BALIPARA FOUNDATION

Assam • India

13TH EASTERN HIMALAYAN NATURENOMICS™ FORUM 2025

10th & 11th December
Guwahati, Assam

IIT GUWAHATI

Recommendations Report

WATER AND ENERGY


Guwahati, Assam
The Future of the Third Pole and Eastern Himalaya (Himsagar)


RESPONSIBLE.
RESILIENT.
RESOLUTE.


NATURENOMICS™ FORUM
2025
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The Future of the Third Pole and Eastern Himalaya (Himsagar)

KEY INSIGHTS

Resilience in the Eastern Himalaya requires systems thinking, not isolated technological fixes.

Water, energy, land, ecosystems, and livelihoods are deeply interconnected and must be addressed together.

Data-driven and community-led approaches are essential for sustainable outcomes.

The energy transition is not just about decarbonisation—it is a broader systems transition.

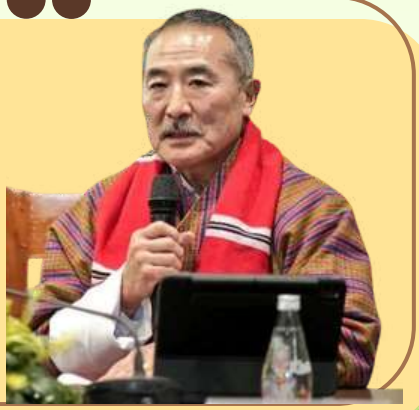
Climate resilience, social equity, and ecological limits must shape infrastructure planning and governance.

We need a complete thinking-what they call a complete cycle of economy. Because everything is connected and one leads to the other.
-**HeProfessor Devendra Jalihal,**
Director, IIT Guwahati

Energy should be seen as a full transition value chain. It is as much as input to supply (downstream), the supply side ecosystem and the demand side ecosystem, This is the interface of energy markets. We must see things from systematic point of view.- **Himal Tewari, CHRO,**
Chief - Sustainability & CSR, Tata Power

To progress you need energy. Till society needs oil, we will continue to provide oil but also build on our own portfolio for better functionality, keeping in mind green energy.
-Bhaskar Jyoti Phukan,
Managing Director, Numaligarh Refinery Limited

If the aquifers go away, it will have an impact on life and livelihoods. The aquifers are a dependable buffer to fight climate change. Our interconnectedness is a scientific reality. We need regional and hydrological cooperation.
- **His Excellency Kesang Wangdi,**
Former Ambassador and Chairman, Board of Trustees, Bhutan Trust Fund for Environment Conservation



CHALLENGES IDENTIFIED

1. Intensifying Water Insecurity Across Glacial, Riverine and Subsurface Systems
2. Fragmented Governance Driving the Water-Energy Nexus
3. Grid Vulnerability and Infrastructure Constraints in the Northeast
4. Uneven Access to Clean Energy and Persistent Skills Gaps
5. Technology-Community Disconnect

CHALLENGES IDENTIFIED

1. **Intensifying Water Insecurity Across Glacial, Riverine and Subsurface Systems**

Glaciers in the Eastern Himalaya have already retreated significantly in recent decades with estimates indicating losses of nearly one-third of their volume in some basins. While accelerated glacial melt may temporarily increase river discharge, long-term projections point toward declining dry-season flows, heightened flood risks and growing uncertainty for agriculture, hydropower and urban water supply.

Compounding this challenge is the limited understanding and governance of mountain aquifers and springsheds. These subsurface systems play a critical role in sustaining base flows, drinking water security and ecosystem stability particularly for rural and high-altitude communities where access to water is already difficult. Yet they remain largely invisible in policy, planning and investment frameworks, leaving a foundational component of Himalayan water security inadequately addressed.

2. **Fragmented Governance Driving the Water-Energy Nexus**

Hydropower development, irrigation systems, industrial water use and urban infrastructure are often conceptualised and implemented in silos despite their deep hydrological and operational interdependence. Energy stakeholders noted rising operational and financial risks as water availability becomes increasingly volatile. Hydropower, while critical for grid balancing and renewable integration, faces mounting challenges from sedimentation, extreme rainfall events, dam safety concerns and regulatory uncertainty. The absence of integrated planning frameworks weakens both climate resilience and investment confidence.

CHALLENGES IDENTIFIED

3. **Grid Vulnerability and Infrastructure Constraints in the Northeast**

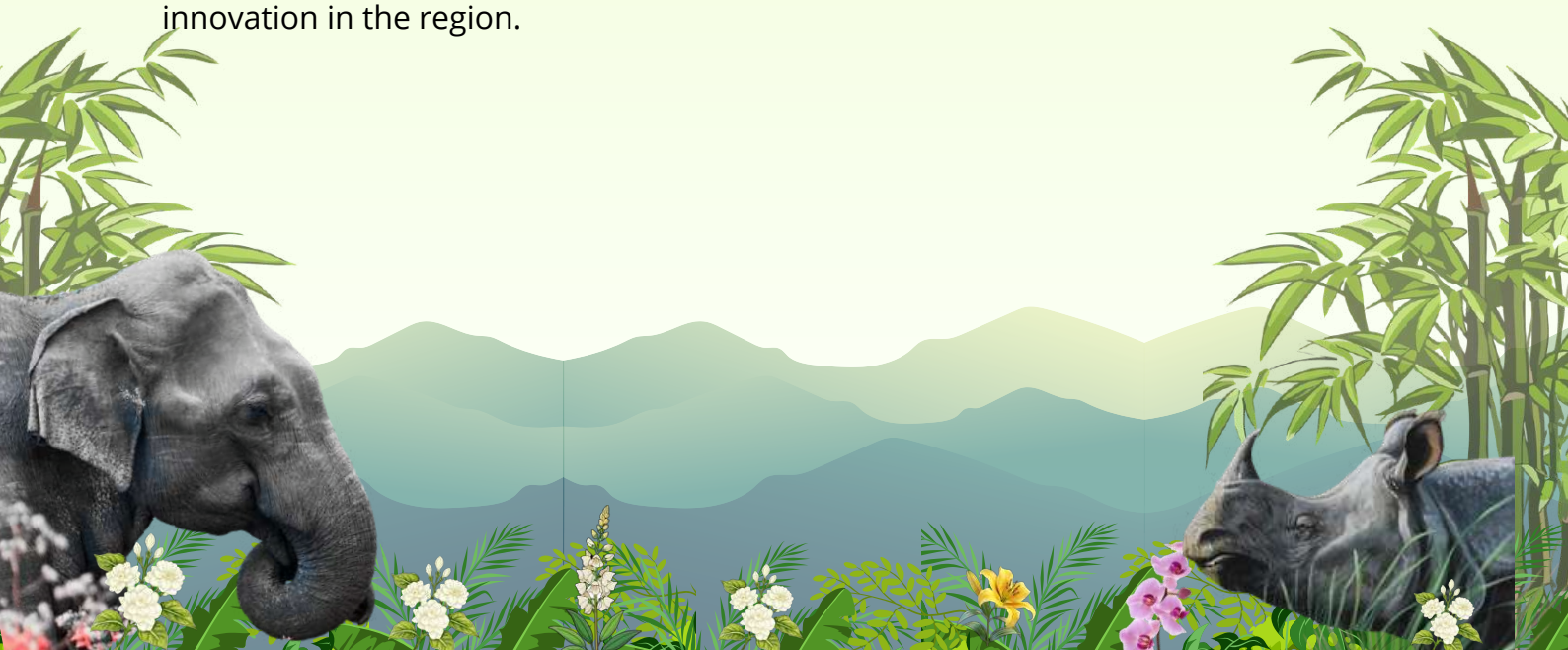
While the Northeast holds immense potential for renewable energy including hydropower, solar, biomass and emerging green hydrogen pathways, structural and technological bottlenecks continue to constrain scale and stability. These include limited transmission capacity, land-use conflicts, regulatory delays and insufficient energy storage infrastructure. Without parallel investment in smart grids, digital management systems and regional transmission corridors, rapid renewable expansion risks destabilising the grid rather than strengthening it particularly in a climate-volatile region.

4. **Uneven Access to Clean Energy and Persistent Skills Gaps**

Despite technological advances, access to clean and reliable energy remains uneven particularly in remote, riverine and border regions. While India produces large numbers of engineers, there is a shortage of trained technicians capable of installing, operating and maintaining decentralised and hybrid energy systems. This mismatch threatens the durability and scalability of renewable energy investments particularly in contexts where local capacity is essential for long-term operation and maintenance.

5. **Technology-Community Disconnect**

Across both water and energy discussions, speakers emphasised that technological sophistication alone does not guarantee successful outcomes. Projects frequently underperform or fail when communities lack ownership, capacity, or trust especially when technologies are introduced without cultural grounding or participatory governance. The persistence of this disconnect weakens conservation legitimacy, reduces system longevity, and limits the transformative potential of technological innovation in the region.



STRATEGIC RECOMMENDATIONS

1. Recognise and Govern Mountain Aquifers and Springsheds as Critical Infrastructure

Why it Matters

- **01** Hidden hydrological backbone
- **02** Regulates water across seasons, elevations, climate extremes
- **03** Sustains river base flows, drinking water, irrigation
- **04** Often invisible in policy (focus on dams/canals)
- **05** Climate change & glacial decline → water scarcity, ecosystem stress, livelihood risk

Recommendations

Water Security

01	02	03
Map & Monitor	**Governance Shift**	**Community Stewardship**
Geological surveys, remote sensing, hydrological modelling, Community-based observations	Include springshed-based planning with watersheds	Embed local institutions in formal governance, Support with science, technical assistance, legal recognition.

Results

- **01** Strengthened water security
- **02** Ecosystem-based, proactive water governance
- **03** Stable agriculture & livelihoods
- **04** Reduced disaster vulnerability
- **05** Climate resilience

STRATEGIC RECOMMENDATIONS

2. Embed Climate Risk and Hydrological Uncertainty into Infrastructure Planning

Why it's Critical

01 Himalayan hydrology is changing rapidly

02 Older climate data and assumptions = unreliable

03 Risks: Glacial lake outburst floods, intense rainfall, prolonged dry spells

04 Maladaptive infrastructure = Failure & costs rise

Recommendations

Climate-Resilient Infrastructure

01

Risk Assessments

Include climate and hydrological uncertainty in planning

02

Strengthen Early Warning Systems

Boost flood forecasting systems and sediment management strategies

03

Nature-Based Solutions

Prioritise recharge enhancement, forest and wetland protection, and catchment restoration

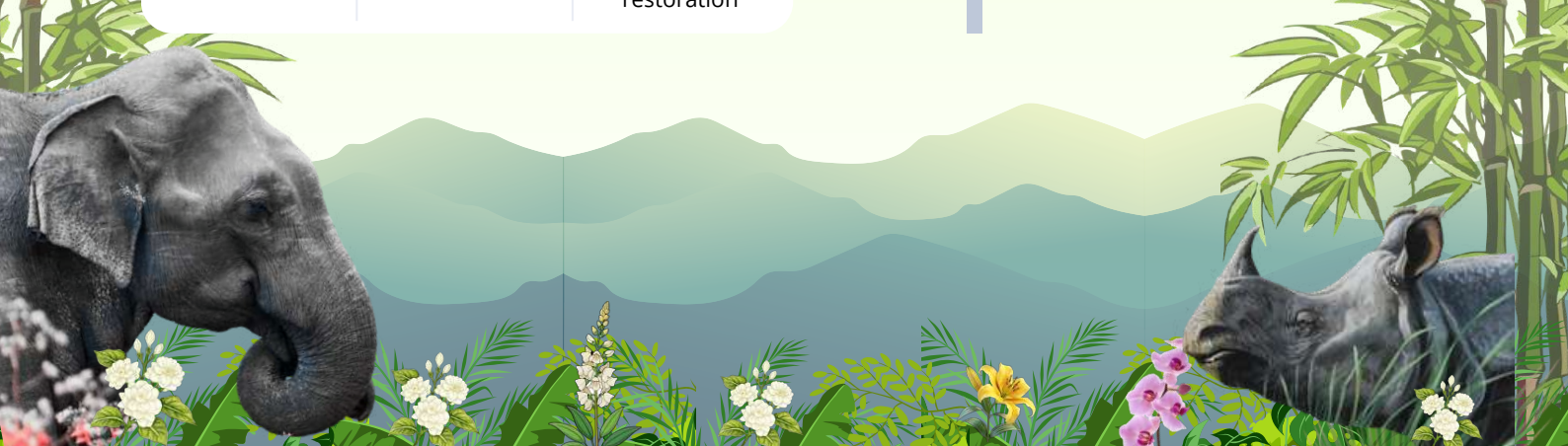
Results

01 Improved performance & safety

02 Reduced failure & costs

03 Protected communities & ecosystems

04 Aligned with changing Himalayan climate



STRATEGIC RECOMMENDATIONS

3. Accelerate Decentralised and Diversified Renewable Energy Systems

Why it Matters

01 **Mountain regions →** vulnerable to climate extremes & complex geography

02 **Centralised systems →** risk of disruption

03 **Decentralised solutions →** resilient, locally adaptable, economic benefits

Recommendations

Decentralised Renewable Energy Systems

01

Scale Decentralised Energy

Distributed solar, micro/small hydropower, biomass, Agro-photovoltaics, floating solar

02

Hybrid Systems

Combine sources to match local demand & seasonal variability

03

Rural Bio-Energy Models

Bamboo, agricultural residues → clean energy + livelihoods

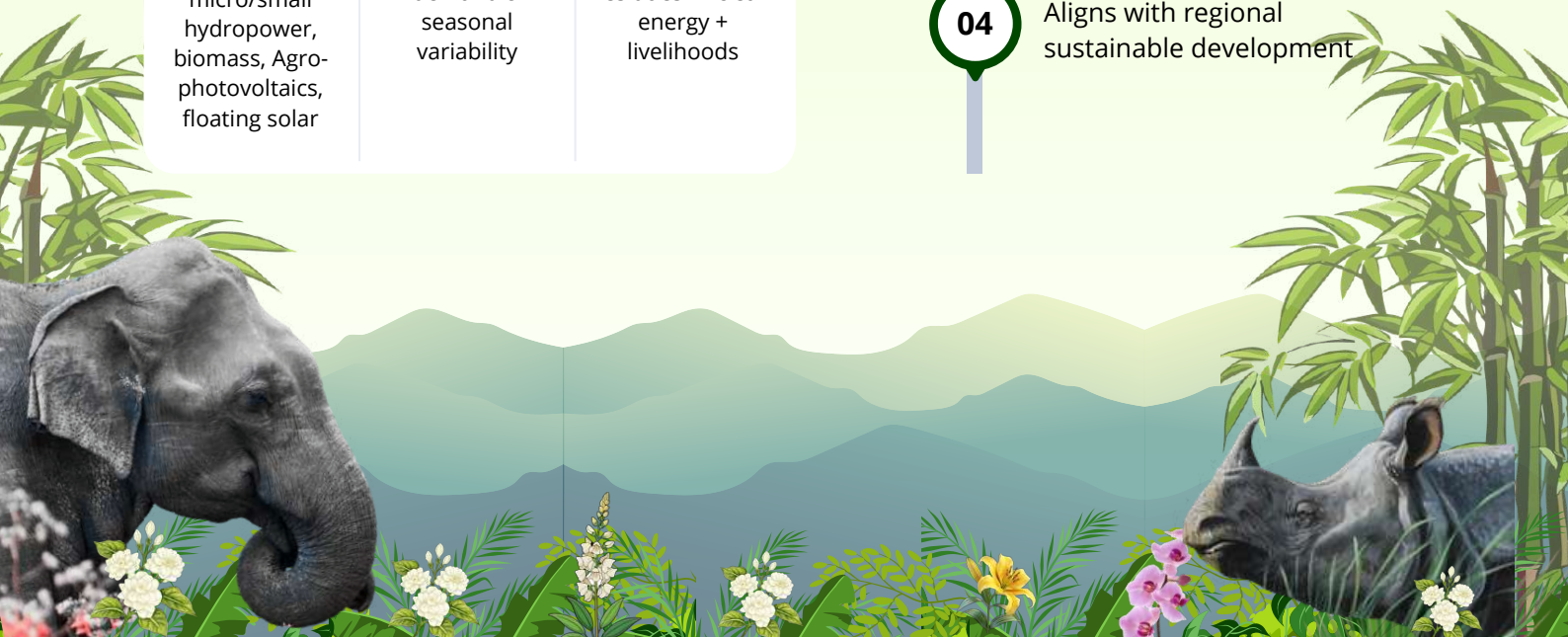
Results

01 Enhances resilience → less reliance on distant infrastructure

02 Improves energy access & equity

03 Supports local economy & livelihoods

04 Aligns with regional sustainable development



STRATEGIC RECOMMENDATIONS

4. Build Smart, Digital and Flexible Energy Grids

Why it Matters

01 Renewable variability + climate uncertainty → need adaptive grids

02 NE India: limited transmission, outdated infrastructure → outages & constraints

03 Smart grids → dynamic supply-demand balance

Recommendations

Smart Grid Integration

01
Grid Digitalisation

Invest in real-time monitoring, AI, IoT, advanced analytics

02
Transmission & Integration

Expand regional capacity and open-access renewables to facilitate power sharing and grid balancing

03
Flexibility & Resilience

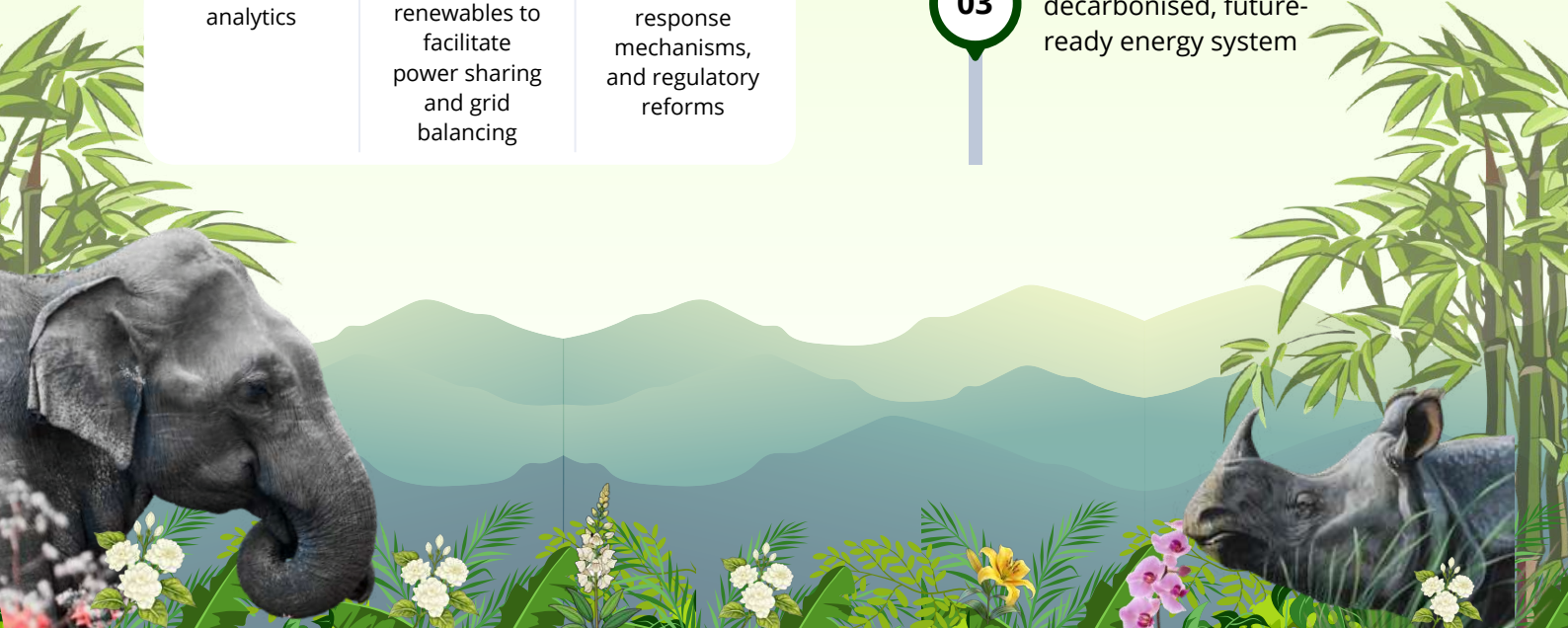
Strengthen energy storage systems, demand-response mechanisms, and regulatory reforms

Results

01 Improved reliability & reduced losses

02 Better renewable integration under variable climates

03 Backbone for resilient, decarbonised, future-ready energy system



STRATEGIC RECOMMENDATIONS

5. Institutionalise Living Labs and Academia-Industry-Community Partnerships

Why it Matters

01 Innovation requires real-world testing & iteration

02 Lab research alone insufficient → context-sensitive solutions needed

03 Decentralised solutions → resilient, locally adaptable, economic benefits

Recommendations

Strategic Partnerships

01
Living Labs

IIT Guwahati & regional institutions → water-energy experimentation

02
Collaborative platforms

academia + industry + government + communities

03
Student & research programs

fellowships, fieldwork, applied pilots

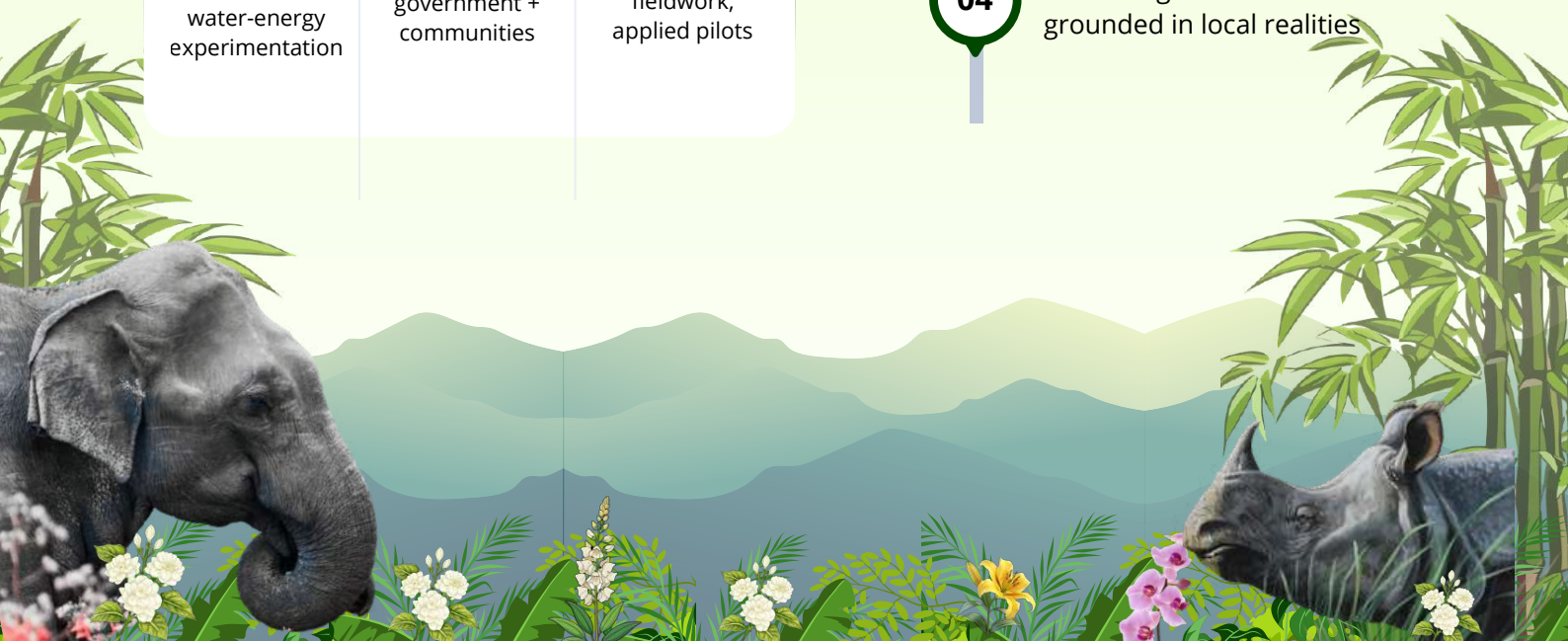
Results

01 Accelerated learning & reduced implementation risk

02 Scalable, context-sensitive innovations

03 Build regional capacity & future leadership

04 Technological advancement grounded in local realities



STRATEGIC RECOMMENDATIONS

6. Prioritise Workforce Development and Community Ownership

Why it Matters

01 Skilled local workforce → designs, operates, maintains infrastructure

02 Local teams prevent failure → reduce deterioration & social resistance

03 Community ownership → collective management & accountability

04 Empowering locals → resilience + inclusive development

Recommendations

Community Ownership

01
Training & Capacity Building
regional programs for technicians, energy managers, water stewards; support decentralised & hybrid systems

02
Equity & Ownership
women-led energy enterprises; community-owned models with local accountability

03
Demand-driven Planning
align with local priorities, culture & livelihoods; avoid externally imposed assumptions

Results

01 Skilled local workforce

02 Community ownership, where infrastructure becomes collectively managed

03 Strengthens resilience, social acceptance & equitable benefits

WAY FORWARD

RESILIENT WATER & ENERGY SYSTEMS IN THE EASTERN HIMALAYA

Overarching Principle: Integrated Systems Approach

Forests, glaciers, aquifers, grids & communities form an interconnected system

Governance that regenerates ecology while enabling inclusive development

SHORT-TERM PRIORITIES (1–3 YEARS)

BUILDING KNOWLEDGE, CAPACITY, AND EARLY MOMENTUM

Aquifer & springshed mapping

foundational data on water systems, recharge, vulnerabilities; integrate science + community knowledge

Decentralised renewable energy

hybrid systems in remote areas; enhance energy access & climate resilience

Living Labs & technician training

test solutions locally, build skills, create early demonstration effects

MEDIUM-TERM PRIORITIES (5–10 YEARS)

INSTITUTIONALISING INTEGRATION AND SCALING RESILIENCE

Integrated water-energy planning

cross-department coordination reflecting hydrology, climate risks, and energy needs

Smart grids & energy storage

ensure reliability for renewable-heavy systems under climatic variability

Community governance models

formalise local stewardship, embed participatory mechanisms in planning and decision-making

LONG-TERM VISION (2035 AND BEYOND)

SECURING REGENERATIVE INFRASTRUCTURE FUTURES

North-East as a global exemplar

demonstrating how mountain regions can align decarbonisation, adaptation and development within ecological limits

Secure water-energy systems

ensure long-term reliability for communities, ecosystems, and economies

Equity-driven infrastructure

Embed planetary boundaries, social equity, and intergenerational justice into planning, finance, and governance

OUTCOMES FROM PARTNERSHIP WITH IIT GUWAHATI

1. **Integrated Renewable Energy Solutions for Rural India: From Farmer to Agripreneur**

Under this partnership, EHNF and IIT Guwahati committed to developing integrated renewable energy models that enable rural communities to transition from subsistence farming to agripreneurship. The collaboration explores decentralized solar and clean energy applications across agriculture, irrigation, storage, and value addition, aiming to reduce energy costs, improve productivity, and create sustainable income opportunities. These models are designed to be locally adaptable and scalable across rural and agrarian landscapes of the Eastern Himalaya.

2. **Introduction of Solar-Powered Cooking and Drying Solutions for Forest Fringe Communities**

The partnership advances the introduction of solar-powered cooking and drying technologies for forest fringe and indigenous communities, with a focus on reducing dependence on fuelwood and minimizing pressure on forest ecosystems. By integrating appropriate technology with community needs, the initiative supports improved health outcomes, reduced drudgery, especially for women and enhanced processing and value addition of agricultural and non-timber forest produce. This outcome reinforces the linkage between clean energy access, livelihood resilience, and forest conservation.

3. **Clean Brahmaputra, Great Brahmaputra Initiative**

As part of the EHNF–IIT Guwahati partnership, the Clean Brahmaputra, Great Brahmaputra initiative was launched at the 13th Eastern Himalayan Naturenomics Forum as a collaborative platform for long-term engagement on river sustainability. The initiative fosters dialogue, knowledge exchange, and collective action among stakeholders from science, policy, industry, and grassroots practice to address river health, pollution, and ecological resilience. Designed to extend beyond the forum, it integrates research, technology, and community-led solutions to strengthen public awareness, stewardship, and basin-scale approaches for safeguarding the Brahmaputra as a vital socio-ecological system.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