

Track 2 • Powering Through: Environmental Vulnerability & Resilience of Energy Systems

Session 2.4 • Policy, Investment, and Cross-Sector Collaboration

Rebuilding After Climate Disaster

The Kerala Model for Net-Zero, Resilient, and Self-Sustaining Energy
Townships

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Wayanad Landslide



Why Wayanad Matters Beyond Kerala

Climate disasters no longer destroy only homes and roads — they collapse entire energy and infrastructure systems.

The question for Asia is no longer how to rebuild quickly — it is how to rebuild differently.



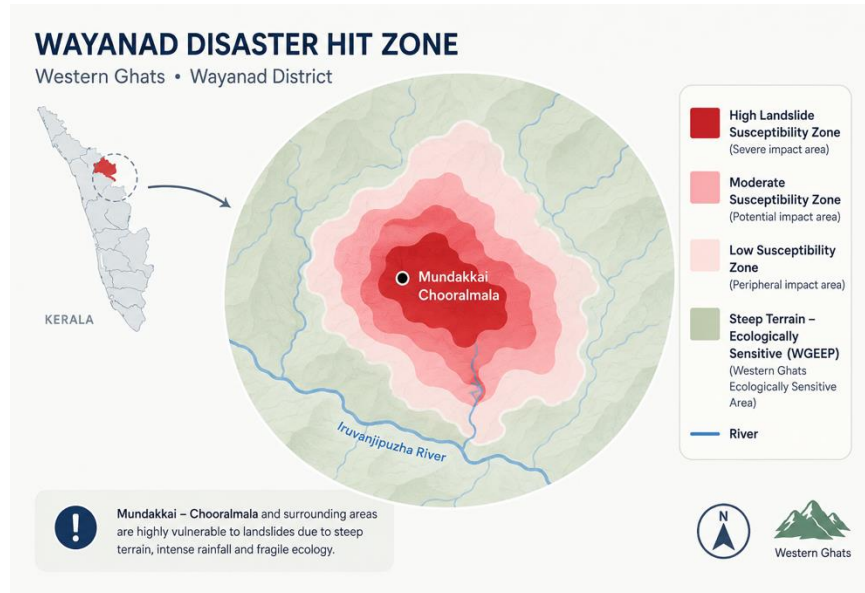
Steep, fragile terrain



Extreme rainfall regime



Vulnerable energy & service lines



WAYANAD MODEL TOWNSHIP

MASTER PLAN

A RESILIENT • SUSTAINABLE • INCLUSIVE COMMUNITY



LEGEND

- 1 ENTRANCE GATEWAY
- 2 HEALTH CENTER AND LABORATORY
- 3 MATERIAL COLLECTION FACILITY
- 4 MARKET
- 5 7'S FOOTBALL GROUND
- 6 MEMORIAL
- 7 ANGANWADI
- 8 PUBLIC TOILET
- 9 OPEN AIR THEATRE
- 10 COMMUNITY CENTER
- 11 WATER RESERVOIR
- 12 OVER HEAD WATER TANK

KEY FEATURES

- Clustered Housing with Green Buffers
- Community Centric Infrastructure
- Water Sensitive Planning
- Sustainable Mobility and Connectivity
- Disaster Resilient and Future Ready



FAMILIES
359
(Phase 1)



TOTAL HOUSE PLOTS
559
(Phase 1)



INTERNAL ROADS
~6.9 km



GREEN AREA
~60%
of total area



WATER BODIES
2
(Reservoirs)



SUSTAINABLE FUTURE
Building a resilient, self-reliant
and inclusive community

From Disaster Recovery to Resilient Township Planning

A paradigm shift: from replacing what was lost to designing an integrated, climate-resilient settlement system.

01



Resilient Infrastructure

Slope stabilisation, drainage, hardened service networks

02



Decentralised Clean Energy

Rooftop solar, microgrid-ready feeders, storage readiness

03



Circular Resource Systems

Water-energy-waste loops, on-site treatment, reuse

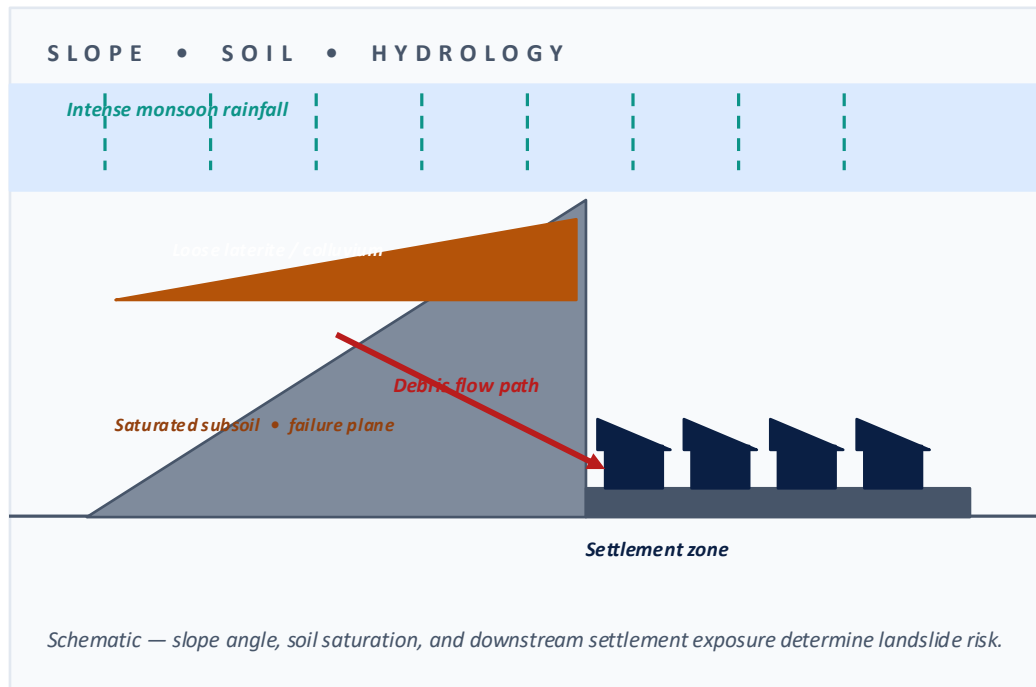
04



Community-Centred Governance

Local participation, transparent delivery, ownership

The Climate & Terrain Challenge



Hydrological extremes

Compressed rainfall events and saturated soils trigger rapid failure.



Slope instability

Steep gradients and weathered laterite/gneiss reduce shear strength.

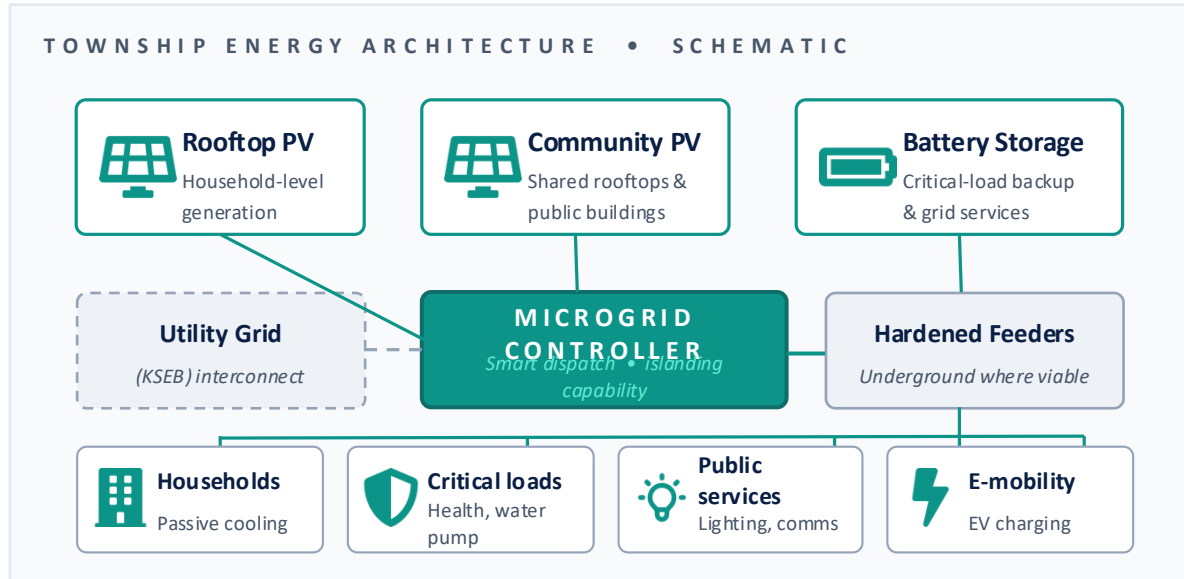


Ecological sensitivity

Western Ghats biodiversity zones constrain reconstruction footprint.

Energy as the Resilience Backbone

Decentralised clean energy is the resilience layer — not the sustainability add-on.

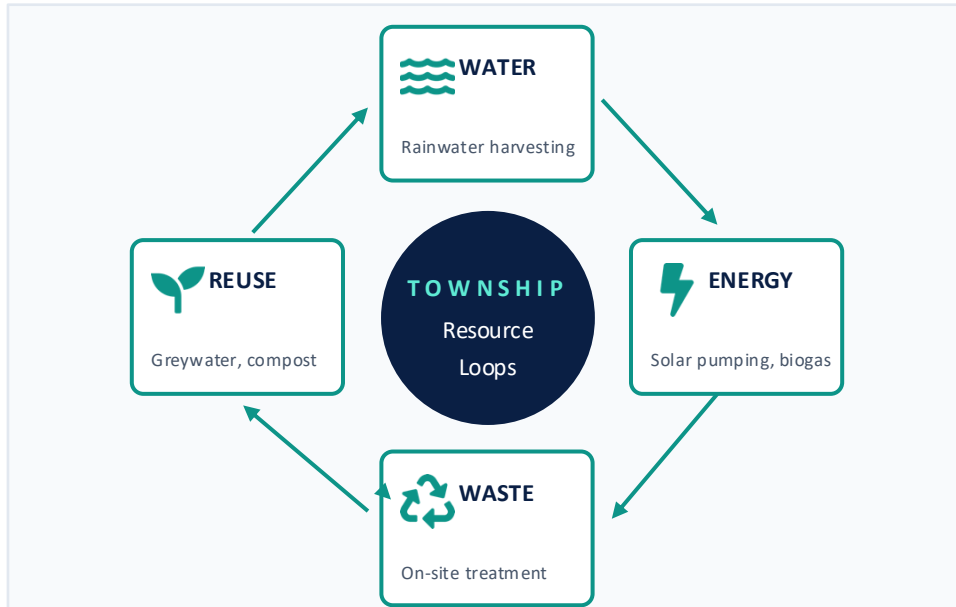


DESIGN PRINCIPLES

- Generation embedded at the load
- Islanding capability for critical loads
- Storage right-sized for outage risk
- Passive-first building envelopes
- Demand management before supply expansion
- Net-metering & surplus export ready

Water • Energy • Waste: Closing the Loop

Resilient townships need integrated resource loops — not siloed utilities.



01

Capture

Rooftop catchment + storm drains feed decentralised storage.

02

Convert

Solar pumping; anaerobic digestion of organic waste for cooking gas.

03

Treat

On-site greywater and blackwater treatment at neighbourhood scale.

04

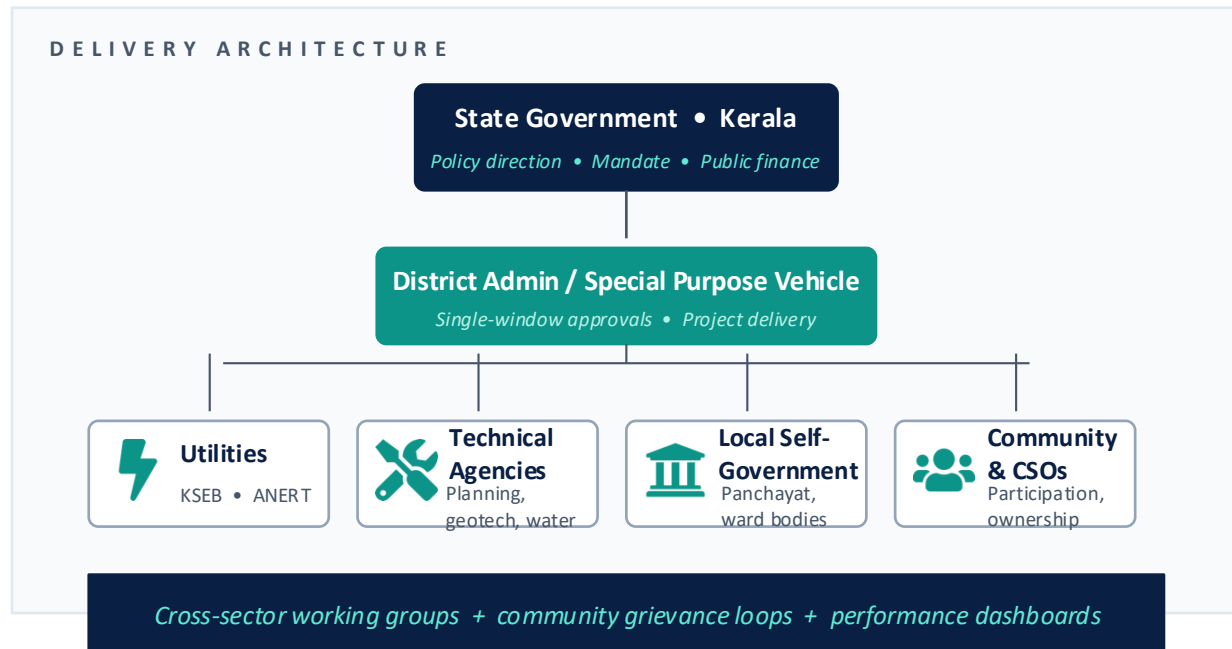
Reuse

Treated water for irrigation & flushing; compost for community gardens.

Energy-water-waste integration cuts demand before supply.

Coordination & Delivery Architecture

Implementation success is not a design problem — it is an institutional coordination problem.



WHAT MAKES IT WORK

Clear mandate

One accountable agency with execution authority.

Pre-cleared approvals

Land, environment, utility tie-ins streamlined upfront.

Community participation

Design choices co-owned with displaced families.

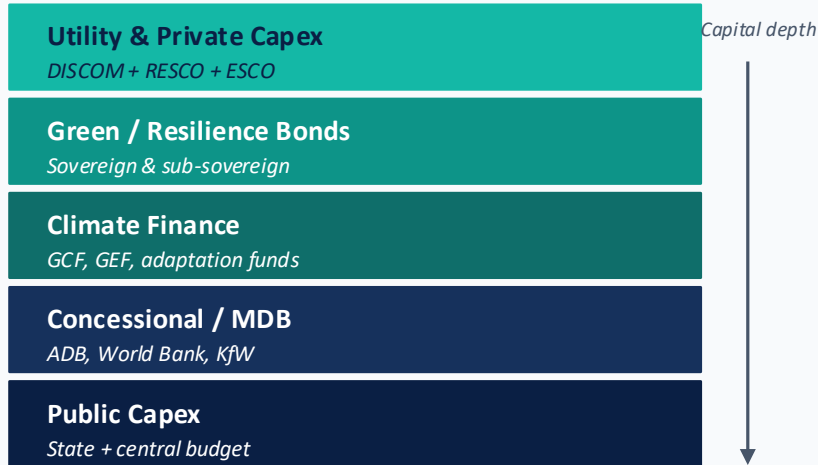
Transparent monitoring

Public dashboards on delivery and disbursement.

Financing the Resilient Reconstruction

Resilient, low-carbon reconstruction is a blended-finance problem — not a single-source budget.

FINANCING STACK • CONCEPTUAL



LIFECYCLE FINANCING PRINCIPLES

Cost the lifecycle, not the build

20-year O&M, replacement, and resilience costs sized in.

Layer risk to attract capital

Concessional tranches de-risk private and bond layers.

Carve out the energy component

Bankable, revenue-generating module suits climate finance.

Embed performance triggers

Disbursement tied to resilience and clean-energy milestones.

Build a replicable instrument

Same vehicle reusable across districts and disasters.

Hurdles, Drawbacks & Missed Opportunities

Credibility requires naming the gaps. The Kerala model is promising — and incomplete.

IMPLEMENTED

Foundations in place

- Cabinet decision & dedicated reconstruction mandate
- Site selection on geotechnically safer land
- Resilient building specifications & terrain studies
- Public financing channelled through state vehicle
- Community engagement framework established

PARTIAL

Started but under-scoped

- Rooftop solar planned, microgrid architecture unclear
- Hardened or underground distribution still being scoped
- Building energy efficiency varies across housing tiers
- Some on-site water systems but limited reuse loops
- Cross-sector coordination still ad-hoc in places

MISSED / AT RISK

Opportunities not yet captured

- Storage sizing & critical-load backup not yet defined
- Biogas / waste-to-energy potential largely unutilised
- Climate finance & green-bond instruments untapped
- No formal resilience metrics or lifecycle benchmarks
- Replication template not yet codified for other states

Global Benchmarks & Replication Lessons

Kerala leads on integrated township thinking and governance — and can learn from peers on scale, speed, and circularity.

Case	Governance	Resilience	Energy	Circular	Financing	Distinct strength
Kerala (Wayanad)	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	Integrated township thinking; community focus
Japan (Tohoku)	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	Resilient engineering & building codes
Türkiye (2023 quake)	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	Speed & scale of housing delivery
Indonesia (Aceh / Palu)	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	Community-led recovery processes
New Zealand (Canterbury)	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	Lifelines planning & insurance-based

KEY LESSONS FOR KERALA & ASIA

Japan: codify resilient engineering standards. Türkiye: industrialised delivery at scale. Indonesia: community ownership. New Zealand: lifelines-based planning & risk-transfer.

● ● ● ● ● Relative strength on a 5-point qualitative scale (illustrative, not formally benchmarked).

From Kerala to Developing Asia

A replicable framework for climate-vulnerable reconstruction.



The future of disaster recovery cannot be about rebuilding yesterday's vulnerabilities.

Kerala's experience suggests a different pathway — reconstruction as an opportunity to build cleaner, safer, more resilient communities for a climate-constrained century.

A Village Was Lost. A Vision Emerged



DISCUSSION

Questions & Discussion

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