surveys, 50

focus group discussions, and extensive interviews across seven districts, Dr Mitra laid bare the vulnerabilities faced by communities around operational and abandoned mines. Using a five-capital framework—human, natural, physical, social, and financial—he detailed chronic deficits in education, healthcare, land ownership, clean water access, and financial inclusion. He stressed that the intersection of environmental degradation, informal work, and social marginalization requires a holistic



Mr Akshat Jain, Chief Executive Organization (CEO), Zila Panchayat, Betul District addressing the session



transition strategy. Among the key takeaways were the need to collectivize women, restore degraded lands for alternative livelihoods, and design dignity-led economic pathways rooted in community aspirations.

Bringing an administrative perspective from the field, Mr Akshat Jain, Chief Executive Organization (CEO), Zila Panchayat, Betul District, shared on-the-ground experiences from Sarni—an area historically supported by the Satpura Thermal Power Plant and Pathakheda mines. He recounted how the closure of these coal facilities has disrupted local livelihoods and left communities grappling with uncertainty. Mr Jain proposed a four-pillar framework for ensuring a just transition: (1) reskilling workers for green sectors such as electric vehicles, solar repair, and battery assembly; (2) enabling women's entrepreneurship through SHGs in areas like coal ash handicrafts and mining tourism; (3) strengthening agriculture and natural resource-based enterprises including agroforestry and mushroom cultivation on reclaimed lands; and (4) leveraging policy convergence across MGNREGA, DMF, and other schemes. He concluded by urging that the speed of transition demands timely planning if justice is to be achieved for communities like those in Sarni.

Mr Uwe Gehlen, Head of Economic Cooperation and Development at the German Embassy in India, shared his reflections drawn from Germany's coal transition and three years of engagement with India's coal regions. He praised the session's grounded articulation of just transition, calling it one of the most precise frameworks he had encountered. He emphasized that transition strategies must avoid one-size-fits-all solutions and instead focus on bottom-up approaches tailored to local conditions. Drawing on visits to coal mines and adjacent communities in Odisha and Jharkhand, he highlighted the resilience of women and the informal economy as central pillars of transition. Mr Gehlen stressed the value of triangular cooperation—adapting lessons from the Global North to support transitions in the Global South—and reaffirmed Germany's commitment to supporting India through technical partnerships and capacity building initiatives.

Addressing the gathering virtually, Mr A K Rastogi, Chairman, Jharkhand Task Force on Sustainable Just Transition, drew attention to the structural dependence of states like Jharkhand on fossil fuels. With over 75% of the population dependent on coal and more than 50% of state revenues derived from it, he cautioned against adopting national or international models without

localization. Drawing on findings from 15 districts, he explained how proximity to coal facilities results in higher aspirations and incomes, making transition difficult without parallel livelihood strategies. Mr Rastogi called for customized skilling for informal workers, capacity-building of district-level officials, and leveraging convergence between MGNREGA, DMFT, and CSR efforts. He emphasized the need to repurpose mining lands in districts like Hazaribagh and Giridih for economic diversification and recommended creating a multi-stakeholder learning platform to share best practices and scalable models.

The keynote address was delivered by Mr O P Mishra, Executive Director (Community Development), Coal India Limited (CIL), who offered a deeply personal and institutional perspective. With over three decades in the coal sector, he emphasized that coal is not just an economic asset but part of people's identities and emotional landscapes. Reflecting on challenges in resettlement areas like Jharia, he spoke about the sense of dislocation that persists despite physical infrastructure upgrades. Mr Mishra underscored that any transition must address both tangible and intangible losses, including emotional, cultural, and psychological impacts. He outlined CIL's comprehensive transition measures including land acquisition, R&R, CSR efforts, and pilot mine closure models developed in collaboration with TERI. He noted that while coal will continue to power over 70% of India's electricity and more than half of its primary energy in the near term, a phased and sensitive approach is essential. He called for enhanced skilling and financial literacy, especially for vulnerable groups, and emphasized that global models must be adapted, not adopted, to suit India's socio-cultural realities.



Mr O P Mishra, Executive Director (Community Development), Coal India Limited (CIL), delivering the keynote address

The session then transitioned into the launch of TERI's new report, *Understanding the Implications of Coal Transition: The Scenario in Chhattisgarh, Jharkhand, and Odisha*. Alongside the report, Mr Mishra inaugurated two TERI-led initiatives, a CIL-supported project in Betul, Madhya Pradesh, and another on mainstreaming equity and justice in renewable land procurement, supported by Landesa.

The panel discussion that followed was moderated by Mr Jiwesh Nandan, Distinguished Fellow, TERI, and brought together diverse voices:

- Dr Premilla D'Cruz, Professor, IIM Ahmedabad, highlighted how class, caste, gender, and religious hierarchies shape resistance to sustainability. She reflected on how those in privileged positions often resist sustainable practices and called for deeper accountability among decision-makers.
- Dr. Karina Standal, Senior Researcher, CICERO, spoke of the importance of enabling community voices, especially women, through participatory platforms like SHGs. She referenced Norway's oil transition, noting its limited focus on gender, and praised India's growing attention to informal workers and gender equity.

- Mr. Nicholas Glicher, COO, Thomson Reuters Foundation (joining virtually), emphasized that just transitions must be rooted in community needs. Drawing from the Foundation's work in the United Kingdom and Brazil, he stressed the need for place-based, participatory approaches that reflect ground-level risks and aspirations.
- Mr Sudipta Ghosh, Deputy General Manager, SELCO India, drew on decades of practice deploying decentralized energy systems. He noted that equity in energy transitions hinges on creating viable models that address affordability, access, and delivery challenges. He showcased how SELCO has used DMF funds to solarize public infrastructure and underscored the need for co-creating sustainable livelihood solutions through cross-sectoral partnerships.

The session concluded with a brief audience Q&A, followed by presentation of mementos by Mr Jiwesh Nandan to the panellists. The thematic track closed with strong consensus on the importance of grounded, community-driven, and equity-led approaches to India's energy transition.





Women carrying home pilfered coal for household use (Source: TERI).

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