Key Takeaways From Technical Session

POWERING RESILIENCE
The Green Energy Transition

Event Details

Conference: World Summit on Disaster Management (28th to 30th November, 2025) Technical
Session: Powering Resilience: The Green Energy Transition
Side Event: Sustainable Land Management and Energy Transition: Pathways to a Net Zero and Disaster Resilient Future
Event Host: Swaniti Initiative
Venue: Graphic Era University, Chanakya Block, Conference Hall, Dehradun, Uttarakhand
Date and Time: 29th November 2025 | 10:00 AM to 12 PM

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Acknowledgement

We at the Energy and Environment Vertical at Swaniti Initiative extend our sincere and heartfelt gratitude to the organisers of the World Summit on Disaster Management 2025, the Uttarakhand State Disaster Management Authority (USDMA), Graphic Era Deemed to be University, and other institutional collaborators, whose commitment enabled the successful representation of Swaniti's mission and vision as an ecosystem enabler at the global summit. We are grateful to Swaniti Initiative for entrusting us with the opportunity to collaborate on and participate in this event, and for its continued support in advancing meaningful policy dialogue.

We extend our deepest appreciation to all the distinguished speakers who made the technical session and panel discussion on "Powering Resilience: The Green Energy Transition" deeply insightful. We are grateful to **Professor Vinod Menon, Dr Ramesh P. V., Mr Sagar Mysorekar, Mr Navneet Gupta, Mr Neeraj Kuldeep, Mr Harikrishna K V, Mr Atul Dhir, and Ms Rekha Dangwal** for generously sharing their expertise and for contributing to a rich and forward-looking dialogue.

A special note of appreciation is extended to **Dr Shivaprakash K.N.**, Vertical Lead (Energy and Environment, Swaniti Initiative), for his leadership and commitment to the field of land-energy nexus, as well as his contributions at Swaniti Initiative and towards India's Net-Zero targets. Additionally, we would also like to thank Ms Gargee Priyadarshini for moderating the session, and Dr Sankalp Arpit for his dedicated coordination and support throughout the preparation and execution of the event.

We thank all participants, attendees, and contributors whose engagement and curiosity strengthened the discussions and helped shape actionable insights for a more resilient, sustainable, and community-centric energy future.

Panelists and Speakers Introduction

The technical session "Powering Resilience: The Green Energy Transition" brought together seven experts from the energy, geospatial science, climate, and disaster management sectors to reflect on the complex interplay between land, energy, climate resilience, and community well-being in India's clean energy transition.

Dr Ramesh P.V. is a seasoned Indian Administrative Service (IAS) officer with a distinguished four-decade career spanning national and international leadership roles in governance, development, and energy. With a strong foundation in public health and grassroots development in India's most underdeveloped regions, Ramesh went on to lead major international assignments with the United Nations and the World Bank across Asia, Africa, Europe, and the Middle East. Returning to India in 2009 to serve the nation, he held key positions such as Principal Secretary for Health and Finance and State Development Commissioner in Andhra Pradesh. Most notably, as Chairman and Managing Director of REC Limited, he played a pivotal role in advancing India's energy transition – accelerating renewable energy financing, spearheading electric mobility development, mainstreaming ESG principles, and chairing the national task force that successfully electrified every village in India. Ramesh continues to shape public policy and energy strategy as a visiting professor and Senior Strategy Advisor to Swaniti Initiative.

Prof. N. Vinod Chandra Menon is a distinguished expert with over 38 years of experience in disaster risk reduction, climate change adaptation, and public policy. He has served in key leadership roles, including Professor of Disaster Management at YASHADA, Pune, and UNICEF India's Emergency Preparedness and Response Coordinator. Notably, he was appointed by the Prime Minister of India as a founding member of the National Disaster Management Authority (NDMA), with the rank of Union Minister of State. An accomplished academic, Prof. Menon has co-edited eight books and authored numerous scholarly articles and chapters. He currently chairs several NGO and think tank boards, including the Africa International Policy Research Center in Nairobi and Terrablu Climate Technologies in India. Additionally, he serves as an Adjunct Professor and Advisor at Amrita Vishwa Vidyapeetham. For his contributions, he was awarded the SKOCH Challenger Award in 2010 for Disaster Management.

Navneet Gupta is a Director at the Global Energy Alliance for People and Planet (GEAPP), bringing over 20 years of experience across the solar energy sector, utility digitalization, and Agri-PV. He has held senior roles at prominent organizations such as Reliance, Mahindra, Sterling & Wilson, and Adani, where he played a key role in deploying large-scale solar infrastructure across India. Academically, he holds a B.Tech., an M.E., and has completed the Post Graduate Executive Management Program (PGEMP), equipping him with a strong technical and managerial foundation. At GEAPP, Mr Gupta leads two major national initiatives: the Battery Energy Storage Systems (BESS) program and the Digitalization of Utilities for Energy Transition (DUET) program. Through strategic collaboration with state DISCOMs and the Ministry of Power, his work is focused on driving India's transition toward a net-zero future by enhancing grid flexibility, accelerating renewable energy integration, and strengthening the resilience of power distribution networks through cutting-edge digital and storage solutions.

Sagar Mysorekar is a geospatial expert with over 20 years of experience in Geographic Information Systems (GIS), spatial data analytics, and the application of AI tools for geospatial analysis and decision-making. His work spans biodiversity conservation, climate resilience, infrastructure planning, and environmental management. Sagar has led impactful projects across Asia and globally, collaborating with esteemed organizations such as The Nature Conservancy, Gojek, and Quantta Analytics. He holds advanced degrees in geography and environmental sciences, and his research has been published in peer-reviewed journals and presented at major international conferences. As the founder of Stratageo, a specialized geospatial consulting firm, Sagar leads the delivery of location intelligence, spatial analytics, and mapping solutions to governments, businesses, and non-profits. Stratageo transforms complex spatial data into actionable insights – enabling smarter planning for market development, infrastructure, conservation, and public policy.

Harikrishna K V serves as the Group Head for the Transmission and Grid Planning Team at CSTEP. With over 16 years of experience in the power sector, he specializes in grid planning and renewable energy integration. He holds a Master's degree in Power and Energy Systems from Bangalore University and has worked extensively across power generation, transmission, and distribution. His expertise lies in transmission and distribution network planning, grid balancing studies, and integrating electric vehicles into the power grid. At CSTEP, he provides evidence-based policy recommendations to major state utilities, supporting India's clean energy transition through strategic grid modernization and planning initiatives.

Neeraj Kuldeep is a Senior Officer – Energy Transition and Efficiency at SEforALL, where he leads technical efforts to advance demand-side management and flexibility programs in India, supporting both national energy efficiency goals and G20 commitments. With over a decade of experience in renewable energy across India and internationally, Neeraj brings deep expertise in policy, regulation, and program design for utility-scale and distributed renewables. He has played a pivotal role in supporting national and sub-national governments in designing schemes, driving regulatory reforms, conducting demonstration pilots, and formulating state-level renewable energy roadmaps. Notably, his work on assessing rooftop solar potential for all households informed the design of the PM-Surya Ghar scheme, targeting 10 million solarized homes. He has also contributed to business model innovation, community benefit frameworks, skilling programs, and utility transition strategies, with a strong focus on people-centric energy transitions. Neeraj holds a Master's in Energy Systems and a B.Tech in Energy Science and Engineering from IIT Bombay.

Rekha Dangwal, an Executive Engineer at UJVN Limited (the electricity generation utility of the Government of Uttarakhand), brings over two decades of experience in the state power sector, specializing in the planning and electrical-mechanical design of hydroelectric projects, policy development, cybersecurity, and commercial operations. She holds a B.E. in Electrical Engineering from GBPEC Pauri and a PGDBM from IGNOU, and is a certified Energy Auditor and Lead Auditor for Quality Management Systems. Rekha has contributed to climate action as a member of the Uttarakhand State Climate Change Centre's Energy Sector Working Group and collaborated with IIT Roorkee on sustainable energy initiatives. She was also recognised among the 100 Women Engineers in the South Asian power sector under the WePOWER SAR-100 program by the World Bank and the Asian Institute of Technology, Bangkok.

Atul Dhir is a clean energy specialist with over 15 years of experience driving renewable energy transitions across South Asia. He currently leads the Renewable Energy Program at The Nature Conservancy (TNC) in India, where he promotes science-based, ecologically responsible renewable energy planning using geospatial tools. Atul has previously led large-scale clean energy initiatives across India, Bhutan, Bangladesh, Nepal, and Sri Lanka under programs funded by the EU, USAID, and USEA. His past roles include Lead – Renewable Energy for USAID's SAREP at RTI International and technical lead for the PV Cell at MNRE under EU–India cooperation, where he supported regional and state governments in designing and implementing RTC, hybrid, and distributed RE projects. He holds a degree and diploma in Instrumentation Engineering and an MBA in Power Management from the United Business Institute (UBI), Brussels.

1. Context

India, like many other developing economies, faces a dual challenge, which is accelerating economic growth while responding to the increasing frequency and intensity of climate-induced disasters. Floods, droughts, cyclones, and heatwaves are becoming more recurrent and severe, causing widespread damage to ecosystems, livelihoods, and critical infrastructure. Unsustainable land-use practices, degradation of natural ecosystems, and unplanned urban expansion have further weakened the natural resilience of landscapes. In this context, Sustainable Land Management (SLM), integrating nature-based solutions and ecosystem restoration, has emerged as a cornerstone for enhancing ecological resilience, supporting livelihoods, and sequestering carbon.

Simultaneously, the global shift toward net-zero emissions is reshaping energy systems and development pathways. India's commitment to achieving net zero by 2070 and scaling renewable energy capacity to 500 GW by 2030 presents both immense opportunities and complex challenges. While the clean energy transition is crucial for climate mitigation, it also brings new pressures on land, water, and biodiversity. Large-scale renewable energy deployment, if not guided by sustainable land-use planning, may exacerbate land conflicts and ecosystem stress. Integrating spatial land-use assessments, circular economy approaches, and community-based governance can ensure that India's energy transition strengthens rather than compromises environmental and social resilience.

Energy systems themselves are increasingly vulnerable to climate extremes. Heatwaves, floods, storms, and wildfires now threaten generation, transmission, and storage infrastructure, creating a paradox where the energy transition designed to combat climate change is also at risk from its impacts. Building resilient, distributed, and flexible energy systems through distributed renewables, battery storage, resilient siting, and climate-proof engineering is therefore vital for disaster preparedness and recovery.

The technical session titled "Sustainable Land Management and Energy Transition: Pathways to a Net Zero and Disaster-Resilient Future" was designed to bring together experts from renewable energy, environment, hydropower, geospatial science, climate, and disaster management to reflect on the complex interplay between land, energy, climate resilience, and community well-being in India's clean energy transition.

2. Why This Session and Its Relevance to the World Summit on Disaster Management (DSM)

Disaster losses are escalating, climate deadlines are fast approaching, and infrastructure lock-in risks are intensifying. Continuing with a fragmented, business-as-usual approach, where land management, disaster preparedness, and energy transition are pursued in silos will result in higher costs, slower progress, and missed opportunities for resilience.

Our session's aim was to bring together leading stakeholders from the energy, environment, and disaster management sectors to co-design integrated pathways for sustainable, climate-resilient development. The discussion was designed to explore how:

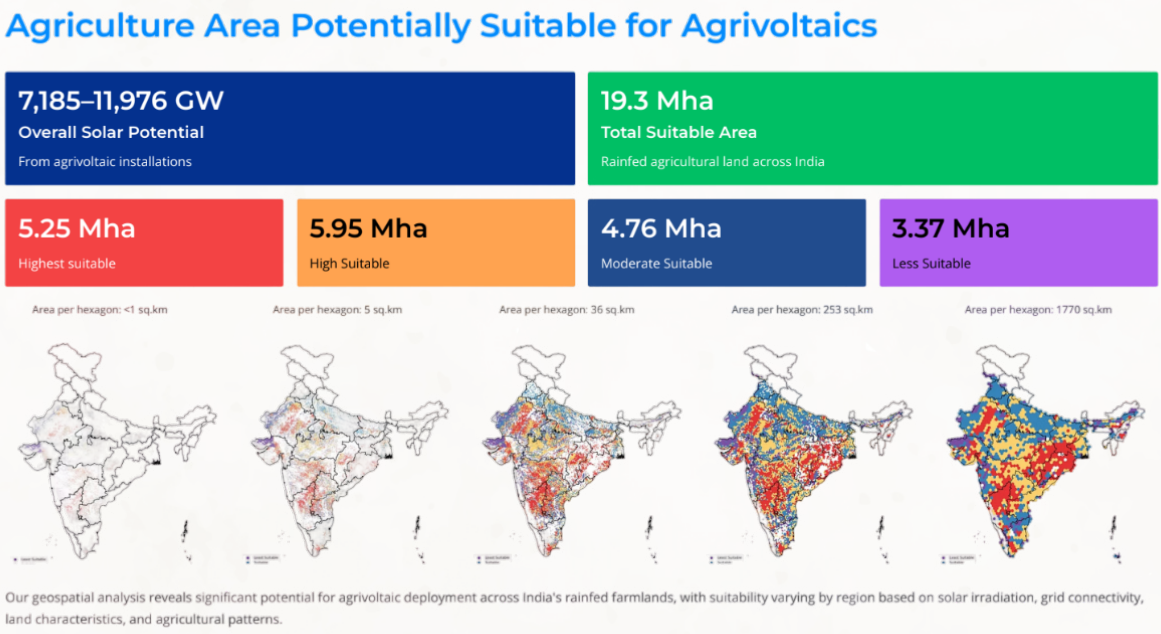
- Sustainable Land Management (SLM) can reduce hazard exposure, restore degraded landscapes, and unlock low-conflict land for renewable energy deployment;
- Energy systems can be designed, sited, and operated to withstand climate extremes while ensuring uninterrupted power for emergency response and recovery; and
- Finance and policy frameworks can incentivize resilience, nature-positive investments, and low-carbon growth trajectories.

By aligning land, energy, and climate agendas, Swaniti's session on "Sustainable Land Management and Energy Transition: Pathways to a Net Zero and Disaster Resilient Future" was designed to underscore the critical need for integrated planning and investment to reduce disaster risks, advance India's energy transition, and accelerate progress toward a sustainable, net-zero future. It directly complemented the summit's broader goal of fostering systemic, cross-sectoral approaches to disaster resilience and climate adaptation.

3. Summary of Event Discussions

3.1 Opening Remarks & Presentations

The session opened by highlighting India's dual challenge: scaling renewable energy rapidly while protecting fragile ecosystems and supporting vulnerable communities. Presenter Sagar Mysorekar shared geospatial modelling work that identifies potential areas across India suitable for agrivoltaics, including crop-specific compatibility and a proposed roadmap for national-scale deployment. His presentation illustrated how dual-use land models can ease land pressures associated with renewable expansion, generate additional income for farmers, and strengthen the resilience of rural communities.



4. Panel Discussion Summary and Key Takeaways

The panel discussion titled "Building sustainable energy infrastructure: Pathways for Disaster-Resilient Energy Transition" brought together seven experts from the energy, climate, geospatial science, digitization, and disaster management sectors to reflect on the complex interplay between land, energy, climate resilience, and community well-being in India's clean energy transition. Discussions highlighted that while India's renewable energy ambitions are rapidly growing, the pathway forward must be grounded in sustainable land use, scientific site selection, climate-responsive hydropower development, and resilient grid planning. Panelists emphasised the increasing importance of geospatial tools, pumped storage systems, demand-side management, and digitalized grid operations in managing climate-induced energy volatility. A strong consensus emerged on the need for integrated institutional frameworks and deeper community participation to ensure that the transition is not only technologically advanced but also socially just, environmentally sustainable, and aligned with local realities.

This overarching dialogue set the stage for a set of detailed takeaways to guide policy action and implementation.

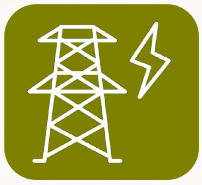
Land as a limiting factor: The discussion underscored that as India scales from 250 GW of renewable energy today to nearly 500 GW within five years and will continue to expand through 2070, land availability will become the most serious constraint. With average landholdings under 0.2 hectares per household and over 60% of India's population dependent on agriculture, renewable energy development cannot continue to rely on large swathes of fertile or densely inhabited land. Land is not merely a physical resource; it is socially, economically, and culturally embedded in rural livelihoods. Planning the energy transition without accounting for land scarcity and land-based vulnerabilities will risk exacerbating rural inequities and generating widespread conflicts.

Geospatial science for low-conflict renewable energy siting and long-term sustainability: Panelists strongly emphasised the need for data-driven site selection to minimise future disputes and ecological damage. Tools such as TNC's SiteRight demonstrate how multi-layered geospatial mapping covering biodiversity, settlements, forest areas, water stress, and infrastructure can identify low-impact zones for renewable energy deployment. As land conflicts rise across India, with more than 30 RE projects stalled and 70+ under challenge, scientific siting will be indispensable for de-risking investments, accelerating project timelines, and safeguarding ecological integrity. Geospatial planning must become a mandatory component of state and national RE policy.

Hydropower and Pumped Storage Systems: While solar and wind capacity are expanding rapidly, they are inherently intermittent. Hydropower, especially pumped storage hydropower (PSH), offers fast-ramping, reliable, and low-emission balancing support. Uttarakhand's pumped storage allocation of 2650 MW indicates a strategic shift toward integrating long-duration storage into India's grid. Panelists agreed that India cannot meet its net-zero target without significantly scaling hydropower and PSH. However, this development must be approached carefully, given the environmental sensitivity and geological fragility of the Himalayan states.

Hydropower planning in the Himalayas incorporating climate risks, geological fragility, and scientific governance: Panelists highlighted that historical hydrological data is no longer adequate because climate change is altering rainfall patterns, glacial melting, and river behaviour. Mountainous terrains like Uttarakhand face amplified risks due to seismicity, landslides, glacier lake outburst floods (GLOFs), and erosion. The Chamoli disaster of 2021 led to the Dam Safety Act 2021, strengthening regulatory oversight and mandating Early Warning Systems. The discussion stressed that future hydropower and PSH projects must integrate updated climate projections, comprehensive geological assessments, catchment-level planning, and multi-department coordination to safeguard human lives and ecosystem stability.

Demand Side Management (DSM): With extreme weather causing sudden spikes during heatwaves and collapses in demand during rainfall, the power system is becoming highly unpredictable. DSM strategies such as automated demand response, load shifting to solar-rich hours, smart metering, and flexible building loads will be essential for grid stability. These measures also make consumers active participants rather than passive receivers in managing energy resilience. Panelists emphasised that DSM ensures grid stability at a fraction of the cost of new infrastructure and is critical for integrating rooftop solar, EV charging, and distributed storage systems.



Power grids from a centralised, one-way system to a dynamic, bidirectional network: The rise of rooftop solar, distributed energy resources (DERs), and prosumers is transforming the traditional grid model. This transition brings opportunities for greater energy democracy but also greater operational complexity. The panel highlighted that grid management must now incorporate real-time data, forecasting tools, flexible loads, and rapid decision systems to handle the volatility introduced by both climate change and distributed renewable energy. This requires investments in digitalization, smart meters, substation automation, and load forecasting analytics across all DISCOMs.

Integrated institutional frameworks: Panelists pointed out a major governance gap, that India currently lacks a unified institutional mechanism that brings together land governance, renewable energy planning, environmental assessments, disaster risk reduction, and climate adaptation. These domains operate in silos, leading to misaligned decisions, inefficiencies, and avoidable conflicts. The discussion recommended establishing interdepartmental platforms at the state and district levels to ensure coordinated planning, joint monitoring, and integrated project approvals.

Community engagement: A recurring theme was the necessity of ensuring that communities, especially small and marginal farmers, are active participants in planning and benefit-sharing of renewable energy transition. Large RE projects often face resistance when communities feel excluded or inadequately compensated. The panel advocated for decentralised models such as community-owned solar, agrivoltaics, rural microgrids, and localised livelihood benefits. Without community trust and participation, large-scale renewable expansion will face increasing delays and disputes.

Climate finance and ESG-aligned investments: The transition to nature-positive, community-sensitive renewable energy requires financial innovation. Panelists highlighted the need for blended finance models that combine multilateral funding, private capital, ESG investments, carbon markets, and state support. Financing must prioritise climate-resilient infrastructure, low-conflict land use, hydropower safety upgrades, smart grid modernisation, and community-centric RE projects. Access to long-term, low-cost capital will be a decisive factor in India's energy transition success.

Technology-driven solutions: Early Warning Systems, geospatial analytics, AI-based mapping, and smart grid tools are indispensable for building climate-resilient energy ecosystems. The discussion collectively stressed that the future of energy planning cannot rely on conventional approaches. Smart meters provide real-time grid behaviour insights; Early Warning Systems reduce disaster risks for dams; AI-powered land mapping improves siting accuracy; and sensor-driven hydro monitoring enhances safety. These technologies reduce uncertainty, improve forecasting, and make the energy system more responsive to climate variability.

People-centric and nature-positive energy transition: The panel concluded that India's energy transition must move beyond capacity addition and focus on protecting ecosystems, supporting local livelihoods, ensuring equitable outcomes, and minimising displacement. Renewable energy goals must be achieved without undermining social or ecological resilience. The path forward requires harmonising climate goals with environmental protection and social justice.

Experts agreed that the discussions must translate into concrete proposals for policymakers covering land allocation strategies, RE siting norms, hydropower safety frameworks, DSM roadmaps, geospatial integration, and institutional reforms. The momentum generated in this discussion is expected to guide future dialogues and policymaking processes.

5. Conclusion

In conclusion, the session highlighted a strong collective recognition that India's energy transition must be pursued with deep sensitivity to land, ecology, and social realities. The panel's insights emphasized that renewable energy expansion cannot be treated as a siloed agenda focused solely on megawatt addition. Instead, it must be shaped by scientific land-use planning, climate-informed project design, community engagement, institutional integration, and resilient grid management. Hydropower, pumped storage, demand-side management, and geospatial intelligence will play pivotal roles in anchoring this transformation. At the same time, community-centric models and integrated institutions will determine whether the transition enhances or undermines social and environmental well-being. Ultimately, the discussions reinforced that India's pathway to net zero must be equitable, nature-positive, technologically advanced, and grounded in long-term resilience.

Swaniti Initiative, as an ecosystem enabler, will continue to collaborate with government, research institutions, and industry partners to translate these insights into projects and policies that advance a net-zero, nature-positive, disaster-resilient energy future for India.

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