NZMATES

Lessons Learned on Sustainability of Renewable Energy Mini Grids

INDO EBTKE Connex 2021

NZMATES - Overview

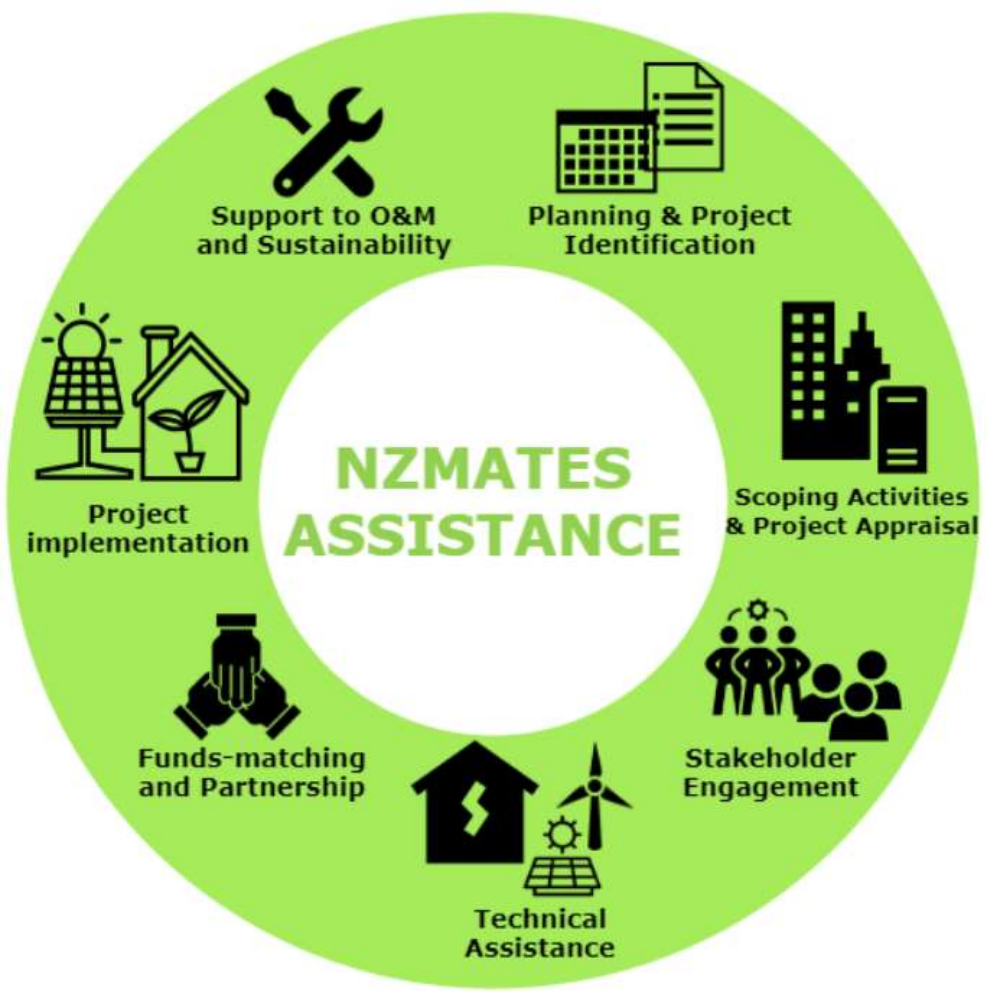
NEW ZEALAND - MALUKU ACCESS TO RENEWABLE ENERGY SUPPORT

NZMATES works in Maluku to support the development of a vibrant renewable energy sector. NZMATES aims to assist Indonesian energy stakeholders to deliver **sustainable, reliable, and affordable** renewable energy project to the people of Maluku Province.

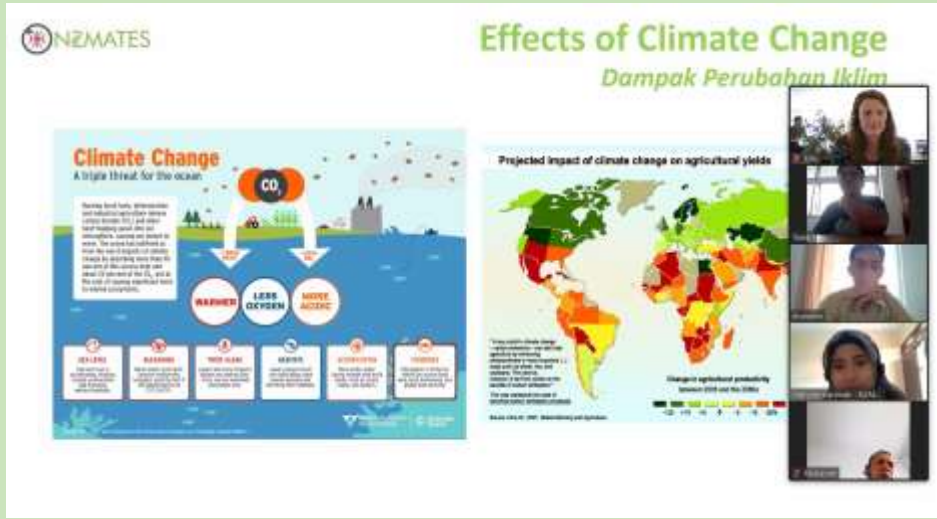
https://nzmates.org/

NZMATES - Overview

Project Assistance



Capacity Building



Sustainability Study Solar PV Mini-grids in Maluku

- NZMATES visited 15 PLTS in Maluku Province during 2018 - 2019.

Technical and socio-economic assessments

Root cause analysis

- Causes of failure mapped into sustainability aspects: technical, economics, social institutional, and others

Suggestions are developed for each sustainability aspect in every project phase

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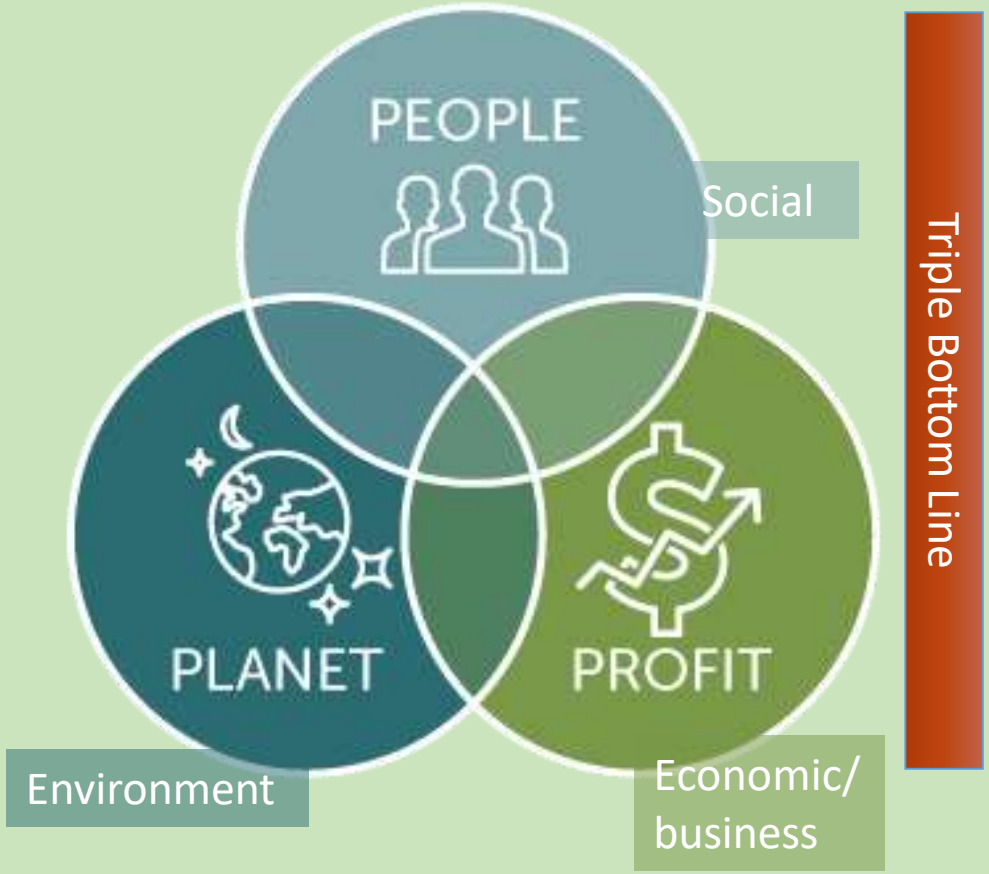

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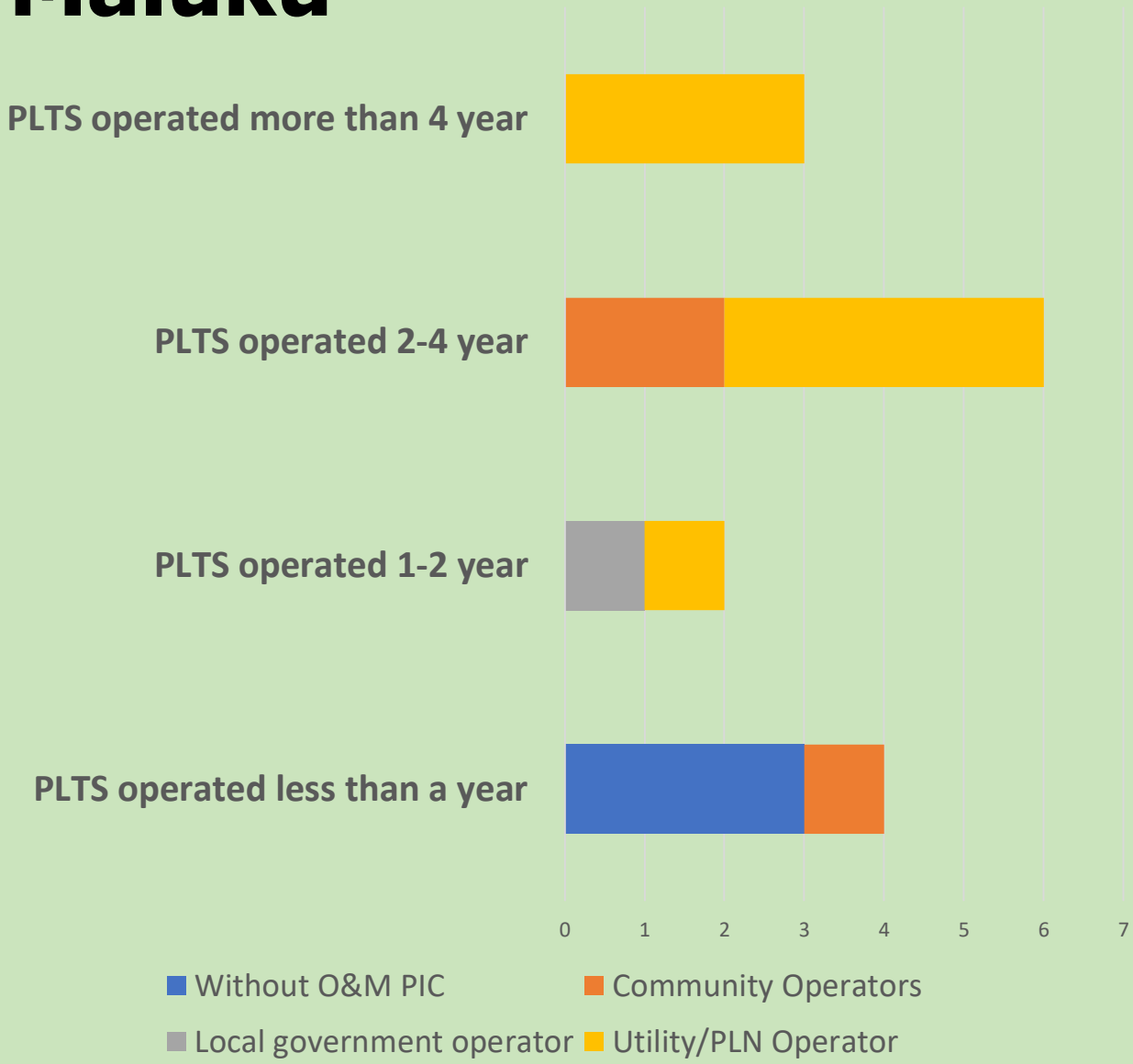
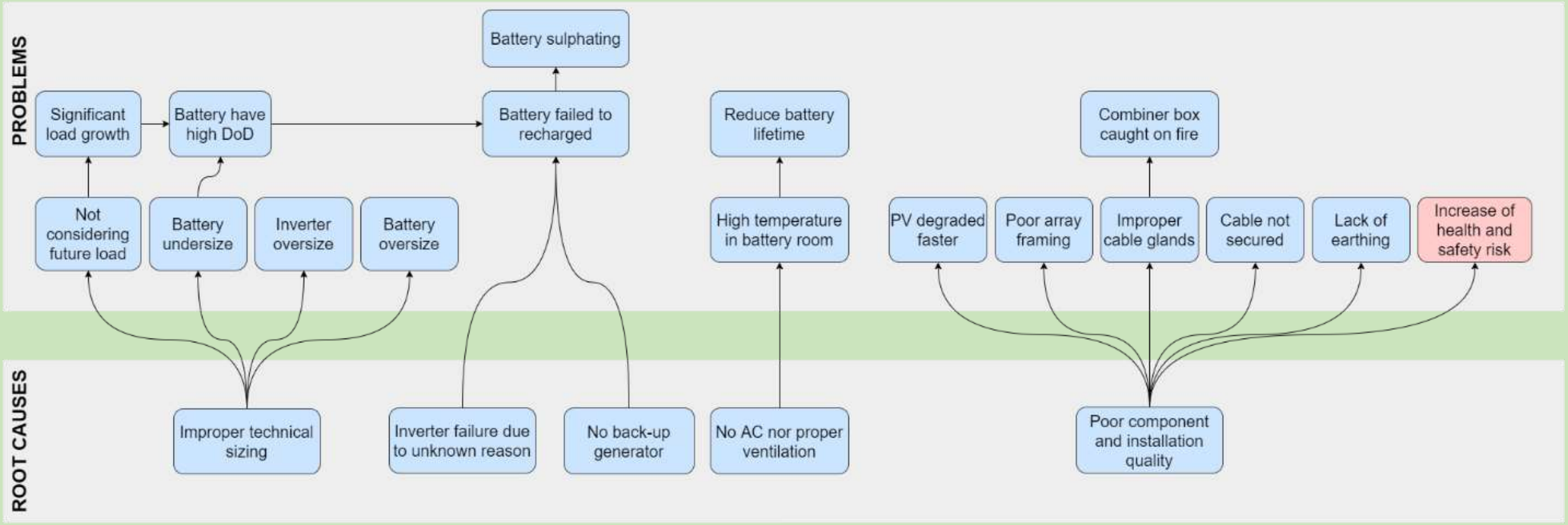


- NZMATES visited 15 PLTS in Maluku Province during 2018 - 2019.
- PLTS which operated using utility/PLN model has longer operation period.
- Most PLTS operated for 2-4 years.
- Shortest operation period: 40 days; longest operation period: 6 years.

Sustainability Study Solar PV Mini-grids in Maluku

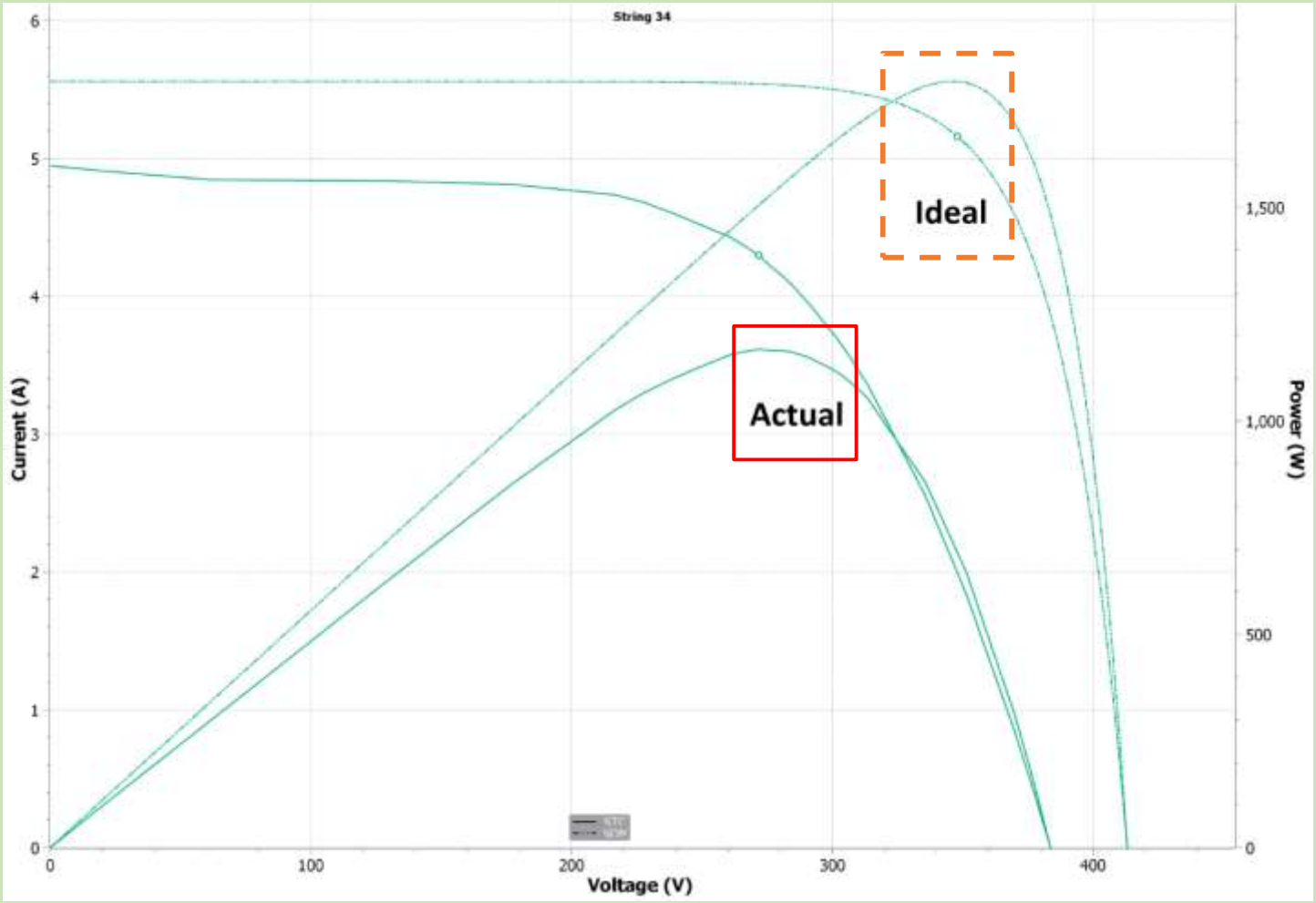
- Sustainability challenges in Maluku caused not only by technical factors but social, economic, institutional, and other problems.



LEGEND:

Social aspect | Technical aspect | Economic aspect | Institutional aspect

Sustainability Study Solar PV Mini-grids in Maluku



Source: IV Curve Testing Result in one of NZMATES assessment locations

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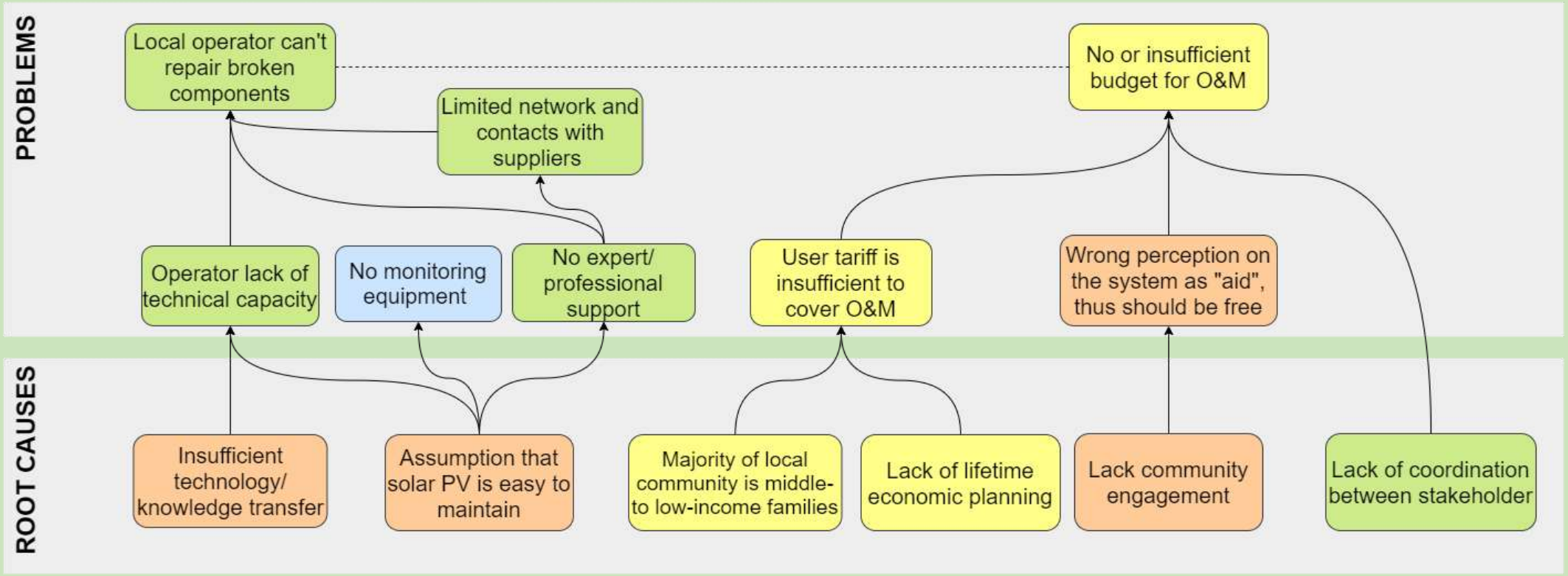
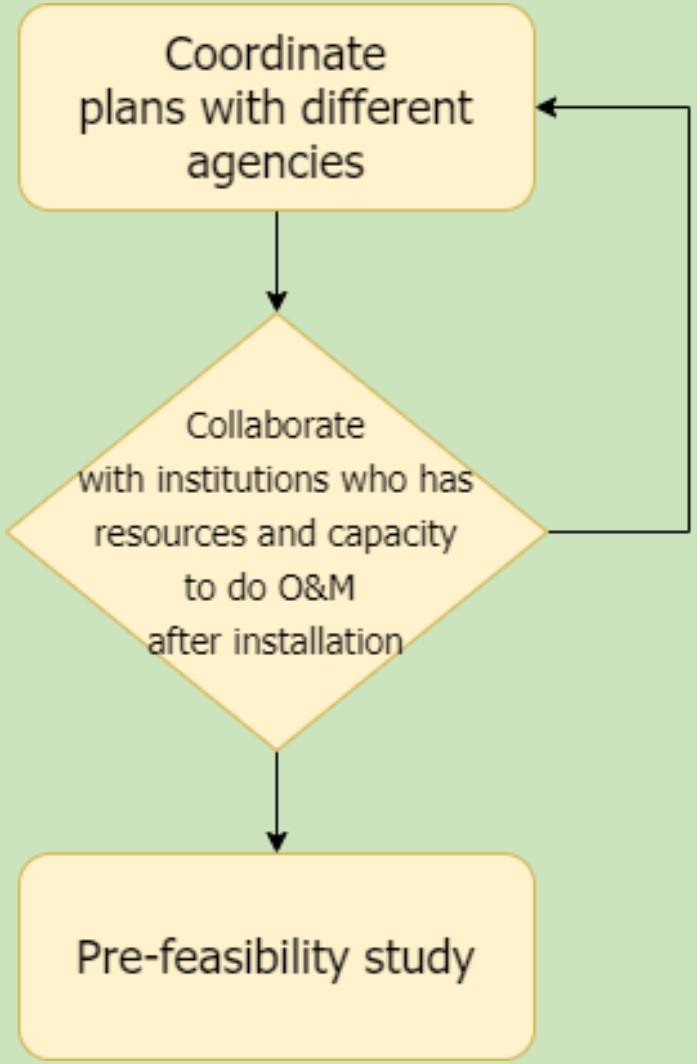


Recommendation



During scoping phase, project/asset owner and the O&M institution should make planning especially on these matters:

- How the O&M activities will be fund?
- How the field operators get support to get spare parts or components that need to be replaced?

O&M Institutions should have resources and capacity, such as:

- Have experience working with RE system
- Have engineers in place who have capability to perform regular O&M (preventive, routine, corrective and condition-based maintenance), performance testing, and troubleshooting.
- Have expert support in place in case system trouble cannot be handled by field engineers/operators
- Have plan and resources to procure spare-parts and components when it's needed
- The institution should have financial plans and resources to conduct O&M activities
- The institution should meet all legal requirements to conduct the O&M activities

Recommendation

- There should be a platform for energy stakeholders to discuss and collaborate, so the renewable energy planning and implementation is **synchronized** among stakeholders. Besides, coordination on data is important so all stakeholders have accurate information. For example, database on electrification.
  - Since there are RUED in each province, now is the perfect momentum to synchronize RUED planning and implementation.
- The coordination platform not only invite government institutions, but also PLN as government-owned utility company, and energy NGOs and think tanks.

Recommendation

- Conduct proper sizing and design
  - Define load profile
    - Use direct measurement, or load profile for location with similar setting.
    - Best practice is to have load profile with 15-minutes time step for over one month, at least.
    - Expected load growth once a stable electricity supply is introduced
  - Consider to extend battery lifetime by:
    - Having back-up generator
    - Install battery management system
  - Include O&M platform to monitor system performance (e.g. Scada)
- Calculate annual energy production
  - Include PV derating factor and annual degradation throughout system lifetime (20 years).
- Develop planning for component end-of-life, especially for component that need replacement less than 20 years.
- Conduct feasibility with other technology/fuel options to find optimum techno-economic configuration.
- Ensure all components meet minimum standards.

Recommendation

PREPARATION

☐ Contractor develop project plan, including documents such as:

- ☐ Installation milestones
- ☐ Health and safety planning
- ☐ Quality control
- ☐ Contractor submit regular progress report (at least monthly)
- ☐ Supervision conducted to check quality standard

INSTALLATION SUPERVISION

☐ Installation supervision
☐ Identify location, designer, and project contractor information.
☐ Check the arrival of equipment by using a checklist of goods or Bill of Quantity (BOQ).
☐ Document checking: Check if the following document is ready for implementation

- ☐ Technical specifications of Solar PV, storage and mini-grid equipment
- ☐ Certificates of main equipment
- ☐ Lay out diagram/ equipment layout
- ☐ Single line diagram
- ☐ Fire extinguisher layout
- ☐ Grounding layout
- ☐ Operation and Maintenance Manual
- ☐ Occupational Safety and Health-K3 Guidelines

☐ Regular inspections every 4-5 weeks to check progress, milestones, HSS good practice, etc.
☐ Visual inspection (name plate) of installed /newly installed equipment without conducting any real measurements.
☐ Contractors should submit regular progress reports to the supervising agency describing progress against schedule and milestones.
☐ Conduct certified inspection.
☐ Ensure certified testing and commissioning.
☐ O&M Training from the contractor to O&M entity.
☐ Internal report on supervision of installation activity is developed after the testing and commissioning over.

Recommendation

Contoh BoQ

NO	KOMPONEN	ASAL NEGARA BARANG	TIPE/ MEREK	KAPASITAS / UNIT	NAMA PRODUSEN	VOLUME	SATUAN
1	Photovoltaic System						
1.1	Solar Panel	GERMAN		500Wp		5	set
2	Controller						
2.1	Grid Inverter	GERMAN		2.5 kWh		1	unit
2.2	1 set SCADA system	GERMAN				1	set
	dst						

Contoh Visual Inspection List

Module ID: _____ Inspector: _____ Date: _____

CHECKLIST: New Module

COMPONENT		DEFECT	Defect Present? No	Yes	If Yes, Score	Safety issue?
1. Label	1.1	Missing				
	1.2	Poorly attached				
	1.3	Information is missing				
	1.4	Incorrect spelling				
2. Backsheet	2.1	Delamination				
3. Junction Box	3.1	Faulty electrical connection				
	3.2	Cracks/breaks/gaps in housing				
	3.3	Sealant failure				
	3.4	Electrical polarity not indicated				
4. Wiring	4.1	Wire(s) missing or poorly attached				
	4.2	Too short and/or too thin				
5. Frame	5.1	Damaged				
	5.2	Adhesive/sealant failure				
6. Front Glass	6.1	Cracking				
	6.2	Scratches				
7. Encapsulation	7.1	Delamination				
8. Cells	8.1	Fake				
	8.2	Dummy pieces disguising missing material				
	8.3	Cracks				
	8.4	Partially covered				
	8.5	Scratches				
	8.6	Differently sized				
	8.7	Edge chips				
	8.8	All cells very shiny				
9. Cell Metallization	9.1	Fingers not connected to busbar				
	9.2	Not the same pattern on all cells				
	9.3	Fingers off of edge of corner of cells				
10. Cell Interconnection	10.1	Interconnection is discontinuous				
	10.2	Cells connected in parallel (counterfeit)				
	10.3	Poorly aligned and/or soldered				
	10.4	Cells connected in parallel (real cells)				
Defects are present suggesting module is used rather than new						
SUMMARY Indicate if any defects and safety issues are present and sum score						

ACCEPT: ☐ REJECT: ☐

Sinclair, K., and M. Sinclair. 2016. "Silicon Solar Module Visual Inspection Guide." Zayed Energy and Ecology Centre. https://www.engineeringforchange.org/wp-content/uploads/2017/09/Solar-PV-Product-Visual-Inspection-Guide.pdf.

Recommendation

Technical aspect

☐ Ensure regular O&M (preventive, routine, corrective, and condition-based maintenance) conducted properly.
☐ Expert technical support is available.
☐ Ensure certain spare parts are ready on the site, such as spare parts for:
- ☐ O&M modules
- ☐ MCBs
- ☐ Surge protection devices
- ☐ Cables
- ☐ Fuses
- ☐ Inverters

☐ Conduct inspection and safety checks in year 7, year 10 and year 15.
☐ Ensure key supplies are on site, which are:
- ☐ Warranty documents (in Bahasa Indonesia), including claim conditions and procedures, and contact details.
- ☐ Operating manuals (in Bahasa Indonesia) for all components
- ☐ Site inspection guide
- ☐ Measurement devices

Economic aspect

☐ Maintain good bookkeeping.
☐ Perform annual budgeting practices properly.

Institutional aspect

☐ Maintain proper documentation of financial mechanism, including user payment, and O&M budget.
☐ Ensure all employees, including local staffs, get full-time employment and salary.

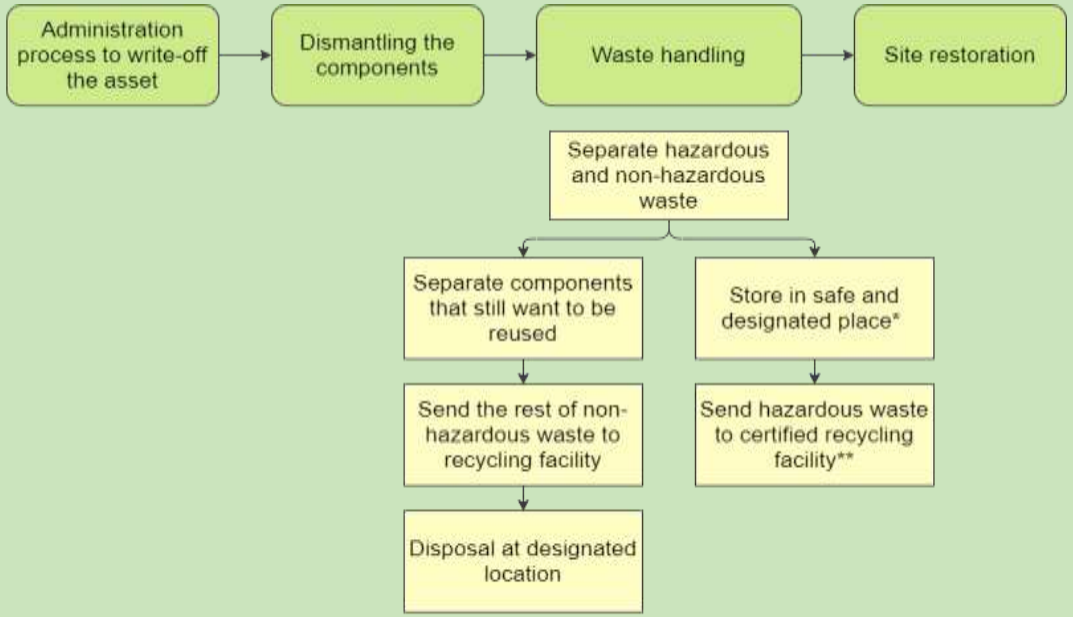
Social aspect

☐ Continue to engage with the community
☐ Ensure mechanisms in place to allow community to submit feedback regarding electricity service, and the O&M entity to respond to the community.
☐ Promote feedback mechanism so the community know how to submit feedback.

Other aspects

☐ Operators and other staff are equipped with enough knowledge of hazards and H&S procedures to safely operate the plant.
☐ Ensuring environmental management procedures are in place and that all operators know what to do in the case of an environmental incident.

Recommendation



*) Storage for hazardous waste should comply with regional and national regulations
*) Hazardous waste transportation should comply with regional and national regulations

- Asset owner – or the O&M institution – should
  - fulfil local and legal requirements related to hazardous waste management, including storage and shipping process.
  - collaborate with a party who capable and certified in handling hazardous waste.
- Site restoration aims to bring back habitat in areas affected by the power plant construction and operation. After the restoration, the site should be functioning the same as it was before the construction of the solar power plant.
- Site restoration includes but not limited to:
  - re-greening and covering the excavated holes
  - leveling the ground
  - normalizing waterways
  - cleaning the sites from used foundation and other materials.
- Site restoration may include monitoring period, a year after the restoration.

"When climate projects go wrong, **it's doubly bad**, because **it is a waste of money** and also **bad for the planet**

If it is a project that is supposed to reduce emissions, or a project that is supposed to help a population adapt, **this is like penalising them twice"**

– Brice Böhmer

Head of programmes at Transparency International

during interview with Financial Times on Climate Finance

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https://nzmates.org/

dintani@nzmates.org | info@nzmates.org