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INTERNATIONAL COOPERATION

EXTERNAL EVALUATION – SHORT REPORT

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Strengthening Quality Infrastructure for the Energy Sector in Indonesia

Country | Region:	Indonesia
Project number:	2015.2119.4
Project term:	01.11.2016 – 31.10.2020
Political partner:	Ministry of Energy and Mineral Resources (ESDM)
Implementing partner:	Directorate General of New Renewable Energy and Energy Conservation (EBTKE)
PTB | Working Group:	9.32 Asia
PTB | Project Coordinator:	Mr Patrick Dolle
Date:	11.06.2020

This is an independent evaluation. The contents represent the view of the evaluator and cannot be taken to reflect the views of PTB.

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List of abbreviations

AESI	Indonesian Solar Energy Association
APAMSI	Indonesian Association of Solar Panel Manufacturers
BAPPENAS	Indonesian Ministry of National Development Planning
BMZ	German Federal Ministry for Economic Cooperation and Development
B2TKE-BPPT	Indonesian Centre for Energy Conversion Technology under the Agency for the Assessment and Application of Technology
BSN	Indonesian National Standardization Agency
DAC	Development Assistance Committee
DeGEval	German Association for Evaluation
EBTKE	Indonesian Directorate General of New Renewable Energy and Energy Conservation
EPC	Engineering, Procurement, Construction
ESDM	Indonesian Ministry of Energy and Mineral Resources
GIZ	German Agency for International Cooperation
OECD	Organisation for Economic Cooperation and Development
IEC	International Electrotechnical Committee
KfW	German state-owned development bank
PLN	Indonesian state-owned electricity company
PTB	German National Metrology Institute
PV	Photovoltaic
QI	Quality infrastructure
RE	Renewable Energy
SDG	Sustainable Development Goal
TC	Technical Committee
ToT	Training of Trainers

1. Project Description

Subject of the evaluation

This report evaluates the results achieved by the PTB project "Strengthening Quality Infrastructure for the Energy Sector" (PV QI project) in Indonesia up to April 2020. The project has a duration of four years (11/2016 - 10/2020) and a budget amounting to 1.5 million EUR, financed by the German Federal Ministry for Economic Cooperation and Development (BMZ). It is part of the German development cooperation programme "Energy in Indonesia". The political partner of the project is the Indonesian Ministry of Energy and Mineral Resources (ESDM). The executing organisation is the Directorate General of New and Renewable Energy (EBTKE) under the ESDM. The intermediaries are specialized institutions within the energy and/or quality infrastructure (QI) sector.
The project's results were analysed by means of five criteria defined by the Development Assistance Committee (DAC) of the Organisation for Economic Cooperation and Development (OECD) as well as five success factors of the management model Capacity WORKS used by PTB cooperation projects. The PV QI management team has expressed a specific interest in strategic questions related to challenges in the PV sector in Indonesia such as a currently slow PV market development, quality assurance of PV installations in remote areas, and further capacity development of QI institutions.
The lead evaluator is Ms Suzana Lange, freelance consultant for quality assurance in international cooperation and for organisational development. The technical evaluator is Mr Hendrik Sträter, physicist at the PTB working group on solar modules.

Framework conditions

Indonesia is the world's fourth most populous country and the largest economy in Southeast Asia. In 2018, 12% of the electricity used in Indonesia came from renewable energy sources with the rest sourced from coal (55%), gas (26%) and oil (7%). Indonesia committed under the Paris Agreement to reduce greenhouse gas emissions by 29% below its baseline emission by 2020, and by 41% conditional on international support. In its National Energy Plan 2017, Indonesia sets the goal of achieving 23% of renewable energy share of its total energy consumption by 2025 and to increase the solar power capacity to 6.5 GW by 2025. Indonesia has, in theory, high potential for the use of photovoltaic (PV) due to its natural and geographic conditions. There is a dynamic set of regulations in the energy sector, with some of the current framework conditions targeting fully legitimate goals such as an acceleration of the electrification rate or creation of green jobs in the Indonesian economy. In comparison, much less attention is paid to the goal of setting sufficient incentives for a massive increase in renewable energies and in particular PV. In Indonesia, the major QI institutions are in the process of developing QI services for quality assurance of PV components and systems. There is a risk of a vicious circle, whereby a low demand for PV creates insufficient incentives for investing in quality measures, which leads to a low quality and mistrust in the PV technology, which in turn might be one of the reasons for a low demand for PV.

2. Assessment of the project

The assessment refers to the German scoring system:

1.0 - 1.5	highly successful	very good result, well above expectations
1.6 - 2.5	successful	good result, in line with expectations
2.6 - 3.5	moderately successful	satisfactory result, is below expectations but positive results dominate
3.6 - 4.5	moderately unsuccessful	unsatisfactory result, is below expectations and negative results dominate despite noticable positive results
4.6 - 5.5	unsuccessful	despite some positive partial results, the negative results clearly dominate
5.6 - 6.0	highly unsuccessful	the project is completely unsuccessful, the situation has rather worsened

2.1 Status of the change process

The overall assessment of the project is successful (1,7).

Relevance

Energy is one of the main fields of German-Indonesian cooperation. PTB has a unique selling point, as no other cooperation project is active in the field of systematically ensuring PV quality through QI services. The PV QI project supports the Indonesian government's goals of 6.5 GW and the setup of an adequate QI for the currently chosen scenario of a local PV industry. But as the expected PV development did not happen in the last years, the actual demand for QI services for PV is still very limited.
Taking the actual circumstances and needs in Indonesia into account, the PV QI project has focused on QI awareness-raising activities and on addressing quality issues of PV systems, especially in remote areas. This approach stimulates the demand side for QI services but does not fully reflect the core expertise of PTB and of supported QI institutions, which - if fully exploited - is an important precondition for the PV development in Indonesia.
Mark: Successful (1,7)

Effectiveness

The project has reached its objective "to improve quality assurance services in the energy sector in the field of PV in accordance with international good practices". If the global Covid-19 pandemic does not delay too much the project activities, all outcome indicators will be reached within the project timeframe.
To create an enabling environment (component 1), the project both provided support on a high strategic level and also support on practical instruments to influence the quality of PV modules and installations, such as quality criteria in tenders and a standardization roadmap.
Regarding QI institutions (component 2), the support provided for setting up the PV module testing laboratory at B2TKE is a major achievement. The PV QI project worked on the intersection between the different PV and QI institutions and increased the understanding between service providers and potential users. First steps towards the setup of a certification scheme to close the QI chain for PV modules were made.
The matching of demand with services (component 3) shifted to capacity development of local PV producers and the quality assurance of PV installations by various means such as inspections.
Important success factors were a pragmatic and holistic approach, stimulating the awareness and the demand side of services, and the gradual building up of trust between project partners, including PTB.
Mark: Highly successful (1,3)

Efficiency

The PV QI project results and impacts are in line with the project budget of € 1.5 million. In the future, the budget might need to be increased to unleash the potential impact in Indonesia and cover the recommended extended scope of the project. During this PV QI project the activities have been provided in sufficiently timely and efficient manner, which might now be endangered by the Covid-19 pandemic.
The PV QI project inputs are well received by the interviewed partners: the management, the technical expertise and the equipment (of which the partners wish to get more) received an excellent feedback. Management resources on central and local level might be increased to achieve more impact, especially if more outreach activities will be performed in the future.
Not enough resources were spent so far to ensure better collaboration with other cooperation projects, especially GIZ, where lots of synergies in the on-grid and off-grid sector are possible.
Mark: Successful (2,0)

Impact

The project contributes to reaching different development goals such as "Climate Action (SDG 13)", "Affordable, Clean Energy (SDG 7)" and "Economic Growth (SDG 8)", although there is a certain

tension between these goals.
By supporting Indonesian QI institutions to provide valuable and transparent QI services, it contributes to increasing the trust in PV technology, which is a precondition for PV development.
A growing focus of the PV QI project was on improving off-grid PV installations, which, however, do not contribute a big percentage to the energy mix, but are a decisive factor for expanding electrification and equal access to quality.
Investing in capacity development of local manufacturers is important due to the local content regulation and their role as EPC service providers. Transparent and binding criteria for quality using international standards/ internationally recognised QI services might increase investors' trust and trade.
The most important impact is the raised awareness on quality. The project achievements can be used for promotion of reliable QI institutions as well as for explanation of the concept of quality assurance via internationally recognised QI.
Mark: Successful (2,0)

Sustainability

In this first phase of cooperation between PTB and PV QI stakeholders in Indonesia, the PV QI project laid the groundwork for further inter-institutional collaboration. Its multilevel approach and the parallel work on supply and demand side for QI services are geared towards sustainability.
The setup of favourable framework conditions and QI institutions working with internationally recognised procedures cannot be easily reversed. The PV QI project contributes to the sustainable use of Indonesia's own resources in the sense of value-for-money and durability.
The main risk for sustainability of project results is the slow development of the PV market. The subsequent risk is that the Indonesian government will not invest in the further development and maintenance of QI and potential users will not invest in using these QI services. In the positive scenario of PV development, broad capacity needs to be built up in cooperation with other projects on individual and organisational level to satisfy the broad scope of need.
Mark: Successful (1,7)

2.2 Success factors for the observed results and change processes

Strategy

The project strategy is based on a thorough assessment of the situation at project start and is well reflected in the results matrix and outputs of the PV QI project. Partners understand and share this holistic strategy to set up QI services for PV, to create an enabling environment as well as to assess and stimulate demand for these services.
The PV QI project adequately reacted to challenges that became clear during the implementation, e.g. that the PV market did not develop with the expected speed, that the quality of locally manufactured PV modules is related to this slow development of the PV market, and that QI services need to be enhanced for the whole process chain from tendering to maintenance in order to rely on the quality and durability of PV systems.
Level of achievement: 90%

Cooperation

The PV QI project managed to successfully cooperate with a variety of governmental and non-governmental stakeholders from the PV sector as well as the QI sector. An important added value of the PV QI project was to bring together service providers and potential users and to improve the understanding of each other's roles, situation and expectations. Some important stakeholders for the on-grid sector and the off-grid sector need to be further addressed and involved in the future.
In the future potential synergies with the GIZ PV projects might be better used especially for pilot projects in remote areas. Cooperation with KfW and also the future German trade facilitation programme might be increased with regards to the enabling environment of the PV on-grid sector. The project should invest more resources in the mapping and continuous update of activities and possible synergies with other organisations.

Level of achievement: 80%

Steering structure

PTB signed an implementation agreement with EBTKE as political partner including Terms of Reference for the steering committee with PV and QI stakeholders. This steering committee meets once or twice a year with a broad but fluctuating participation. It serves mainly informative purposes.
The detailed strategy development, decision making, planning and monitoring is done bilaterally between the individual partners and the core management team, facilitated by the local project representative. A National Quality Committee for PV, as suggested by project experts, has not been created so far. The involvement of partner organisations might be intensified in the future to facilitate the coherent functioning of an inter-institutional QI system.
Additional local and Germany-based project staff would be beneficial to steer this complex project in a sufficiently flexible and cooperative way.
Level of achievement: 70%

Processes

The PV QI project supported the various partners to resolve specific challenges within their own institutions and in relation to/ in collaboration with other institutions. Technical advice as well as tangible support creating a common understanding of challenges were well appreciated and absorbed.
The interviewed partners expressed high satisfaction with the theoretical and practical inputs of the experts. There is a need for greater scaling up in the next project phase. This entails the drafting and dissemination of more written output to different target audiences as well as more in-depth support in pilot installations and processes. In the future more local expertise should be built up on individual and on organisational level.
Level of achievement: 90%

Learning and innovation

How to set up a realistic, up-to-date and demand oriented QI for a value chain such as PV is a successful learning objective of this PV QI project. Important milestones of the PV QI project and achievements of project partners, e.g. the opening or accreditation of the PV module laboratory at B2TKE-BPPT, need to be better promoted in order to achieve the goal of more trust in PV technology and awareness of quality by QI. An increased internet/ social media presence and study tours could be used for the goal of better visibility as well as for knowledge management and internal communication.
International peer-to-peer contacts as well as cooperation projects with universities and research institutes could be strengthened in order to pave the way for continuous learning and innovation.
Level of achievement: 80%

3. Learning processes and learning experience

Learning processes
The initial assessment of PTB's appraisal mission remains valid: Solar energy by PV is a promising value chain in Indonesia that is highly dependent on favourable political framework conditions. For the crucial PV system component of PV modules, there is a domestic industry of PV manufacturers that is promoted and protected by the Indonesian government, mainly by the local content regulation. The project strategy based on this initial assessment remains valid as well: QI institutions adapt their services to the PV sector (component 2), while the PV QI project also lobbies for an enabling environment (component 1) and bridges the services with the demand side (component 3).
The PV QI report developed by the project team shows well that for the scenario of a local PV industry chosen by the Indonesian government, the entire chain of QI services is necessary and needs to be set up or refined. The PV QI project thoroughly assessed the value chain and supported all relevant QI institutions.
The most visible achievement is the PV QI project support in the setup of the B2TKE-BPPT PV testing laboratory. This and other achievements need to be better promoted to increase trust in the PV technology, trust in the PV QI stakeholders and to raise awareness on the topic of quality by

internationally recognised QI.
The PV QI project initiated relevant processes also with other QI stakeholders, especially from standardization and also metrology. In the future, more support needs to be provided for certification on IEC 61215, as well as for inspection, to complete the QI chain for PV modules set up during this project.
QI stakeholders highlighted the added value of hands-on experiences and inter-institutional contact: the PV QI project brought various partners together in practical activities such as onsite assessments of PV installations in remote areas and thereby increased the understanding of each other's role in the quality chain. This indirectly also increases the trust in and the demand for QI services. However, continuous learning, maintenance of capabilities and innovation remain a challenge, so the PV QI project should further stimulate networking on national level, e.g. with research institutions, as well as on international level, e.g. IEC.

Experiences
During the PV QI project implementation, it became clear that the main working hypothesis was overly optimistic: the expected PV market boom did not happen yet, which resulted in a low demand for PV modules and a low demand for established QI services during the current implementation phase. It also became obvious that the quality of locally manufactured PV modules is related to this slow development of the PV market.
The PV QI project reacted to this challenge by taking a gradual and pragmatic approach and by including the manufacturers as direct beneficiaries of the project. The manufacturers' acceptance of standards and other quality assurance measures rose during project implementation.
Whereas the on-grid PV sector almost stagnated, the off-grid sector continued to be developed, mainly through government funds dispersed via the political partner of this project, EBTKE, for the benefit of electrification in remote areas. In this context, support not only in respect to the quality of PV modules and components, but for the whole process of setting up and maintaining PV systems is relevant. The PV QI project took a practical and wide approach, e.g. by providing training on inspections or advocating for the importance of standards in the tendering and commissioning process. The potential future need for capacity for quality in this large partner country is enormous and goes far beyond the possibilities of the PTB project, so that more synergies with other donors and organisations need to be exploited. It is crucial to set up competences and capacities in Indonesia - on national and local level, on individual and on organisational level - that will remain after project end.
On political level, the PV QI project could be successful by continue to provide "technical support" guiding to international standards and best practice and by contributing to awareness raising on quality. So far, this covered the framework for PV QI in Indonesia in general as well as more and more support to the off-grid sector. In the future, the PV QI project should continue with relevant activities for the on-grid and off-grid sector as well as promotion of internationally recognised QI services available for the PV sector.

4. Recommendations

Recommendations to the partners:

Recommendations to the B2TKE-BPPT testing laboratory

- Perform regular recalibration and round robins of own measuring devices (PV modules, WPVS reference cell, spectroradiometer, …).
- Perform regular characterization of the own test equipment, e.g. the light field of the solar simulator.
- Develop closer technical collaboration with PLN to match demand and services.
- Cover more PV-related standards, e.g. the IEC 60904 series and the new version of IEC 60891.
- Promote the existence of the new testing laboratory and the offered services, e.g. by guided tours for potential customers.
- Build up local PV module testing branches in remote areas, after analysis of the types of testing services that are essentialy required in the provinces, based on the needs, budget and logistics considerations.

Recommendations to module manufacturers:

- Adopt the Quality Management System as required for PV module certification.
- Conduct regular tests of PV modules at the B2TKE-BPPT testing laboratory, as required by certification, especially if the bill of materials of the PV Modules changes.
- Ensure constant production conditions to reduce quality loss and production costs.
- Regular acquisition and recalibration of “golden modules”.
- Establish solar cell testing capability (at the PV module factories or a centralized institution such as B2TKE-BPPT).

Recommendations to BSN:

- Offer calibration services for pyranometers and solar simulators.
- Perform regular recalibration of own calibration standards (WPVS reference cell, spectroradiometer, …).
- Participate in IEC TC 82 activities.

Recommendations to EBTKE:

- Promote the necessary infrastructure (pyranometers, data storage, data transmission, maintenance staff) to record and evaluate the performance ratio of a PV power plant.

Recommendations to the project team:

The QI services to be built up for the PV sector depend on the future Indonesian political decisions, which shape the PV market development. At the same time, the development of the PV market could be stimulated by the availability of QI services that secure trust and quality. It is, therefore, recommended to maintain a wide approach and to take following recommendations into consideration for the PV QI follow-up project:

How can quality assurance for the PV sector be supported if the market developments are rather slow?

- The significant PV market development in Indonesia that creates a demand for PV QI services will only happen, if more favourable political incentives and more trust in PV technology is created, especially in the on-grid sector. The PV QI project should continue with relevant activities for the off-grid sector, where PV actually developed in the last years, but at the same time address as much as possible the on-grid sector with activities and instruments that increase awareness of quality, the creation of trust and incentives for PV technology (→ strategy).
- The PV QI project should continue providing technical support leading to the use of international standards and best practice as well as introducing practical tools (→ effectiveness) for quality assurance. For example, it should promote and support tenders or contracts requiring a performance ratio monitoring for a PV power plant.
- In addition to the successful collaboration with BAPPENAS and EBTKE, the PV QI project should intensify cooperation with relevant stakeholders from the on-grid sector such as PLN and possibly

also IPP in the future (→ cooperation).
- As the quality of locally manufactured PV modules is both one of the causes and a consequence of the slow development of the PV market, the PV QI project should continue its gradual and pragmatic approach of including the manufacturers as direct beneficiaries (→ cooperation).
- Intensified cooperation with other PV projects (e.g. with GIZ, KfW, BMWi but also other donors and organisations) is needed to create synergies and to extend existing networks (→ cooperation).
- The idea to establish a National Quality Committee raised in the PV QI report might be revitalised to institutionalise the inter-institutional communication. (→ steering)

How to contribute to further capacity development of QI institutions in Indonesia?
- The development and extension of demand-oriented QI services in all involved QI institutions needs to be further supported (→ technical recommendations), provided that Indonesian funds for maintaining these services are secured.
- Certification as well as inspection will need to be supported to complete the QI chain for PV modules (→ effectiveness).
- The PV QI project should continue stimulating hands-on experiences of inter-institutional collaboration (→ cooperation) and promote collaborations between the PV manufacturers and B2TKE, PLN and/or BSN, among other in applied research projects (→ learning and innovation).
- Achievements such as the extension of the internationally recognised accreditation scope of the BPPT-B2TKE testing laboratory are important milestones for increasing the trust in the PV technology and PV QI stakeholders and a good occasions to promote at the same time the concept of quality through QI. These occasions should be better promoted, with the support of the project, to increase the visibility (→ learning and innovation).
- The project should encourage partners to allocate budget and resources for active involvement at international level, e.g. the IEC TC 82, ASEAN or APMP and might offer mentoring schemes or similar, if necessary (→ learning and innovation).
- It should also stimulate collaboration with universities/ research institutions and the development of applied research projects to improve quality in the PV sector and QI simultaneously (→ learning and innovation).

How to assure good quality for PV in remote areas?
- Electrification is an important topic (→ impact) and PV systems are of high relevance for the rural communities, therefore QI topics related to the setup and operation of these installations should be included in the followup project (→ strategy).
- A needs assessment for QI for remote areas (considering budget and logistics constraints) should be conducted (→ technical recommendations).
- A further roll out of training schemes focussing on manufacturers (including APAMSI), inspectors, potential maintenance operators and local governments to prevent quality gaps is recommended, if possible by using ToT schemes (→ processes).
- Well-established cooperation with EBTKE and AESI can be further developed to organise such roll out and to reach relevant target groups (→ cooperation).
- Synergies with GIZ need to be better exploited, especially when selecting a PV installation with the whole set of relevant local stakeholders as a pilot project (→ cooperation).
- Additional synergies need to be proactively sought out, e.g. for education of EPC (→ cooperation).
- The project should support the identification of necessary types of testing services in remote areas based on needs, budget and logistic considerations. The Indonesian institutions should be further consulted on how to broaden their business field including services in remote areas such as consultancy and trainings (→ sustainability).
- In addition to the local project representative with a management and QI background, a staff member with a technical background in PV (full time or part time in synergy with GIZ) could be hired (→ steering). This is to ensure a focus on (knowledge)-management and communication and at the same time to secure the cost-efficient and timely technical know-how that is needed for the implementation of the training and consulting activities, especially in remote areas.

Management
- A budget increase will be necessary to continue successful approaches (such as building up

demand-oriented services of QI institutions) and in addition expand outreach and pilot activities, using more synergies with other donors and building up greater local expertise (→ strategy).
- Accordingly, the internal PTB management resources need to be increased (→ efficiency).
- The current project setup with three components proved to be appropriate. In addition to the well-established annual steering committee meeting for the entire PV QI project and the informal debriefing sessions on bilateral level, sub-committees for each of the three project components could be set up. Headed by different institutions, they would allow for more participatory decision-making, common result-oriented monitoring, and ownership (→ steering).
- Further progress to be monitored is e.g. the inclusion of the reference to IEC 61215 and other standards in public tender documents, the implementation of technical inspections in PV installations, the accreditation of B2TKE, the question of price formation for B2TKE services for different types of clients, how the policy goals for PV are anchored in the BAPPENAS strategy 2021-2025, and what concrete continuous services such as calibration of solar simulators, assistance in import controls or availability of targeted training programmes will be available for local manufacturers (--> steering).
- Proven resource-intensive formats such as joint hands-on assessments or the participatory development of strategy reports should be maintained (→ effectiveness). For a broader outreach, it is advised to develop more remote measures such as opportunities for distance consulting and to produce written outputs tailored towards various target groups such as flyers, posters, excerpts, etc. (→ processes).
- For increased knowledge management, internal communication and external visibility, an internet or social media presence could be set up by the project (→ learning and innovation).

Recommendations to PTB's International Cooperation department
- The budget as well as the staffing (both project coordinator and local staff) is low compared to the (potential) achievements of the project and the overall challenges/investments in the partner country. Budget and staffing of this cooperation project should be topped up (→ efficiency).
- Change of project coordination staff bears the risk of inconsistencies in project implementation and should therefore be avoided (→ efficiency).
- Find ways to reduce the length of administrative procedures and the necessary time horizon for activity planning in Germany (→ efficiency).
- Ease administrative procedures in the partner country such as petty cash, local subsidy contracts or further use of office structures of German development cooperation (→ efficiency).
- If PTB wants to have questions of cost-efficiency evaluated as well, financial monitoring data as well as additional information (lists of participants, ToR etc) need to be tracked by project teams (→ efficiency).

Recommendations to the evaluation team
- The expectations towards the technical evaluator should be made clearer from the beginning, and a draft format for a technical report should be adapted and made available following the kick-off meeting.
- The Capacity Works questionnaire filled out by the team should be available and discussed at the kick-off meeting.
- If PTB wants to have questions of cost-efficiency evaluated as well, corresponding data needs to be made available by the project teams and respective sub-questions need to be included in the annotated evaluation report template.