TAKING ONE LEVEL UP THE QUALITY AND PERFORMANCE OF SOLAR PV MINI-GRIDS: THE MSP INSTRUMENT

BACKGROUND

In Indonesia, since 2012 the Directorate General for New and Renewable Energy and Energy Conservation (EBTKE) launched an ambitious rural electrification programme using solar photovoltaic (PV) and battery technology, electrifying around 100 rural communities annually using 15kWp to 150kWp solar PV mini-grid systems, also termed as Photovoltaic Village Power (PVVP) or PLTS in Indonesian abbreviation. GIZ has been supporting this government initiative under the Energising Development (EnDev) Indonesia project, through an effective quality assurance instrument, the Mini-grid Service Package (MSP), to assess the technical quality as well as addressing the need of operational skills for the mini-grid installations.

"The MSP is proven to be a robust, cost-effective and time-efficient instrument for assuring quality in the deployment of solar PV mini-grids, with great potential for replication nationally and internationally."

Figure 1 Summary of MSP and its visible impact

MSP comprises:
- Technical inspection
- Socio-economic survey
- Photographic documentation
- On-site operator training
- EBTKE-contractors feedback

Year of MSP	2013	2014	2015
	112 Mini-grids	110 Mini-grids	83 Mini-grids
	11 EPC companies	11 EPC companies	5 EPC companies

Visible impact of MSP:

Preventing poor quality contractors. Contractors with poor quality were not qualified in the next tender.	
Safer installation.	Less dysfunctions on PV array mounting structures.
Improved workmanship quality.	Less failures in combiner box and internal wiring.
Less numbers of exposed battery terminal connections.	Better installation at customer's connections.

To date the Indonesian government have been installing almost 600 solar PV mini-grids, of which as many as 305 mini-grids were directly supported with MSP. These 305 solar PV mini-grids supply electricity to over 32,000 rural households and over 1,400 public facilities

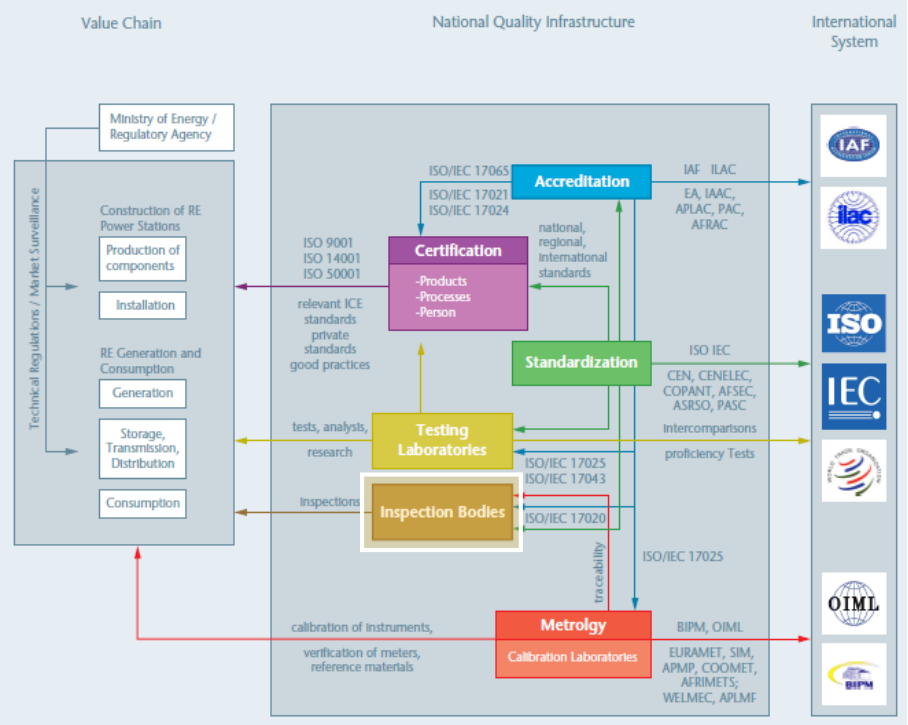
such as schools, health centres, and community centres, as well as more than 1,400 rural kiosks, mostly for lighting purpose.

INSPECTION: AN ELEMENT OF QUALITY INFRASTRUCTURE

The MSP methodology inspects the quality of the installation and later technical performance of solar PV mini-grids. It comprises technical inspection, socio-economic survey, on-site training for operator and village management team, photographic documentation, technical reporting, and feedback mechanism between EBTKE and the EPC (Engineering, Procurement, and Construction) companies.

MSP instrument equipped with a comprehensive and explanatory documentation i.e. checklists, measurement form, socio-economic questionnaire, evaluation criteria; making it possible to be used by inspectors with basic (to medium) knowledge and technical experience in solar PV mini-grids. The technical inspection includes component compliance check, performance verification, and workmanship quality check.

Figure 2 Inspection as part of developing quality infrastructure



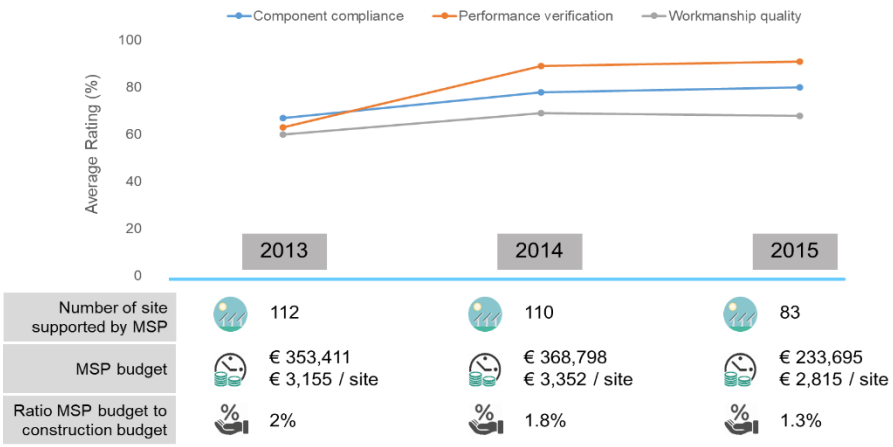
The inspection done equally consider all technical and construction aspects of a mini-grid installation, from electrical to civil construction. Thus, the inspection must be technically holistic, with emphasis on safety aspects. MSP eases the implementation of one of the elements of quality infrastructure in renewable energy, this element is Inspection Bodies as highlighted in Figure 2.[1] For further information about MSP refer to the Appendix A.

[1] For more information in how to develop a quality infrastructure for renewable energy, visit: http://www.irena.org/Publications/

IMPROVING QUALITY FOR SOLAR PV MINI-GRIDS PROJECTS WITH MSP

The impact of MSP is noticeable in regards to safer installation, less technical failures in the components of the PV system and lower dysfunctions in mounting structures, while at the same time lifting the quality level in the tendering process.

Figure 3 Summary of MSP evolution



The cost of MSP takes up not more than 2% of the construction budget for solar PV mini-grids (Figure 3). As a result, improvements were evident in the component compliance, performance verification and workmanship quality of the mini-grids.

Figure 4 provides better detail of the progress made in workmanship quality, the cells exhibit number of misconducts in installation for each category in the given year of technical review. The colour spectrum indicates high-number of faults in red, while low-numbers are expressed in green. The year 2015, shows a significant decrease in the number of faults in installation e.g. PV array mounting structure, module wiring, distribution grid pole installation, and further more as shown in the green-cells and changing state of circles.[2] Some increasing number of faults occurred in 2014 were due to the more stringent scoring criteria by the evaluators.

The MSP tool has contributed to develop a stronger quality oriented market, this cost effective solution has facilitated a safe and reliable development and operation of over 300 solar PV mini-grids in Indonesia.

[2] Data from technical review and data survey for 305 solar PV mini-grid installations across Indonesia, installed by local suppliers in budget year 2012 to 2014.

Figure 4 MSP impact on workmanship quality

Workmanship categories and occurrence of deficiencies

Workmanship categories	Number of occurrence of deficiencies 2013	2014	2015
1. PV module quality	49	65	37
2. PV module array foundation	114	99	53
3. PV array mounting structure	323	225	39
4. PV array combiner box and internal wiring	207	160	71
5. Module wiring	121	128	44
6. External wiring and weather proofing	19	153	43
7. Wiring to power house	5	105	37
8. Grounding and earthing	82	88	63
9. Battery rack	32	62	26
10. Battery terminal connections	94	63	38
11. Internal power house wiring	45	92	20
12. Power house foundation	23	61	60
13. Power house general condition	89	127	106
14. Power house ventilation	28	113	63
15. Power house flooding prevention	38	60	38
16. Fence and gate	134	98	93
17. Distribution grid pole installation	44	158	105
18. Distribution grid wiring	39	74	85
19. Streetlight installation	85	106	52
20. Household installation	64	53	34
21. Others	16	33	0
Number of PV mini-grid sites inspected	**112**	**110**	**83**

Note: the statistics show number of occurrence, not necessarily represent number of sites. One site could have more than one deficiency in each workmanship category.

CONTACT INFORMATION

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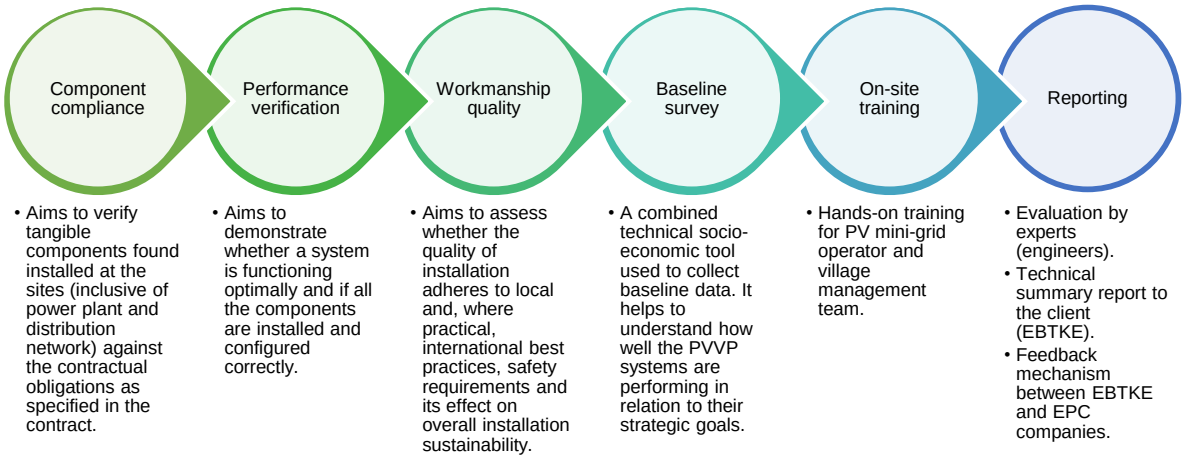
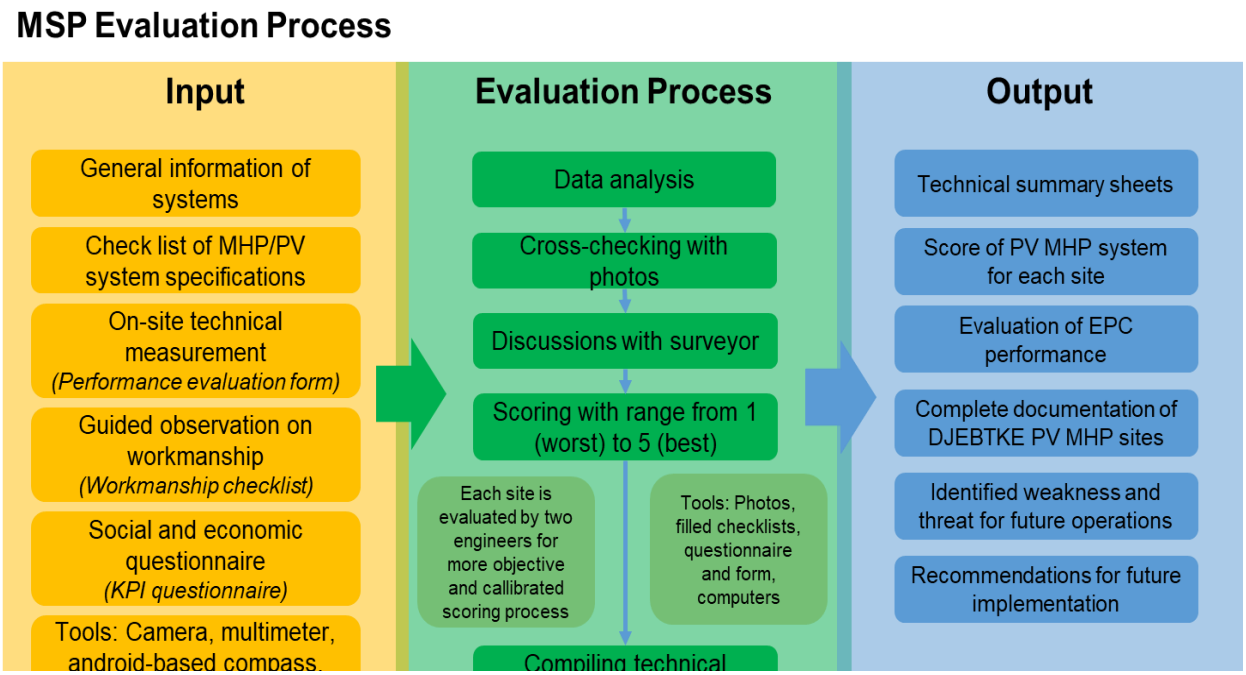
ANNEX A. Overview of MSP Instruments

The Mini-grid Service Package consists of technical review, socio-economic survey, training for operator and village management team, and technical reporting. Technical review comprises inspections for the components, its performance, and the quality of workmanship in the installation. The flow of MSP is shown in the diagram below.



The evaluation process of technical review is conducted after the data collection measures as mentioned in the diagram of MSP evaluation process.



Details on Inspection guide for Photovoltaic Village Power (PVVP) Systems
https://energypedia.info/wiki/File:Inspection_Guide_for_PVVP_150524_(GIZ_2015).pdf