The Iconic Island For Renewable Energy

SUMBA ICONIC ISLAND

The Indonesian "Iconic Island": Opportunities for Renewable Power and Access Scale-up

Renewable Energy Opportunities for Remote Indonesian Grids

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castlerock consulting

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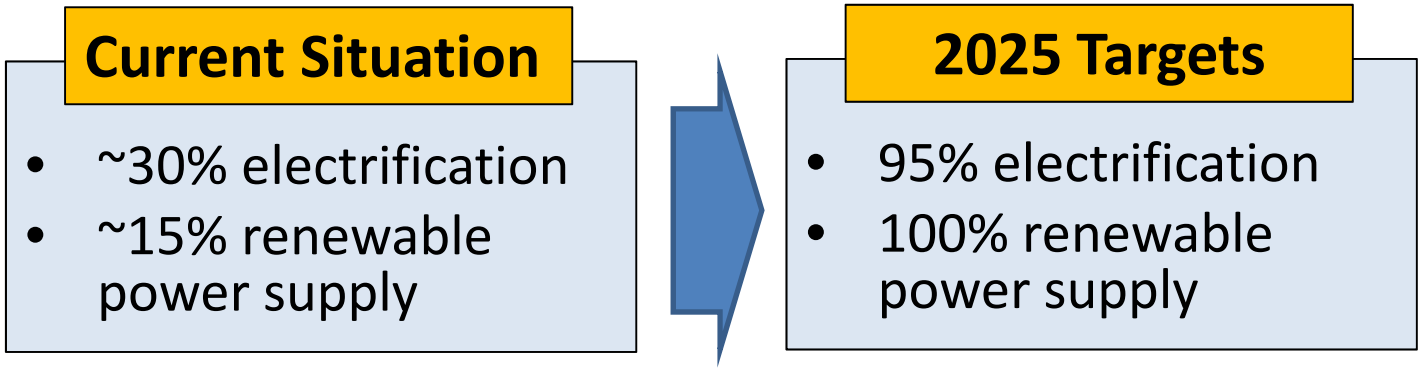
Sumba Island, Indonesia

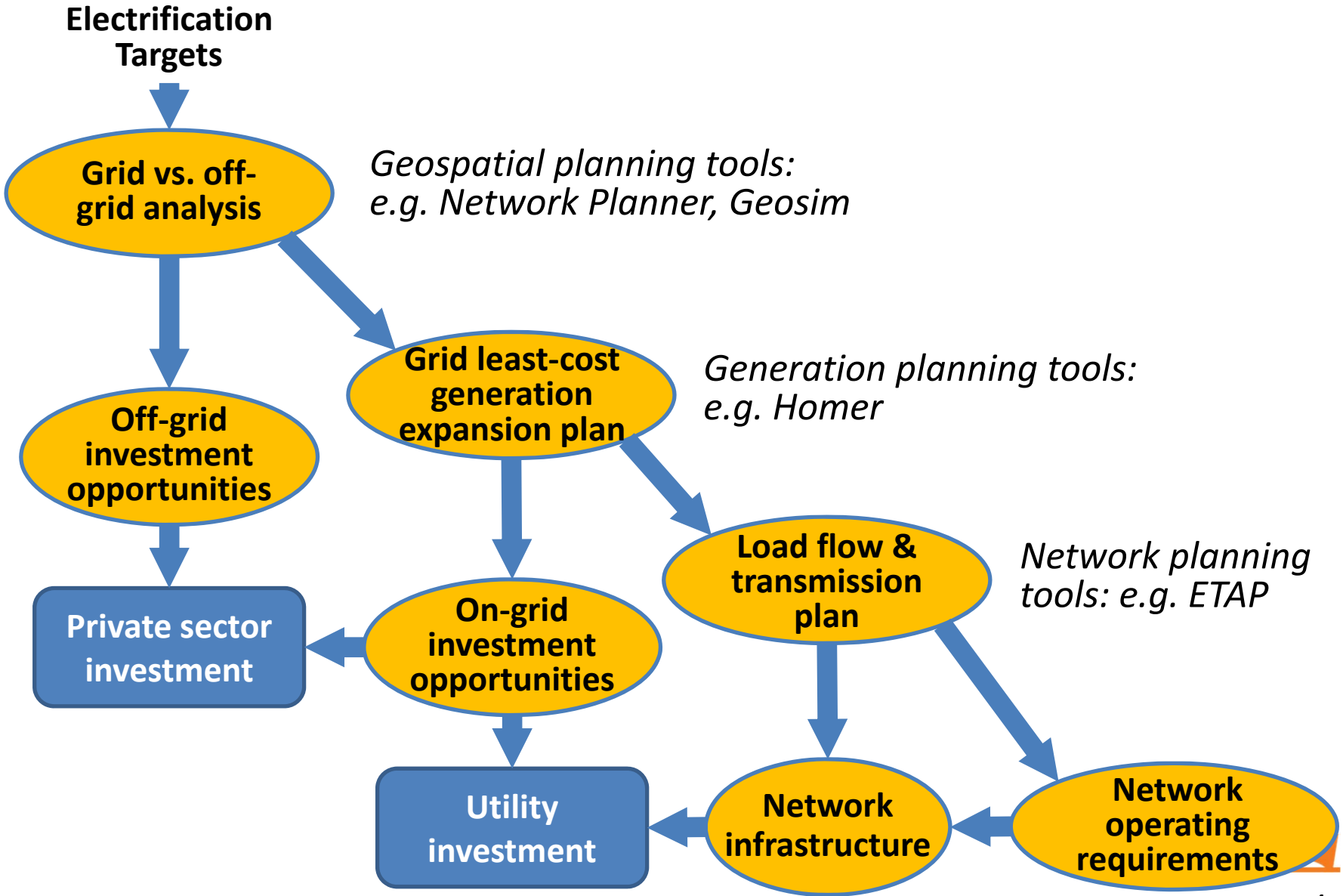
- Located in eastern Indonesia
- Approximately 200 km long, 100 km wide
- Population of about 700,000
- ~12 MW peak demand, ~50 GWh annual sales

The Sumba Iconic Island Initiative



- Multi-stakeholder initiative started in 2010, led by Ministry of Energy & Mineral Resources
- Serve as a replicable model for Indonesia & elsewhere
- ADB supporting planning & implementation since 2013
- Transformation from a collection of pilot projects to development & implementation of a feasible, least-cost plan
- Good planning supports private investment & optimizes public expenditure

The planning framework

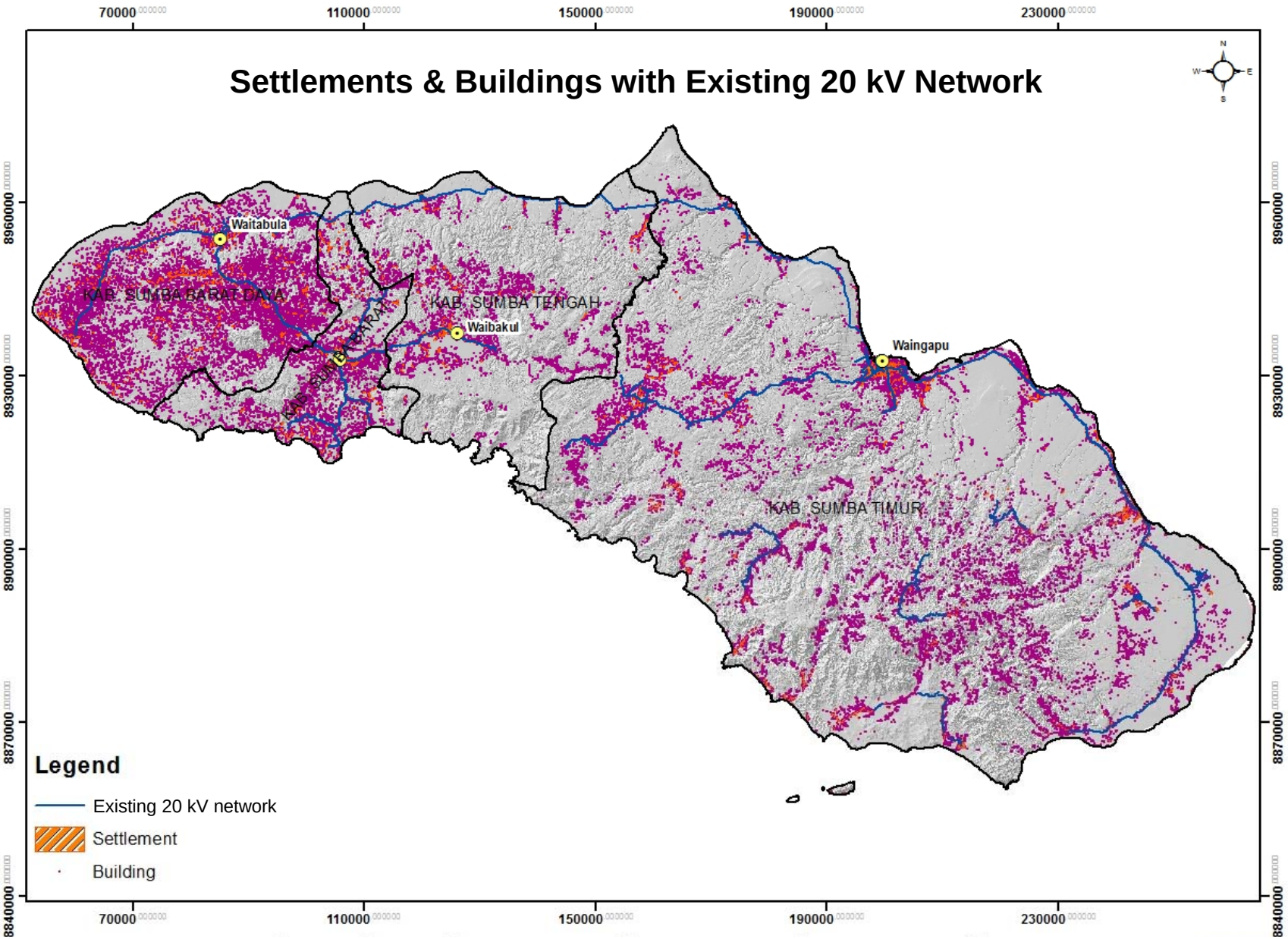


Geospatial planning for electrification

- Settlement patterns & load density
- Distance to existing transmission infrastructure
- Cost & performance of electrification technologies
  - Grid extension
  - Renewable, diesel or hybrid minigrids
  - Individual household PV systems

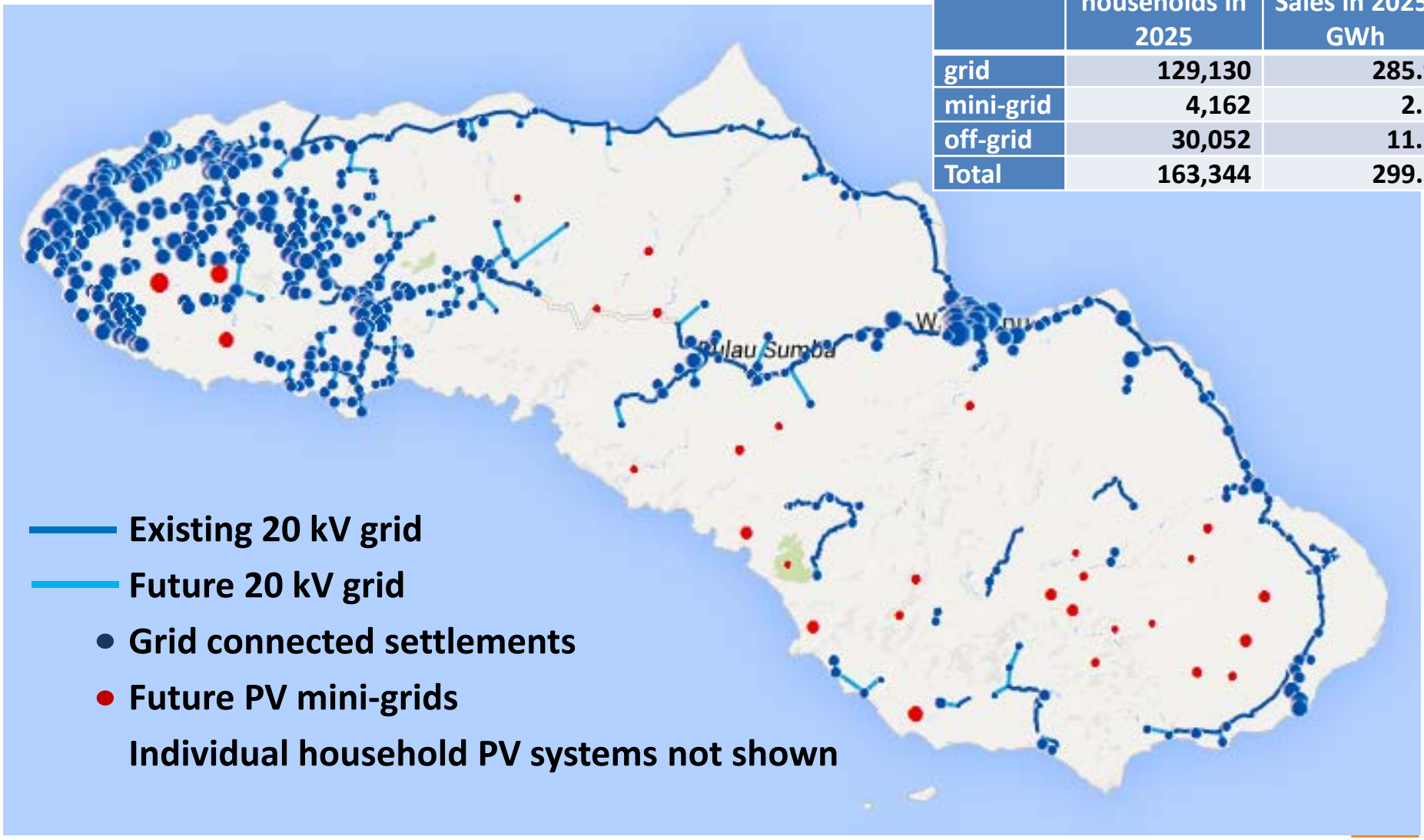
	Conventional Rural Electrification Planning	Geospatial Access Planning
Scale	Local	Regional / National
Orientation	Engineering design	Financial planning
Key Outputs	Infrastructure specification	Prioritized investment plan
Technology selection	Ad hoc	Comprehensive & automated
Data requirement	Field studies	Census data
Planning Horizon	Static	Dynamic
Timeliness	Incremental (years)	Rapid (months)
Platform	Proprietary	Open

Current situation (~30% electrification)



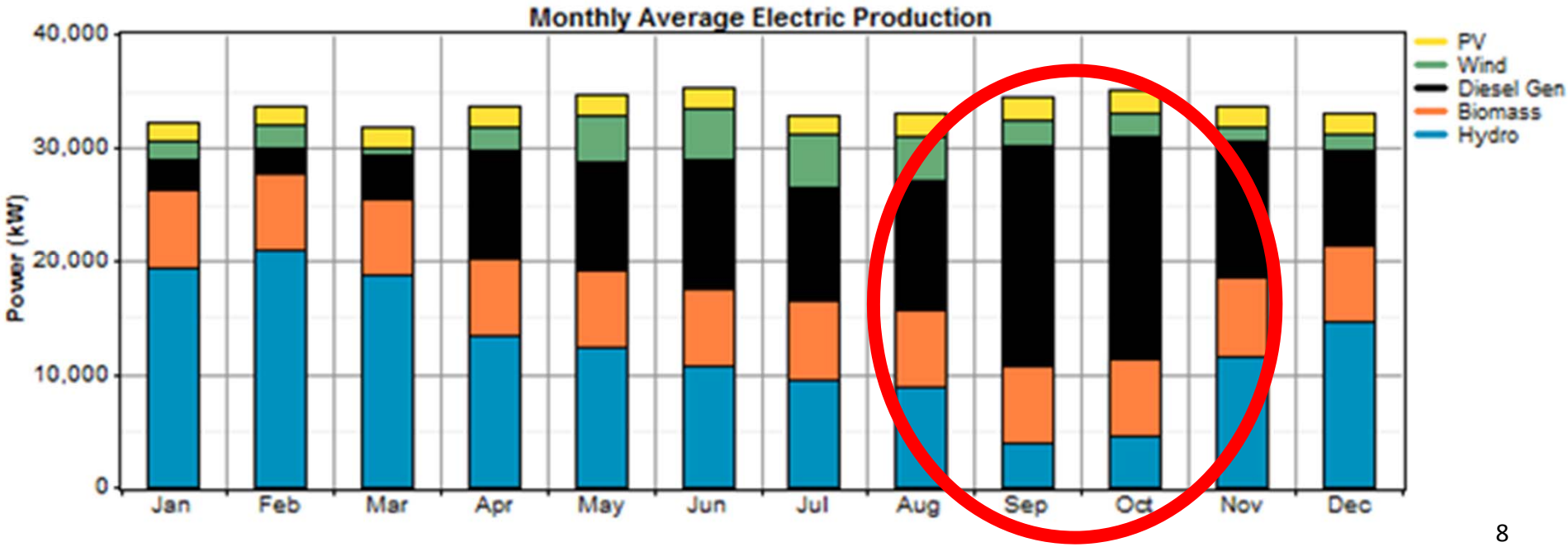
Situation in 2025 (95% electrification)

	Number of households in 2025	Sales in 2025, GWh
grid	129,130	285.9
mini-grid	4,162	2.1
off-grid	30,052	11.3
Total	163,344	299.3



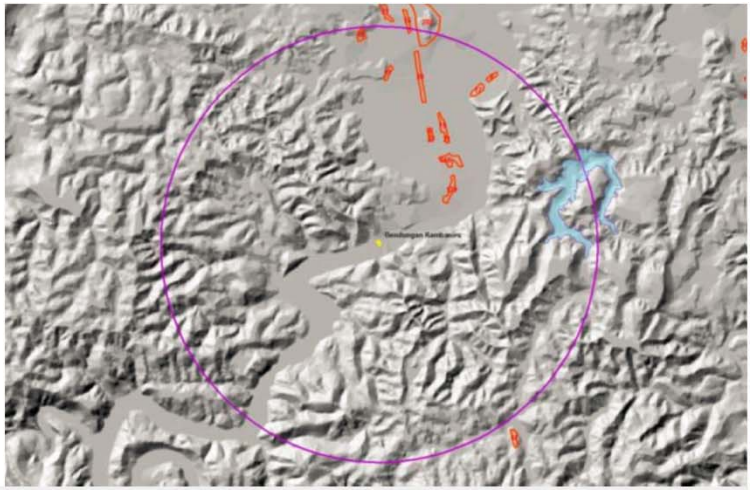
Least-cost generation analysis

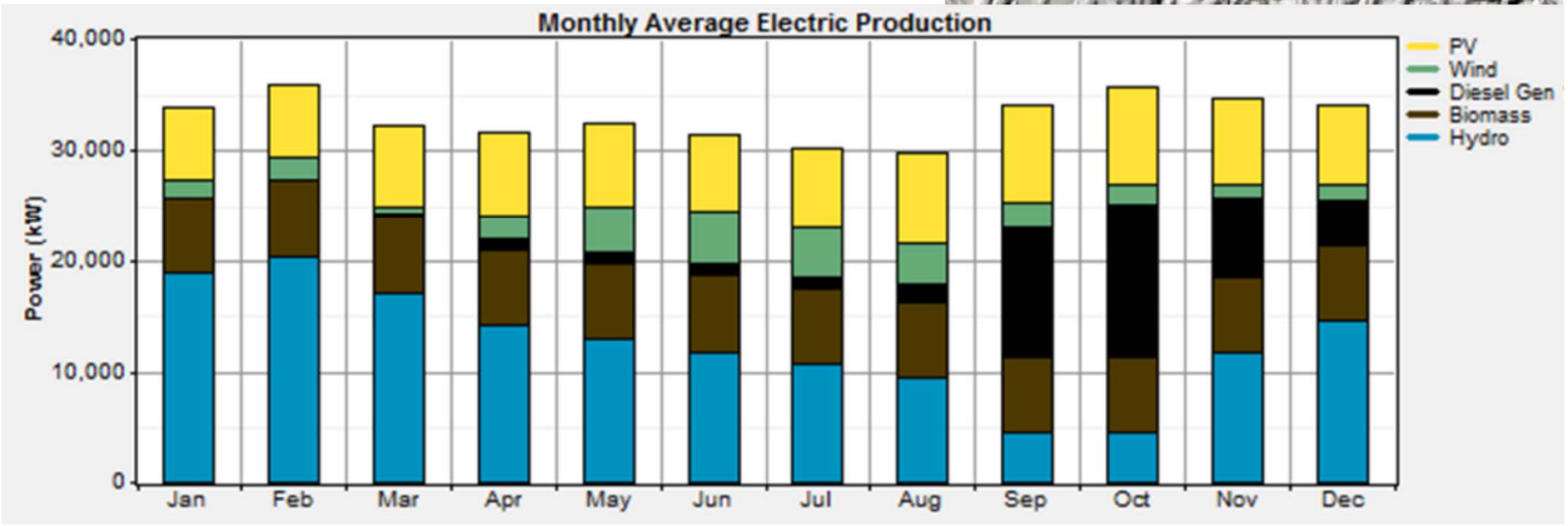
- 2025 grid peak demand 52 MW, 286 GWh annual consumption
- Maximum available capacity for each technology based on:
  - Maximum grid penetration: PV, wind
  - Resource availability: biomass, run-of-river hydro, storage hydro
  - Unconstrained: diesel
- Least-cost mix achieves 71% reliance on renewables
- Seasonal hydrology and wind availability forces continued use of diesel
- Total capital investment of USD 226 million for 97 MW of capacity



Pumped storage can increase renewable penetration

- Homer results indicate pumped storage could increase penetration to 89%
- Actual penetration could be higher through optimal operational planning



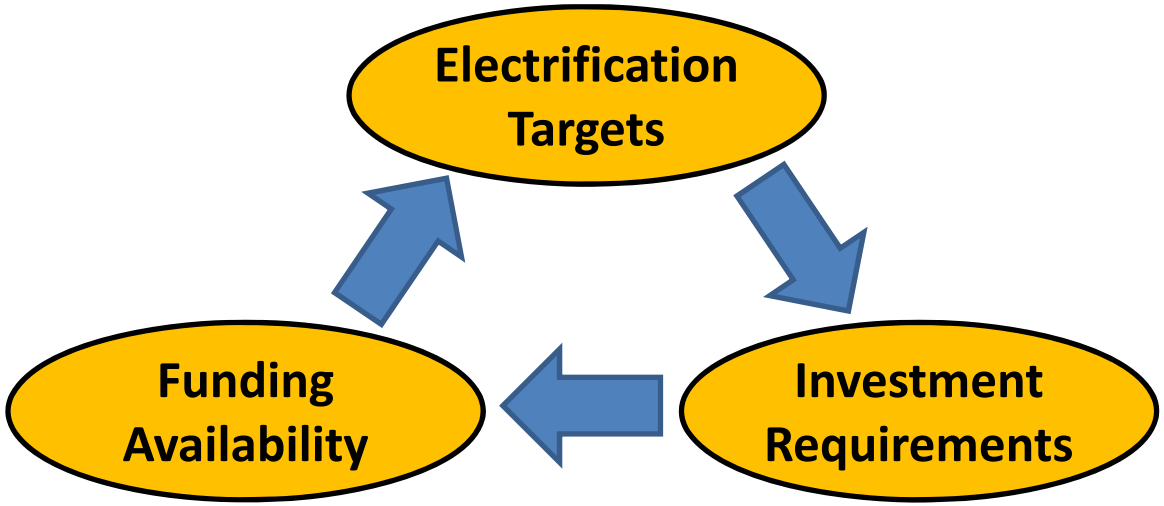


Transmission investment requirements

- Transmission needs determined from 2025 load flows
  - Reduced system representation
  - Scenarios reflecting variability in resources
- Analysis is underway

Electricity access planning is iterative

- Achieving 95% electrification requires large G, T&D investment
- If the funding is not available, the targets must (will!) be adjusted



Renewable power opportunities on Sumba

Technology	2025 Opportunity*	Comments
PV	> 10 MWp	Depends on control systems & pumped storage
Wind	> 10 MWp	Depends on control systems & pumped storage; wind measurement underway
Biomass	10 MW	Depends on land availability, wood productivity & fuel security; Pre-FS underway
RoR Hydro	7 MW	All large sites already identified for development
Storage Hydro	~10 MW	Geotechnical, conceptual design/cost, social & environmental studies required
Pumped Storage	~18 MW	Geotechnical, conceptual design/cost, social & environmental studies required
Mini-grids	30 systems 2.1 GWh p.a. ~4,200 households	Depends on institutional mechanisms; pilot projects under preparation

* Based on least-cost generation expansion plan with 95% electrification ratio

Total generation capex requirement of at least USD 300 million

Lessons learned

1. **Requires coordination**
   - Many stakeholders
   - Single plan
2. **Build stakeholder capacity**
3. **Determine funding needs and availability up front**
4. **Quality resource data is essential**
5. **Geospatial tools facilitate planning**
6. **Storage & control key for high renewable penetration**
   - System operations
   - Seasonality
7. **Improving electricity access requires investment in generation as well as T&D**

THANK YOU !

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