# Geospatial Planning for Universal Electricity Access in Indonesia

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# Indonesia's Electrification Ratio Per Province in end 2015


Source: Directorate General of Electricity, Indonesia

# Planning Under Uncertainty

- Electrification as a unfunded mandate
- Role of PLN versus local governments versus the private sector
- Very little information on household energy demand patterns
- Affordability and willingness to pay concerns
- Role of renewables?
- Need a flexible and adaptable planning framework

# Indonesia: Targets & Actions

2015-2019 National Medium Term Development Plan (RPJMN): 96.6% electrification ratio by end of 2019

National Electricity Plan 2016-2035 (RUKN): 99.35% electrification ratio by 2020

Bright Indonesia Program (Program Indonesia Terang)

Prioritize 6 provinces in Eastern Indonesia (Papua, Papua Barat, NTT, NTB, Maluku, Maluku Utara)

Three-pronged approach to reach the last mile:

- Grid extension
- PV Mini grid/off grid
- Solar home systems

ADB is assisting with least cost geospatial electrification planning for **Papua, Papua Barat, NTB**

50 YEARS

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# Planning Process Features (1)
# Grid Vs Off Grid?

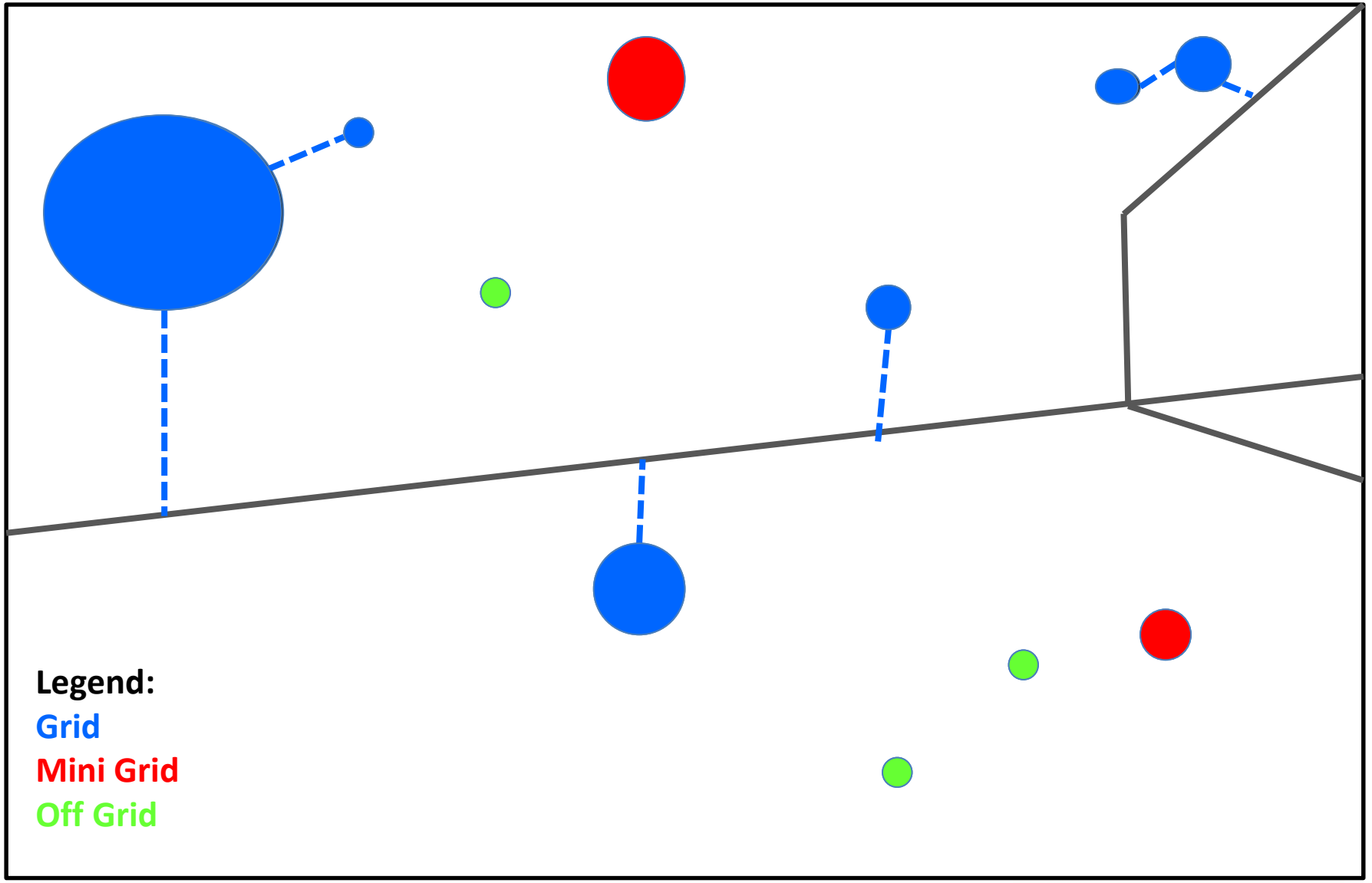
Utilize Network Planner® to consider options for Grid Extension, PV mini grids and solar home system

Determines capital and operating costs for each region and type of technology

It is an ECONOMIC approach and not an engineering approach

Note:
Website address for Network Planner®
http://networkplanner.modilabs.org/

# The Network Planner Algorithm Process



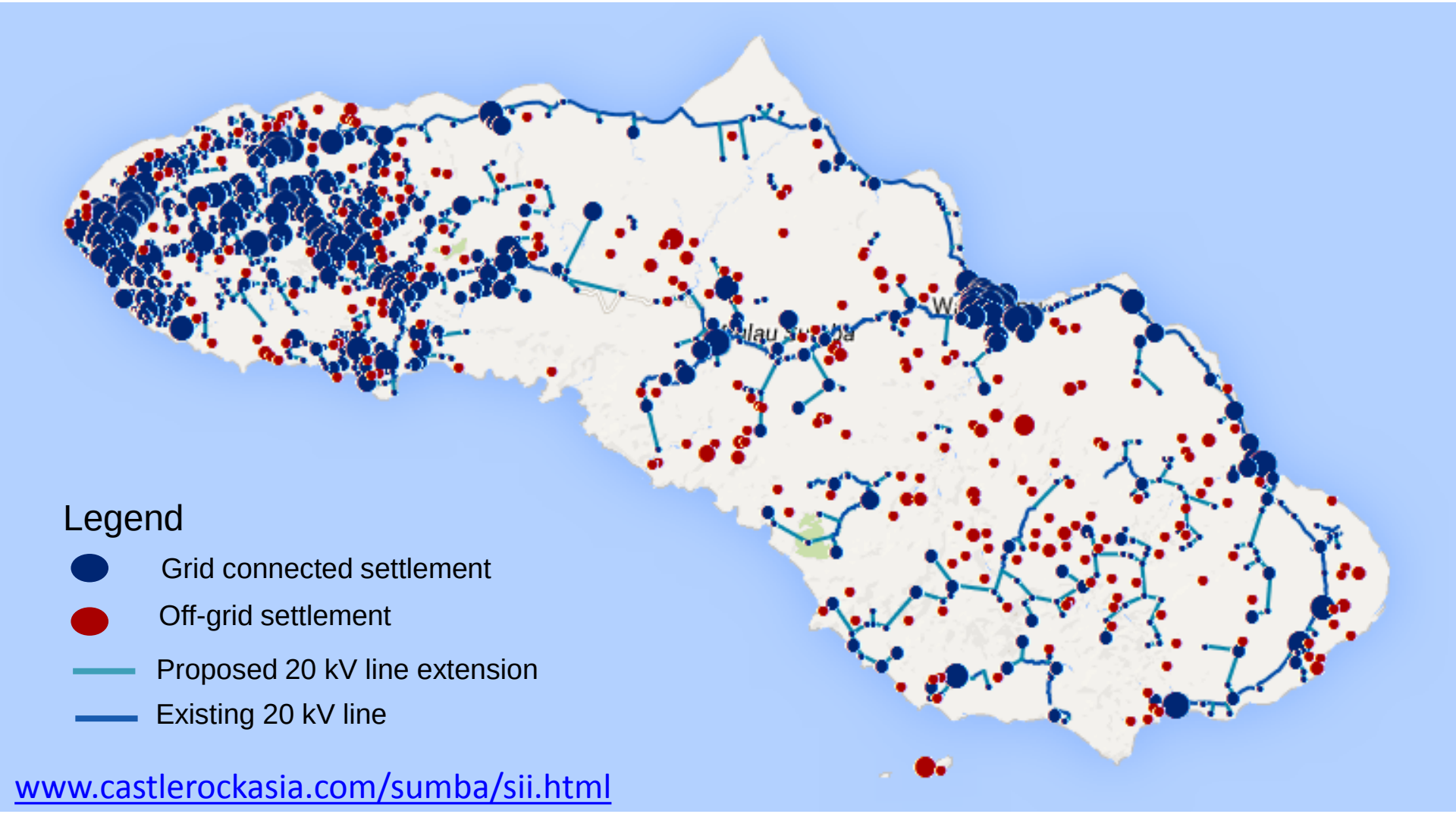
# Planning Process Features (2)
# A Geospatial Approach

Takes into acount actual settlement patterns and proximity to the existing grids

Based on publicly available satellite imagery and maps

Selects the lowest lifecycle cost technology to serve the greatest number of customers

# Sumba Least Cost Electrification Result (1)




www.castlerockasia.com/sumba/sii.html

# Sumba Least Cost Electrification Result (2)

## Investment needed

| | 71% renewable* | 87% renewable |
|---|---|---|
| Mini-grid & Off-grid | 42.8 | 42.8 |
| Grid | | |
| - Generation | 215.9 | 434.9 |
| - Network | 171.9 | 171.9 |
| - Other** | 12.9 | 19.5 |
| **TOTAL** | **443.5** | **669.1** |
| **Total per household** | 2,661 | 4,014 |

Values in USD million except for Total per household which is in USD.
* The 71% RE refers to the portion of grid supply produced by RE under the base case with 10MW storage hydro, while the 87% with pumped storage case
** Others represent an estimate of the cost of a control system and other studies and implementation activities. Assumed to be 3% of all grid capex

## Sales estimations

| | Number of households in 2025 | Sales in 2025, GWh |
|---|---|---|
| grid | **138,670** | **290.0** |
| mini-grid | **17,208** | **6.5** |
| off-grid | **10,810** | **1.4** |
| Total | **166,688** | **297.9** |

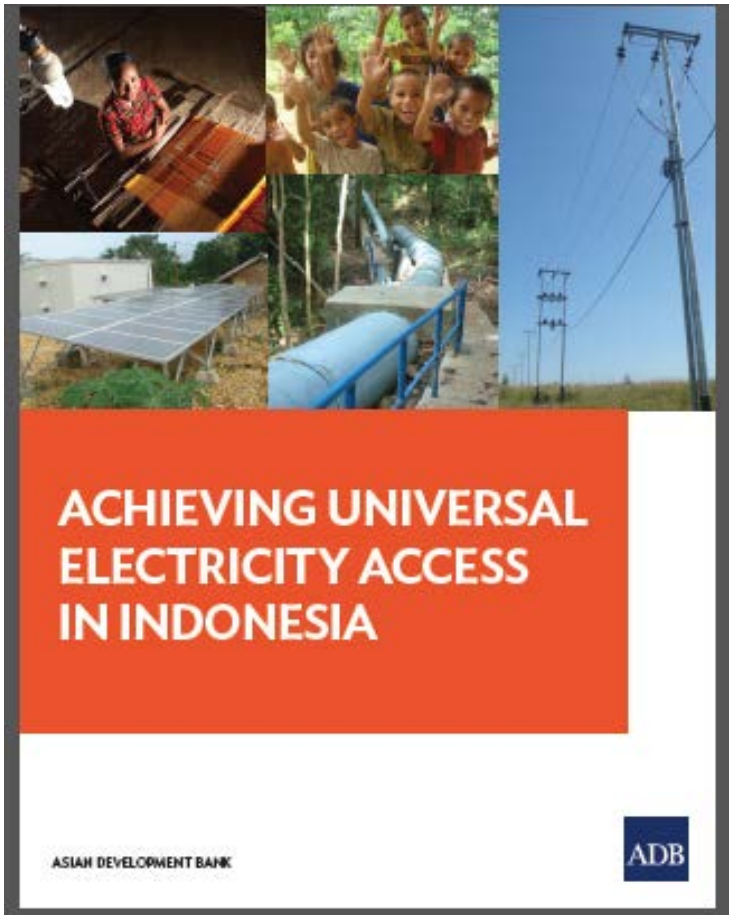
# Technical Challenges : Identifying Settlement Nodes

| Challenges | Solutions |
| --- | --- |
| Old maps or lack of settlement details | Use satellite imagery |
| No satellite imagery available, or available with poor quality | Use multiple sources: Google Earth, Bing Maps, Nokia HERE |
| Satellite imagery needs to be processed to identify settlements | • Machine learning is possible but requires ground truthing and calibration<br>• Manual rooftop tagging with training and quality control is possible |
| Roof top tags need to be aggregated into settlements | “Proximity Criterion” applied with reasonable results |


# Settlement Nodes Identification Process

# Salient Aspects of the Planning Approach

- Geospatial Least Cost Approach
- Integrates grid extension and off-grid options
- Integrates engineering and economic considerations
- National utility to focus on grid extension
- Micro-IPP (concessions) for off-grid areas
- Initial rollout in the eastern Provinces of the country
- National utility is very involved with the analysis and roll out
- Approach trialed in Sumba, now being rolled out in all eastern provinces.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The Government of Indonesia
& Asian Development Bank
ADB TA 8287-INO: Scaling Up Renewable Energy Access in Eastern Indonesia
Final Report
31 December 2015

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Thank You!

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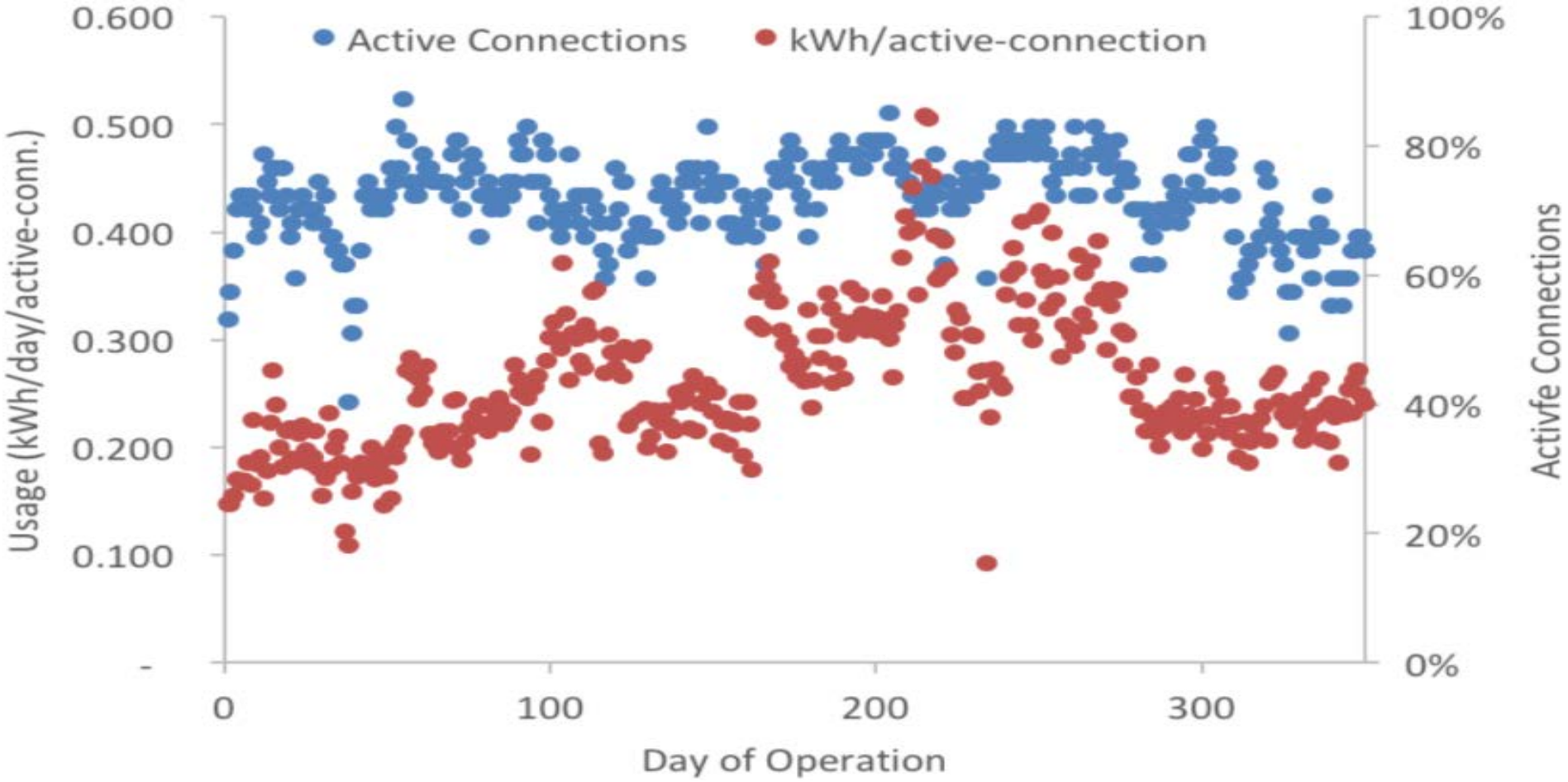
# Social Challenges : Promoting Productive Use of Electricity

# Electricity consumption: experience from Indonesia

- Electricity consumption and productive utilization constrained by:
  - Electricity tariff is NOT the constraint
  - Knowledge / availability of technologies that fulfill local needs/opportunities
  - Capital cost of equipment
  - Lack of access to markets for goods
  - Lack of capacity

- In the absence of opportunities to invest in productive uses, households optimize own-consumption

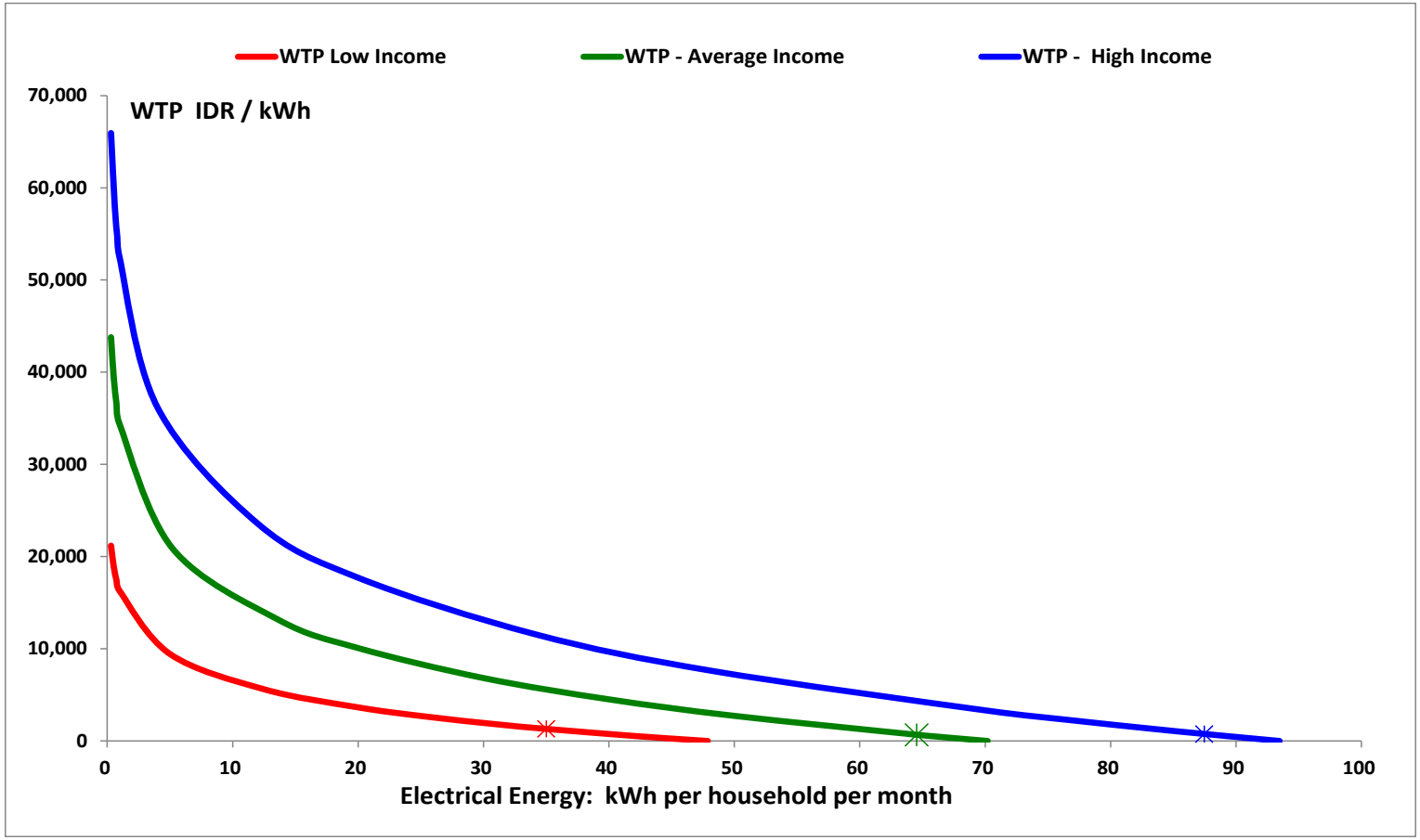
# Consumption pattern at Danau Sentani communities (in Papua Province)



# Solution : to provide more than just electricity but also promote livelihoods

- Thorough assessment of community assets, capabilities and productive opportunities
- Provision of capital
- Access to market
- Capacity building for communities

# Sample: Sumba's household WTP for electricity




* Indicates the average monthly consumption per household in that group