kerja sama jerman
DEUTSCHE ZUSAMMENARBEIT

Implemented by:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

In cooperation with:

ENERGI DAN SUMBER DAYA MINERAL

Directorate General of New, Renewable Energy, and Energy Conservation

SUSTAINABLE ACCESS TO ELECTRICITY

Objectives

The general objective of this Monitoring & Evaluation activity is to elaborate lessons learned based on previous rural electrification programmes and issue recommendations 1) to maintain the electricity service of existing rural electrification systems and 2) to raise the sustainability of future programmes based on these findings.

Specific Objectives
To draw and analyze the data and information on:

- The operational status
- Management and costs structure
- Involvement and engagement and gender mainstreaming
- Impacts on the social, economic and environmental aspect

Methodology

Methodology and the evaluation process

A. Sampling selection: purposive sampling considering operational status, battery types, management setup, location within ELREN's working areas
B. Tools development
  - Quantitative - Questionnaire for 22 sites targeting operators
  - Qualitative - Focus Group Discussions (FGD) in 8 sites with local communities and village administrations
C. Training and try-out with enumerators - 26 students of The Polytechnic Kupang and 4 lectures
D. Data analysis process - triangulations and internal discussions with rural energy experts
E. Problem Root Cause analysis
F. Program Evaluation

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Overview Sites

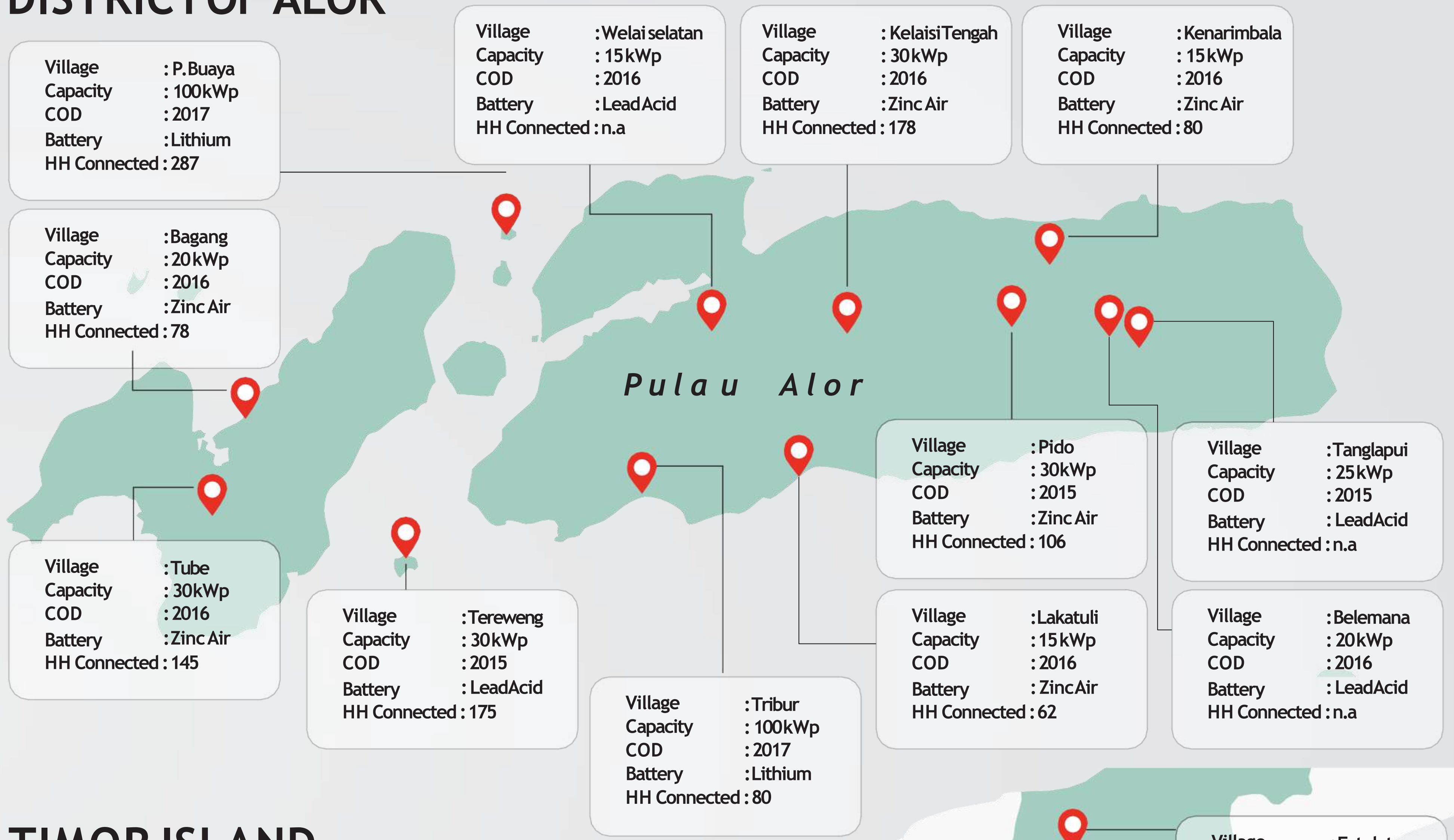
Livelihoods and Socio-Economic Setting

The main livelihoods of these villages are **farming and mix of farming, plantation, fishing, woodwork, ikat weaver and trading** (18 sites) **and fishing** (4 sites). Respondents in 21 sites acknowledged their monthly income is **lower than IDR 1 million**. The exception is Pulau Buaya, which is closer to the main city and has an abundance of fishery and marine products. The average population of all sites is 200, with the lowest is 34 (Erbaun) and the highest is 629 (Tribur).

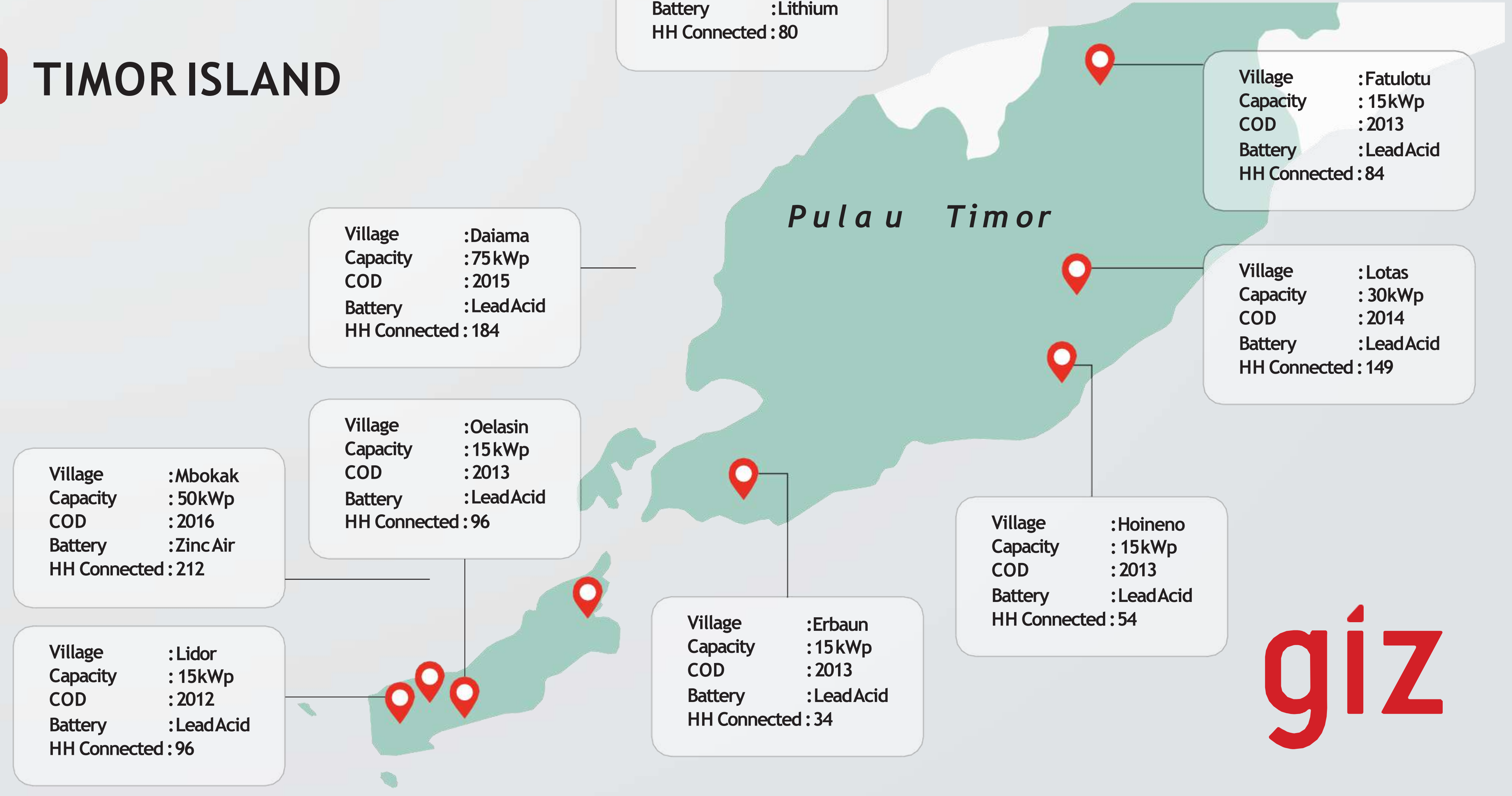
Accessibility (access to road and communication)

Most locations have good accessibility either by road and sea transportation. However, for land transportation, four-wheel-drive cars are required - especially for Alor and Kabupaten Kupang. In total, 18 locations can be **reached by land** (6 sites with limited access) and 4 sites could **only be reached by sea** (boat). Most locations have either Telkomsel or Indosat signals with quality varied from **GPRS to 4G**. Only Fatulotu in Kabupaten Kupang has no access to communication.

DISTRICT OF ALOR



TIMOR ISLAND



SOUTH SULAWESI

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Achievements of Rural Electrification Program

Through government-funded rural electrifications programmes close to **700 RE-powered village electrification systems** have been installed between 2012 and 2017

- **More than 75,000 households** connected providing opportunity for economic growth
- Minimum of **2,000 jobs** was directly created in remote areas on the village level.
- At least **9,730 income opportunities** were created during planning and construction **(10 jobs per system on average)**.
- Growing opportunities for **skilled employment** through Engineering, Procurement and Construction (EPC) service companies.

How is Energy Access Measured

Multi-tier matrix measuring access to household electricity

	TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Capacity	NO ELECTRICITY	1-50W	50-500W	500-2000W	>2000W	
Duration	<4 Hours	4-8 hours		8-16 hours	16-22 hours	>22 hours
Reliability	Unscheduled outages				No Unscheduled outages	
Quality	Low Quality			Good Quality		

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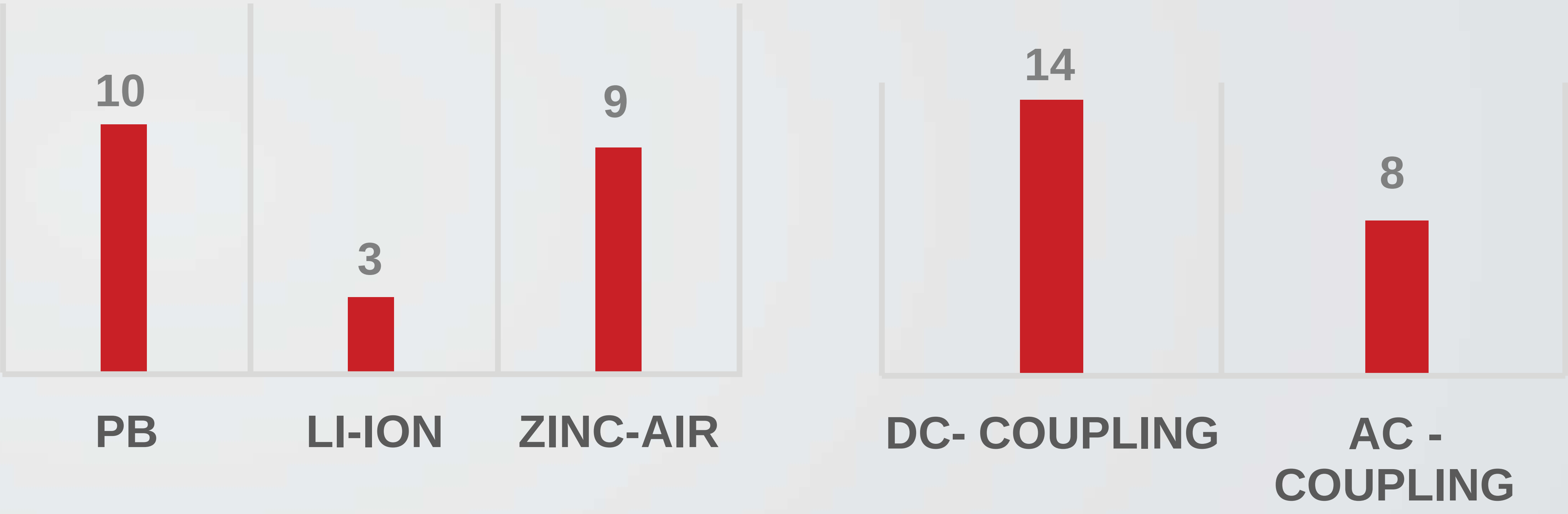
Findings and Lessons Learned

1. Technical findings
2. Post-installation managements
3. Social, Economic, Environmental Impacts
4. Program level evaluation

Study sampling consisted of 10 PB, 9 Zinc-air battery and 3 Lithium battery sites. The study concluded that both Zinc-air and Lithium batteries have disadvantages compared to PB batteries.



ALMOST 60% of the sampling are DC-Coupling

11 SITES were ever visited by Endev team in the past

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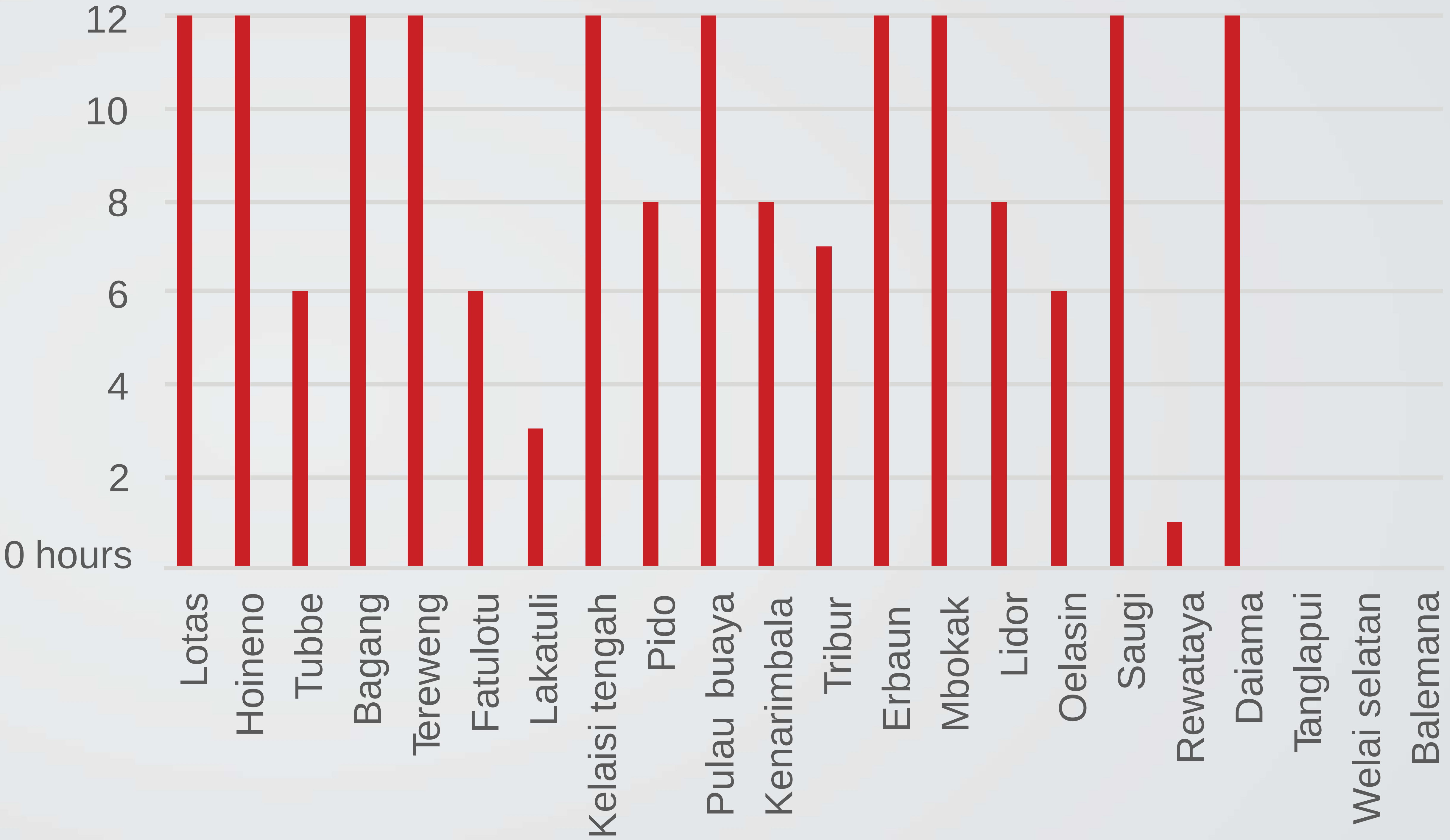
Findings and Lessons Learned

Benchmark of service
between 6 pm - 6 am (12 hours -> 24 hours)

- Ten locations (45%) served longer than 10 hours each day
- Five locations (23%) served up to 6 hours
- Four locations (18%) served between 6-10 hours
- Three mini-grid (14%) have stopped operating



?

1 Are the mini grids providing electricity continuously, reliably and according to the requirements of the villagers?

2 How are the PV mini grids performing from a technical point of view, years after their installation?

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Technical Scoring of all Sites Based on Functionality, Safety and Accessories Aspects

1. Scoring method

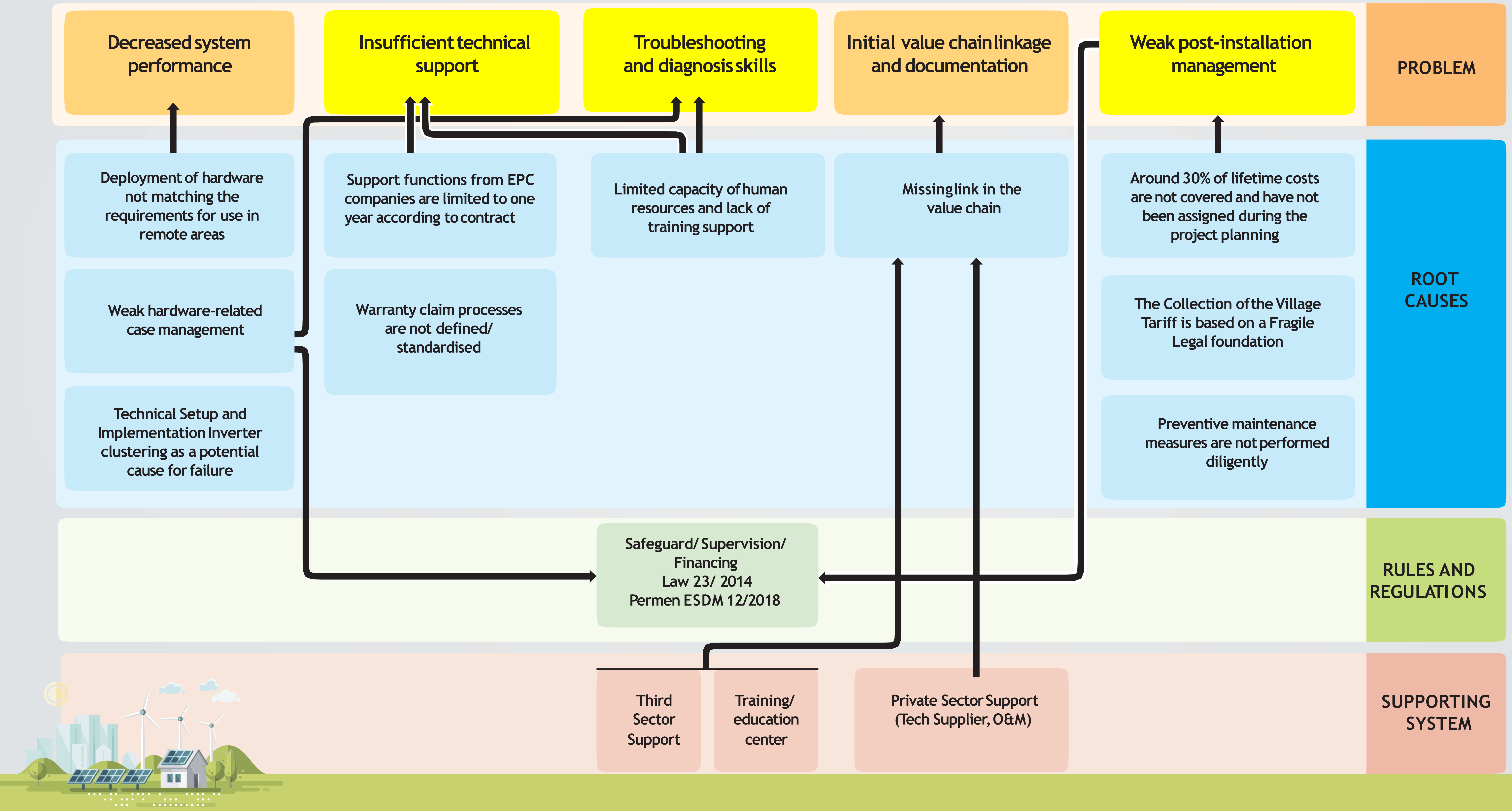
Functionality	Fully functioning	Light restrictions	Heavy malfunctions	Total malfunction
Essential components	3	2	1	0
Safety components	3	2	1	0
Ancillary components	3	2	1	0

2. System performance

According to the scoring method under Step 2, values are given for each system.

- A score of 2-3 categorises a system as functional (with minor restrictions).
- Values of 0-1 classify a system as not safe to operate.

Findings and Lessons Learned - Root Cause Analysis



Lesson Learned - Root Cause Analysis

RULES AND REGULATIONS

SUPPORTING SYSTEM

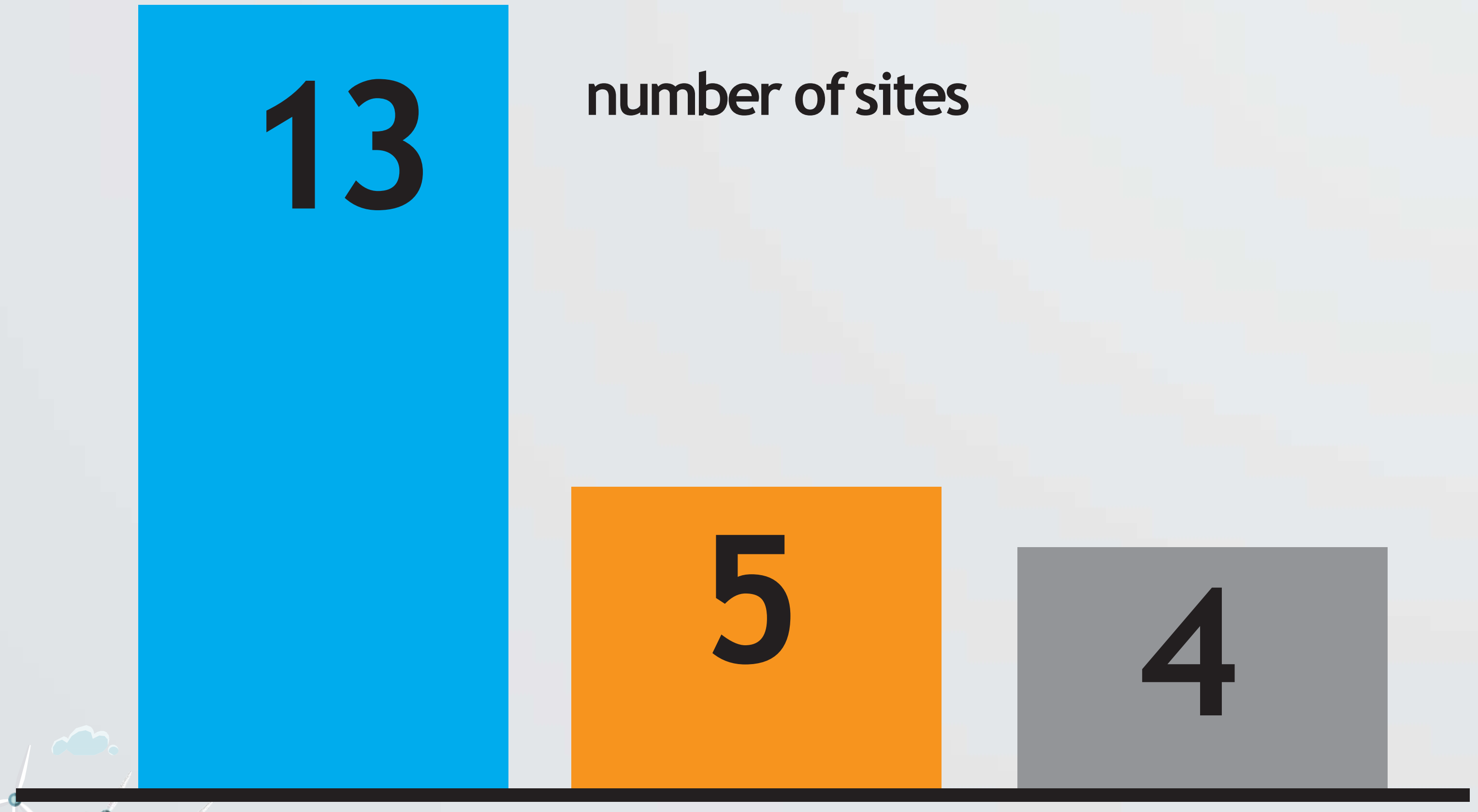
PROBLEM 2: Insufficient Technical Support Available

- Root cause 1: Support functions from Engineering, Procurement, and Construction (EPC) companies are limited to one year according to contract
- Root cause 2: Warranty claim processes are not defined/ standardised and operators do not know how to report or claim a hardware replacement

Contributing factors:

- Service limitation pre-defined by contract
- Support by O&M/ Turn-key EPC companies has not been defined and is not funded for by asset owners

Types of the Assistances from EPCs During one year of guarantee



- Assisted malfunction diagnosis and troubleshooting by call(cabling)
- Diagnosis and troubleshooting, devices/ spareparts replacement, buying tools and measuring instrument
- Never

Lessons Learned - Root Cause Analysis

PROBLEM 3: Troubleshooting and Diagnosis Skills are Needed.
On the Village-Level, a Gap Between Technology and Skills Persists

- Root cause 1: Limited capacity of human resources and lack of training support

"There is no special training. Technically I was only taught how to turn off and turn on the lights and cleaning cables and PV panels", explained Kasim from Bagang who has a Bachelor of Indonesian Language from Muhammadiyah University, Kupang. Kasim, who also works as a Language Teacher in his village's Vocational School. He admitted that he only ever cleans the PV mini-grid area twice a year. He does not have a background in both skills and knowledge about electricity and PV mini-grids.

RULES AND REGULATIONS | SUPPORTING SYSTEM

Contributing factors:

- Only one operator ever trained in government training provider. In the past, there was a Patriot Energy program and PPSDM conducted trainings for free. But both have stopped.

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Recommendations - PROBLEMS 2 & 3

Urgency **Recommendation**

<u>Training Centers / Knowledge-Hubs in Eastern Areas:</u> Government to set up new or leverage existing training programmes at the provincial level, accessible for operators and local technicians e.g. working with educational institutions or to allocate funds for training and certification. While operators can be funded through village funds.
-> e.g. BLK, Polytechnics, Vocational Education

<u>Enabling Provinces (minigrids to unlock economic potentials):</u> Increase the transfer of knowledge on technology and use of to the provincial level. The systems' potentials for productive use of energy should be unlocked to enable economic growth in remote areas through a coordinated approach.

<u>Private-sector Engagement:</u> Engage the private sector for corrective maintenance by contracting O&M / EPCs / turn key companies with service level agreements (e.g. based on kWh provided) from the beginning. This also will answer the problem of linkage to the suppliers for village operators.

<u>Market-enabling environment:</u> Create market-enabling environments for private sector market niches to grow and develop sustainably, e.g. for technical services / O&M off-grid / service & repair, creating employment demands and job creation. To overcome the remoteness, strategies such as purchasing services from key partners, O&M services from EPC beyond building and transfer and develop a network system could be the solution.

Immediate Medium-term

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Lessons Learned - Root Cause Analysis

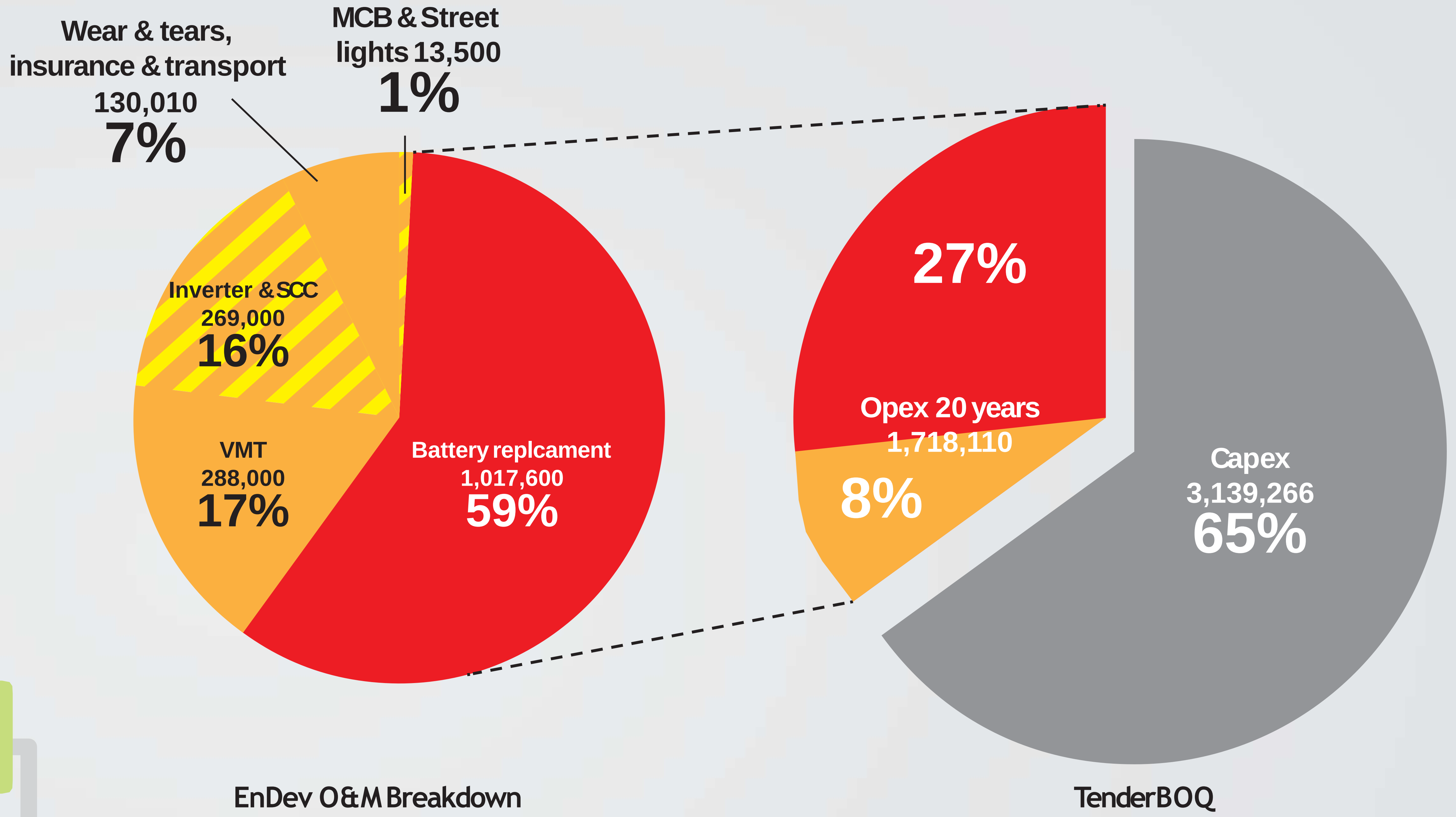
PROBLEM 5: Weak Post-Installation Management Threatens the Lifetime of the Installations and the Sustainability of the Electrification Programmes

- Root Cause 1: Around 30% of the lifetime costs are not fully assigned during the project planning
- Root Cause 2: The collection of the village tariff is based on a fragile legal foundation
- Root Cause 3: Preventive maintenance measures are not performed diligently

RULES AND REGULATIONS

Contributing factors:

- **Program planning and leverage from the provincial government**



- National ↑↓ Central Gov / Local Gov
- Not Covered
- Costs covered through local village tariff / fee collection
- Depends; various factors; operator, relationship with EPCs / suppliers, financial management.

Lifetime costs

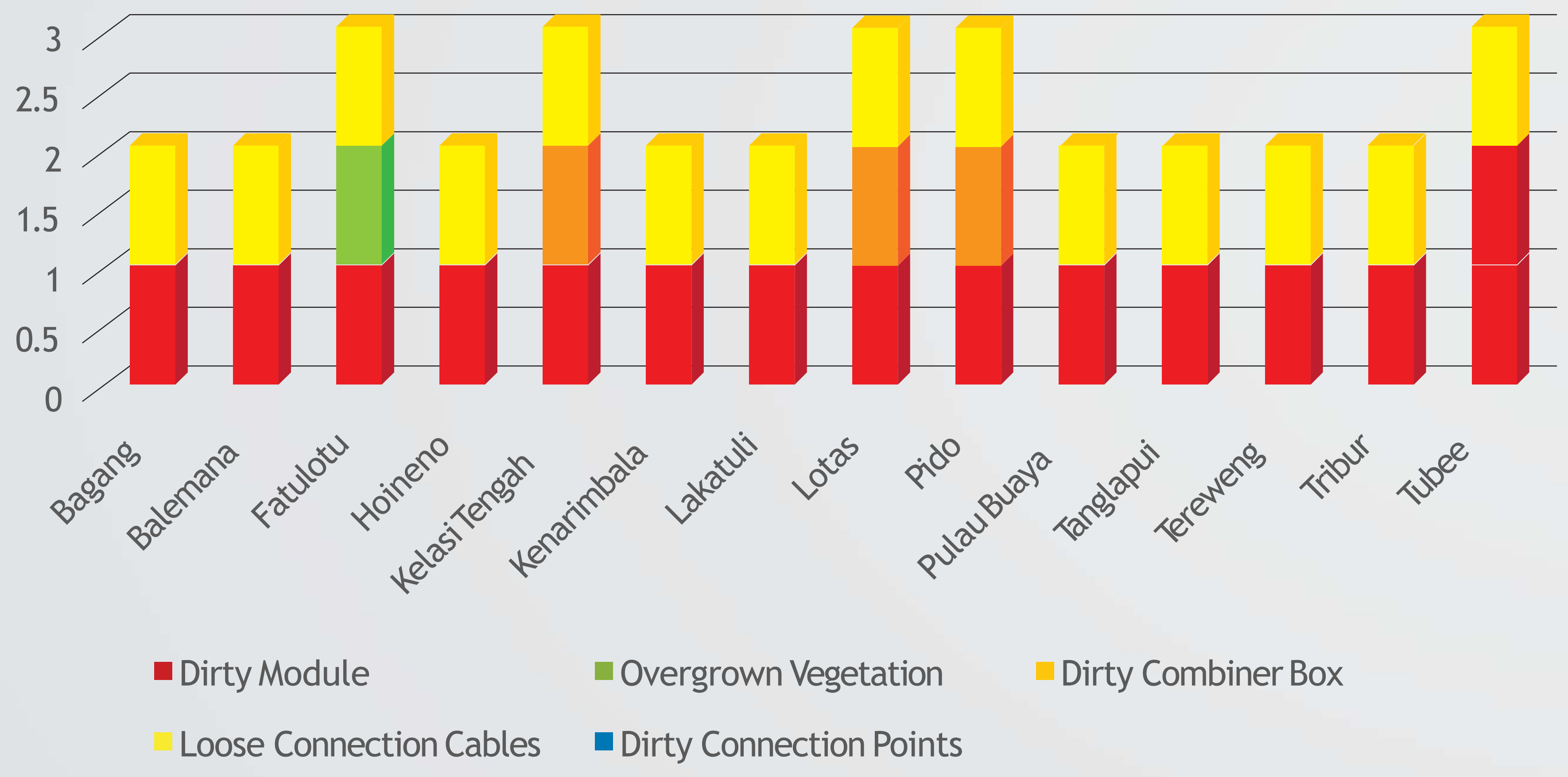
73% covered

27% not covered

Lessons Learned - Root Cause Analysis

Preventive Maintenance

Despite being able to explain their job well, Preventive maintenance is hard to keep because “operator” is not their main job



Corrective Maintenance

On the village level, it was observed that operators generally fall short of comprehensive troubleshooting skills. Nevertheless, the survey could document the following action initiated by operators in order to fix system malfunctioning:

- contacted EPCs or installers (18 sites)
- consulted ESDM staff (4 sites)
- seek help from National owned Electricity Company (1 site)
- consulted the head of the village (1 site)

KEY TAKEAWAY

“It needs training programmes for operators but also an overarching technical support structure to assist operators in their job”