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April 2019 –  
March 2020

# Annual Report



NZMATES Annual report – *1 April 2019 – 31 March 2020*

Prepared by: NZMATES PMO

Prepared for: NZ MFAT

April 2019 – March 2020



***Annual report #2***  
***1 April 2019 – 31 March 2020***



Date: 1 July 2020

*Cover photo: Solar mini-grid on Kisar Island, potential refurbishment project in the NZMATES pipeline.*

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## LIST OF ACRONYMS

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ADB	Asian Development Bank
AFD	Agence Francais de Developpement (French Development Agency)
DJ EBTKE	Direktorat Jenderal Energi Baru Terbarukan dan Konservasi Energi (Directorate General for New and Renewable Energy and Energy Conservation)
Dinas ESDM	Dinas Energi dan Sumber Daya Mineral (Energy and Mineral Resources Agency)
FOP	Forward Operating Plan
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Agency)
HSS	Health, Safety and Security
LOP	Life of Programme
MEL	Monitoring, Evaluation and Learning
MFAT	Ministry of Foreign Affairs and Trade
MMU	Maluku dan Maluku Utara (Maluku and North Maluku Provinces)
NZMATES	New Zealand – Maluku Access To Renewable Energy Support
PDPC	Partnerships and Development Practice Coordinator
PLN	Perusahaan Listrik Negara (National Electricity Company)
PM	Programme Manager
PMO	Programme Management Office
PSG	Programme Steering Group
RE	Renewable Energy
Renstra	Rencana Strategis (Strategic Plan)
RPJMD	Rencana Pembangunan Jangka Menengah Daerah (Medium-Term Regional Development Plan)
RUED	Rencana Umum Energi Daerah (General Provincial Energy Plan)
TC	Technical Committee
YMCI	Yayasan Mercy Corps Indonesia

## EXECUTIVE SUMMARY

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This annual report corresponds to the second year of the NZMATES programme, from 1<sup>st</sup> of April 2019 to 31<sup>st</sup> March 2020. This was an exciting period during which the strong foundations laid in the establishment phase were built upon and the implementation of pipeline and capacity-building activities was ramped up. This report outlines progress towards programme outputs, and comments on early progress towards short-term outcomes as well.



*Figure 1: The NZMATES Programme team with Mercy Corps Indonesia support staff in Ambon. At statue of Martha Christina Tiahahu, National Heroine of Indonesia from Maluku.*

# 1 KEY ACHIEVEMENTS AND PROGRESS

## 1.1 Results framework

NZMATES’ results framework was endorsed at the first Programme Steering Group (PSG) meeting in May 2019. The framework was then reviewed as part of the NZMATES Baseline Study, carried out from August 2019 to December 2019, and some changes have been proposed. The main changes are:

- Combining the grid-connected and off-grid pipelines into a single project pipeline, to facilitate tracking and maintain flexibility in project design.
- Updating short-term outcome 1 and medium-term outcome 1 to focus less on the internal success of NZMATES, and more on the impacts of that success in facilitating collaboration and improving the enabling environment for RE in Maluku.
- Changes to some indicators to align with updated outputs and outcomes, and to better measure outcomes of capacity-building activities.

Given that the review process is still underway at the time of writing this report, and the new framework has not yet been approved by the Programme Steering Group (PSG), this report uses the previous version of the framework approved by partners in May 2019 for progress reporting.

Figure 2 below shows the previously approved results diagram, while Figure 3 shows the updated diagram that will be put to partners for approval at the next PSG meeting.

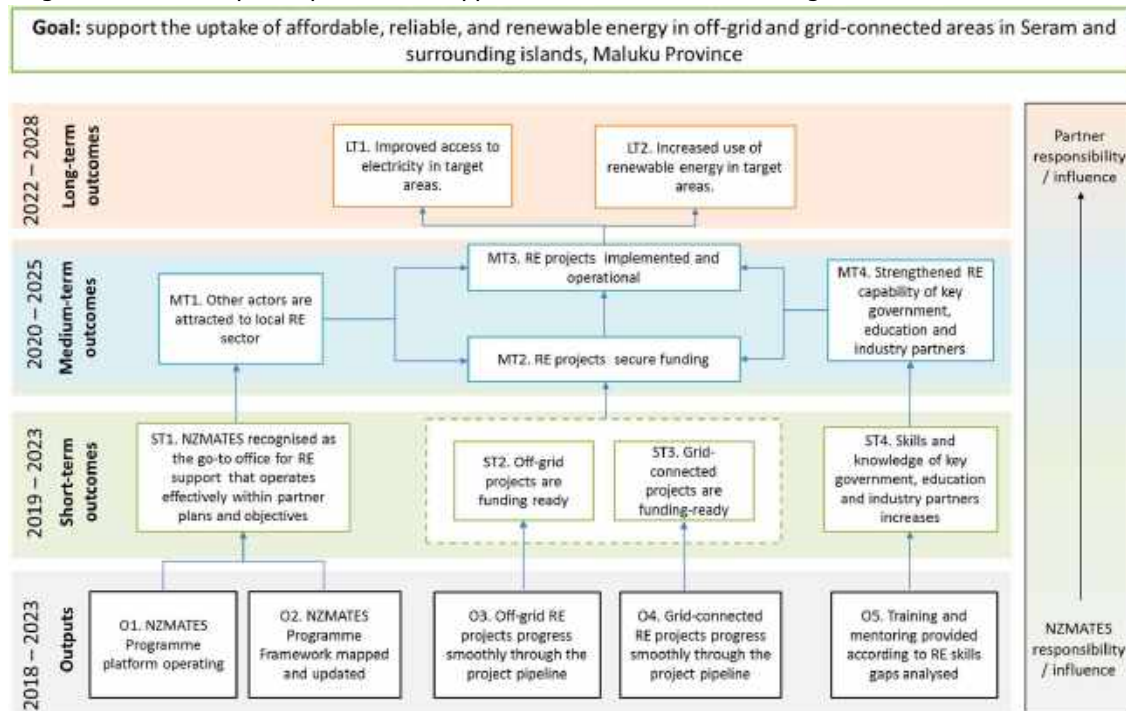


Figure 2: Results diagram approved at PSG meeting in May 2019.

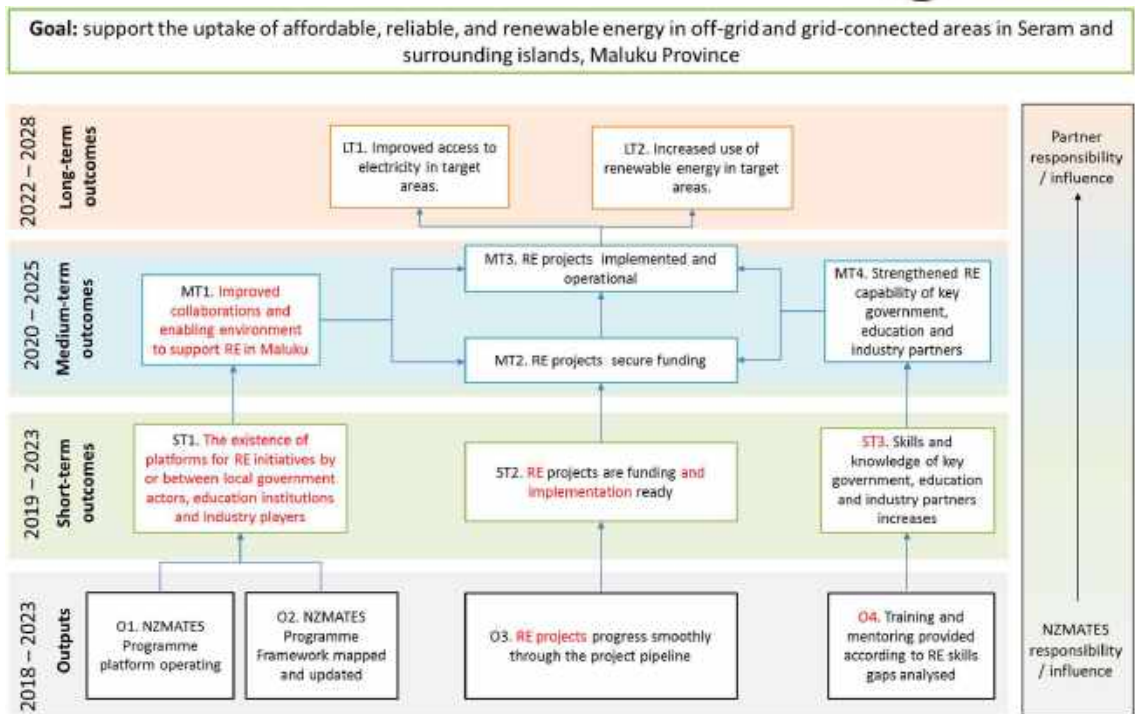


Figure 3: Updated results diagram for approval in 2020 (changes shown in red).

## 1.2 Geographic scope

In the second year of the NZMATES programme, NZMATES continued to receive many requests for assistance from partners that fall outside of the programme’s initial geographic scope of Seram and surrounding islands. The possibility of extending the programme’s geographic scope is a question that has been raised by partners at Working Group level as well as Technical Committee (TC) and PSG meetings.

The mix of requests being received indicate that, while Seram continues to be an important area in terms of renewable energy development and electrification, NZMATES’ partners PLN and Dinas ESDM both balance the needs on Seram with other priority areas. In particular, areas like the Aru Islands and Maluku Barat Daya regency, which not only have very low electrification rates, but due to their geography have little potential to be electrified through grid extension, are seen as more urgent targets for electrification through solar mini-grids.

NZMATES has submitted to MFAT a proposal to officially extend the programme’s scope to include the whole of Maluku Province, in order to allow NZMATES to adequately respond to and support the needs and priorities of programme partners. So far NZMATES has been approved to respond to partner requests outside of Seram and surrounding islands on a case-by-case basis only, and several projects in other areas of Maluku have been included in the 2020 workplan.

# Output 1: Programme Platform Operating

## Programme Management Office



**O1.1**  
Qualified PMO Team in place

	Actual	Target
Year 1	Yes	Yes
Year 2	Yes	Yes
LOP		Yes



**O1.2**  
PMO has sound, relevant procedures and policies in place, approved by Programme Manager and updated annually.

	Actual	Target
Year 1	Yes	Yes
Year 2	Yes	Yes
LOP		Yes

## Stakeholder Engagement and Program Governance



**O1.4**  
Number of PSG meetings that are well-attended and produce clear outcomes

	Actual	Target
Year 1	0	0
Year 2	2	2
LOP		9



**O1.5**  
Number of TC meetings that are well-attended and produce clear outcomes.

	Actual	Target
Year 1	1	0
Year 2	3	5
LOP		9

## Monitoring, Evaluation, and Learning



**O1.3**  
Results Framework reviewed annually and endorsed by PSG

	Actual	Target
Year 1	Partial	Partial
Year 2	Yes	Yes
LOP		Yes



### 1.3 Output 1: Programme Platform Operating

NZMATES' second year began with a strong team in place in the Programme Management Office (PMO) in Ambon, and a suite of policies and procedures to work under. Close relationships had been established with key stakeholders and were being built with educational institutions and others. During the second year these foundations were maintained and expanded upon to ensure the continued success of the programme – the following sections summarise progress in the key sub-areas of this output.

#### 1.3.1 Programme Management Office

No.	Indicator	Year 1	Year 2	LOP <sup>1</sup> target
<b>O1.1</b>	Qualified PMO team in place	Yes	Yes	Yes
<b>O1.2</b>	PMO has sound, relevant procedures and policies in place, approved by Programme Manager and updated annually.	Yes	Yes	Yes

Several new staff members joined the NZMATES team during the last year, and there were also a few departures.

The first resignation came from Meihaar Josiano Marsaoly, Deputy Programme Manager. He was replaced by an internal candidate, Safitri Yanti Baharuddin, previously in the role of Local Stakeholder Engagement Specialist (LSES). Safitri has quickly grown into the leadership role and is making an excellent contribution to the programme. Her previous role was modified to become Stakeholder Engagement and Partnerships Officer, and recruitment is ongoing for this position.

Renewable Energy Technical Specialist (RETS) Munawir S was transferred into the new role of Field Coordinator, overseeing field travel, Health and Safety (HS) and relationships with stakeholders in target communities. NZMATES' other RETS, Johannes Smith Sormin, unfortunately resigned in early 2020. Two new RETS were therefore brought on board, Kurnia Setiawan, who has extensive experience on renewable projects through PLN and private sector, and Maryam Muthiah Karimah, who has a Masters in Energy Systems from the University of Illinois.

NZMATES recruited a Senior Communications Officer, Luh Putu Kusuma Ririen, during this reporting period, however she unfortunately resigned for family reasons in early 2020. Recruitment for her replacement is currently on hold due to the Covid-19 pandemic.



*Figure 4: The NZMATES Programme Management Office team in December 2019*

<sup>1</sup> Life of Programme target – target for end of NZMATES programme in June 2023

Another new addition to the team is Senior Community Engagement Officer, Johanis Valentino Fofied. Johanis joined NZMATES on a 6-month contract to help with field activities and desk research on project locations.

Finally, in preparation for the planned departure of NZMATES' Partnerships and Development Practice Coordinator (PDPC), Kitty Garden, the transition role of Monitoring, Evaluation, Learning and Reporting Specialist was created. Dintani Naimah was chosen for this role, and joined the NZMATES team in March 2020. Dintani is an Engineer who moved into interdisciplinary research focusing on monitoring and evaluation of the sustainability of renewable energy systems.

NZMATES spent several months recruiting for a Renewable Energy Technical Manager (RETM), intended as a transition role to take over responsibilities currently under Programme Manager Mauricio Solano Peralta, however several rounds of recruitment failed to find any suitable candidates willing to relocate to Ambon for the salary available. NZMATES Management is currently looking into alternative approaches.



Figure 5: The new NZMATES PMO

Given the expansion of the NZMATES team, it was decided to move to a larger office. Fortunately, an opportunity arose to relocate nearby the existing office, to a larger space available at a cheaper price. MCI and the NZMATES programme team relocated in February 2020. The new location offers similar advantages to the previous space (on a hill outside tsunami risk zone, while also being close to the city), as well as a more comfortable and flexible space. A health and safety audit has been conducted on the new office and a few minor repairs are underway.

Policies, procedures and other documentation continued to be updated and revised as needed, especially in the area of Health and Safety. NZMATES' Health, Safety and Security Plan (HSSP) was translated into Indonesian and induction sessions were carried out with staff. Standard Operating Procedures (SOPs) for vehicle travel, marine travel and journey management were updated and refined based on field experience, and reporting procedures for incidents and near misses proved successful in identifying areas for improvement. For example, after near misses involving live voltage present in PV framing and combiner boxes at old solar installations, SOPs for safely testing the integrity of earthing on old systems were developed.

One major health and safety challenge which emerged towards the end of this reporting period is of course the global Covid-19 pandemic. As the severity of the pandemic grew over the early months of 2020, NZMATES developed a specific Covid-19 Safety Plan, and YMCI, Infratec and NZMATES took progressively more serious measures to protect team members. This started with the cancellation of non-essential travel and public events, and ended in March with the relocation of the Programme Manager to his home country of Costa Rica, and the decision for all Indonesia-based staff to work from home – some from Ambon but others from Makassar and Jakarta where they had returned to be with their families at this difficult time. The situation is still rapidly evolving, and the NZMATES HSS Committee continues to meet at least once per week to assess recent developments and recommend any necessary changes to policies and procedures.

### 1.3.2 Monitoring, Evaluation and Learning (MEL)

No.	Indicator	Year 1	Year 2	LOP target
<b>O1.3</b>	Results framework reviewed annually and endorsed by PSG.	Partial	Yes	Yes

As mentioned above, the updates to the results framework developed in Year 1 were officially endorsed at the first PSG held in May 2019. A second review was undertaken as part of the Baseline Study contracted in July 2019 and begun in August. The Baseline Study included two key aspects:

- A review of the NZMATES MEL system, including the results framework, indicators and their measurement methodologies, and MEL Plan; and
- A field survey in a sample of target locations to provide context and background to complement the programme's quantitative indicators.

These two tasks fed into a revised MEL Plan, including recommendations on changes to the results framework, additional enhancements to the programme's MEL system (including the use of a question-based approach to complement indicators), and recommendations for mid-term and final evaluation. The recommended changes to the results framework were reviewed by NZMATES and have been presented to MFAT for consideration.



*Figure 6: Baseline consultants conduct a focus group discussion with a women's group in a potential NZMATES target area*

The field survey component of the consultancy faced some challenges due to the remoteness of some of the target locations. While the original selection of sample locations was done based on geographical and project characteristics, some locations had to be excluded due to weather conditions and/or travel costs at the time the survey was conducted. However, 13 locations were visited in the end, and not only was useful data gathered on these sites but also some key generalisations about conditions in target areas. The raw data from these surveys can serve not only as the basis for an eventual impact evaluation if required, but also as a baseline for follow-up studies in the same locations after projects are implemented.

Within the NZMATES office, two reflection meetings were held to identify successes and challenges, and any changes requiring adaptation. These allowed the programme team to discuss strengths and successes, such as strong collaboration both within the NZMATES team and in relationships with stakeholders, and identify improvements to aspects such as planning processes, field travel procedures and internal coordination mechanisms.

### 1.3.3 Stakeholder Engagement and Programme Governance

No.	Indicator	Year 1	Year 2	LOP target
<b>01.4</b>	Number of PSG meetings that are well-attended and produce clear outcomes.	0	2	9
<b>01.5</b>	Number of TC meetings that are well-attended and produce clear outcomes.	1	3	9 <sup>2</sup>

The Partnership Arrangement between NZ MFAT, PLN and EBTKE was re-signed in April 2019, allowing for the first Programme Steering Group meeting to be held in May, with participation from the New Zealand Embassy, EBTKE and PLN Pusat. Staff from NZMATES and Dinas ESDM Maluku also attended. The pipeline workplan developed in collaboration with PLN MMU and Dinas ESDM through the working groups and signed off at the Technical Committee was approved by the PSG, allowing the NZMATES team to launch into the implementation of pipeline activities and delivery of technical assistance.

The second Technical Committee meeting was slightly delayed, due to the need to finalise technical assessments and reporting activities for the first round of locations visited. The meeting was eventually planned for September 27<sup>th</sup>, 2019 but was further delayed to October 1<sup>st</sup> after a magnitude 6.5 earthquake struck Ambon on September 26<sup>th</sup>.



*Figure 7: Attendees of NZMATES' first PSG meeting.*

The third Technical Committee meeting was held in February 2020, and a progress report on the previous year's workplan was presented and a new workplan for 2020 endorsed. This set the stage for the second PSG meeting, which was also held in February 2020, in conjunction with a joint visit from the New Zealand Ambassador to

Indonesia, H.E. Dr. Jonathan Austin, and high-level representatives from BAPPENAS, EBTKE and PLN.

The joint visit of the New Zealand Ambassador with national-level stakeholders was an opportunity to hold a series of events, which included a panel discussion on 'A Renewable Energy-Powered Future for Maluku', a visit to the site of the UnPatti solar lab, and a visit to the solar installation on Pulau Tiga.

There were several changes in key personnel among NZMATES' partners and other stakeholders during this reporting period. The new Governor of Maluku took office, which led also to changes in personnel including the Heads of Maluku's Dinas ESDM and Bappeda. NZMATES worked to engage with the new holders of these positions and has built strong, collaborative relationships so far.

<sup>2</sup> Original LOP target was 16, however at last TC it was decided to meet only every 6 months, with 3-monthly progress reporting in the interim.

NZMATES was very sad to lose a close collaborator and friend with the unexpected passing of Ir. Muchtar Bakri, Head of Electricity Division at Dinas ESDM, at the end of 2019. Pak Bakri had been an enthusiastic supporter and friend to NZMATES since the early design phase, and he will be sadly missed. His position remains vacant at the time of writing this report.

Finally, PLN appointed a new Planning Manager in the Maluku and Maluku Utara office in January 2020. This required some quick engagement to get the new Manager, Pak Widodo, up to speed on NZMATES activities and prepare the planning of next steps for project sites already visited.



*Figure 8: Panel Discussion on 'A Renewable Energy-Powered Future for Maluku' at Pattimura University*



*Figure 9: Ambassador Jonathan Austin arrives at Pulau Tiga and is greeted by Didi (left) and La An (in green), head of Ureng Village and head of P. Tiga sub-village*

NZMATES worked with Dinas ESDM in its energy planning processes, contributing to the development of the draft 5-year strategic plan for the agency (Renstra). NZMATES supported the preparation of a public consultation meeting on the plan, which was unfortunately cancelled due to the September 26<sup>th</sup> earthquake, which occurred only minutes before the event was scheduled to begin. Eventually a follow-up multi-stakeholder forum was held to share and gather input on the draft Renstra on December 20<sup>th</sup> 2019. The Renstra has now been finalised and submitted to form part of Maluku's overall RPJMD (Medium-Term Regional Development Plan).

NZMATES also began providing support for the development of the long-term strategic energy plan (RUED). NZMATES has prepared a Discretionary Budget request to support Dinas ESDM with RUED development through an independent consultant, which will be shared in year 3 with MFAT for consideration.

NZMATES has also developed a strong and collaborative relationship with the Asian Development Bank (ADB), and is working in support of their renewable energy results-based loan for PLN and asset refurbishment grant, both of which include Maluku.

Finally, NZMATES also participated in public events to increase awareness of the programme and trigger possible future collaborations. For example, in October 2019, NZMATES PM was invited as a speaker to the HOMER International Microgrid Conference where he shared with an international audience in Boston, USA about electrification challenges in Maluku. The conference served as a platform to share NZMATES' work in Indonesia, build relations with the mini-grids sector internationally, and provide media coverage for the programme.

# Output 2: Programme Framework Mapped and In Use



## 1.4 Output 2: Programme Framework Mapped and In Use

No.	Indicator	Year 1	Year 2	LOP target
<b>02.1</b>	Institutional framework mapping updated annually and approved by PM.	Partial	Yes	Yes
<b>02.2</b>	Technical framework analysis updated annually and approved by PM.	Partial	Yes	Yes
<b>02.3</b>	Financing, funding and grants catalogue updated annually and approved by PM.	Partial	Yes	Yes

NZMATES' three framework deliverables were completed during the reporting period, and have continued to be updated as new information, documentation and data becomes available.

Under the Institutional Framework, NZMATES continues to monitor regulatory developments related to RE and electricity sector, as well as building on the socioeconomic and cross-cutting issues analysis drafted during the first year. In particular, the expanded geographic area covered by NZMATES' activities in the past year required the Community Engagement team to adapt to the widely varying cultural and socioeconomic contexts found in different parts of Maluku Province. The Baseline Survey also provided the team with valuable insights into some aspects of how electrification and RE can influence, and be influenced by, social, cultural and economic conditions in different communities.



*Figure 10: Drying seaweed in Watmasa village. Seaweed is an important commodity for many coastal and island communities in*

The Technical Framework has also been finalised and updated, including updated data on plans from PLN and other actors, available RE resources, and technological options. Particular focus has been on technologies applicable to economic activities and social well-being in NZMATES target locations, especially related to fishing communities. In addition, a detailed database has been developed of options for technical components of PLTS installations, from batteries and panels to remote monitoring technology, allowing for accurate costing estimates and detailed discussions with PLN about refurbishment plans.

Finally, NZMATES has also maintained good relationships with potential international funding and financing agencies, such as the ADB, KfW, AFD and World Bank, with whom NZMATES coordinates regularly. As the first round of NZMATES projects near funding-ready status, increasing attention will be placed on keeping the funding and financing catalogue up-to-date and identifying ways forward for particular projects once roadmaps are approved by partners. Locally, NZMATES will also try to tap into sources of funding such as provincial or national budgets, budgets from different ministries, CSR funds from the private sector, and PT SMI.



## Output 3: Off-grid RE projects progress smoothly through the project pipeline

**03.1**  
Number of off-grid RE projects in the NZMATES pipeline that have made progress towards funding.



**03.2**  
Number of off-grid project assessments, studies or surveys conducted to support project progress through the pipeline and approved by partners.



Icon by **Freepik** from [flaticon.com](http://flaticon.com)

## Output 4: Grid-connected RE projects progress smoothly through the project pipeline



**04.1**  
Number of grid-connected RE projects in the NZMATES pipeline that have made progress towards funding.



**04.2**  
Number of grid-connected project assessments, studies or surveys conducted to support project progress through the pipeline and approved by partners.



Icon by **Freepik** from [flaticon.com](http://flaticon.com)



## 1.5 Output 3: Off-grid RE projects progress smoothly through the project pipeline

No.	Indicator	Year 1	Year 2	LOP target
<b>O3.1</b>	Number of off-grid RE projects in the NZMATES pipeline that have made progress towards funding.	0	14	15
<b>O3.2</b>	Number of off-grid project assessments, studies or surveys conducted to support project progress through the pipeline and approved by partners.	0	10	NA

This year NZMATES supported 14 off-grid projects with progress towards funding, and 10 Technical Asset Assessment reports were submitted to partners, outlining the status of broken PLTS assets and recommendations for refurbishment, redesign or decommissioning.

All of the 14 projects started with the same first step, a field visit by technical and community engagement staff to assess the current status of the PLTS (all broken except one), analyse current and potential loads in communities, as well as geographic and socioeconomic characteristics of the sites. This data was then analysed to determine possible ways forward for each of the sites. For the broken sites, recommended next steps were either refurbishment (7 PLN sites<sup>3</sup> and 2 EBTKE sites) or decommissioning (4 EBTKE sites).

For the 9 sites with good potential for refurbishment, load modelling was carried out and various different refurbishment configurations were compared in terms of technical, economic and social factors using a HOMER study.

For the 7 PLN sites, NZMATES involved PLN throughout the analysis process, to ensure not only that they had full understanding of the report content and the methodologies used, but also that they gradually build the skills to conduct these kinds of analyses and comparisons themselves in future. Thus the reports reflect the priorities and considerations of PLN, and there is a high likelihood of recommendations being accepted.

One of the assessed locations, Pulau Tiga, has been chosen as a model system, which NZMATES and PLN will collaborate closely to repair. NZMATES prepared its second request for discretionary budget to repair the PLTS in P. Tiga and develop the site jointly with PLN. In this way the site will serve as a showcase project and provide the opportunity for NZMATES and PLN to work together on the lifecycle of project development and O&M deployment. The location will also serve as a live model near Ambon of an operating PLTS.

For the EBTKE sites, NZMATES will provide support for suitable decommissioning in the form of identifying recycling and responsible disposal options. For the two sites with refurbishment potential, they have been proposed for funding under and ADB refurbishment grant, and NZMATES has supported coordination between EBTKE, ADB, PLN and community leaders to facilitate this process.

For the one site which was not broken, NZMATES conducted a sustainability analysis, and is in the process of finalising a Sustainability Assessment report, which will inform the development of a Sustainability Roadmap for the PLTS in collaboration with Dinas ESDM.

<sup>3</sup> For three of these sites the final Technical Assessment Reports are still being finalised after discussing with PLN.

The figure below summarises the progress of these 14 projects through the NZMATES pipeline.

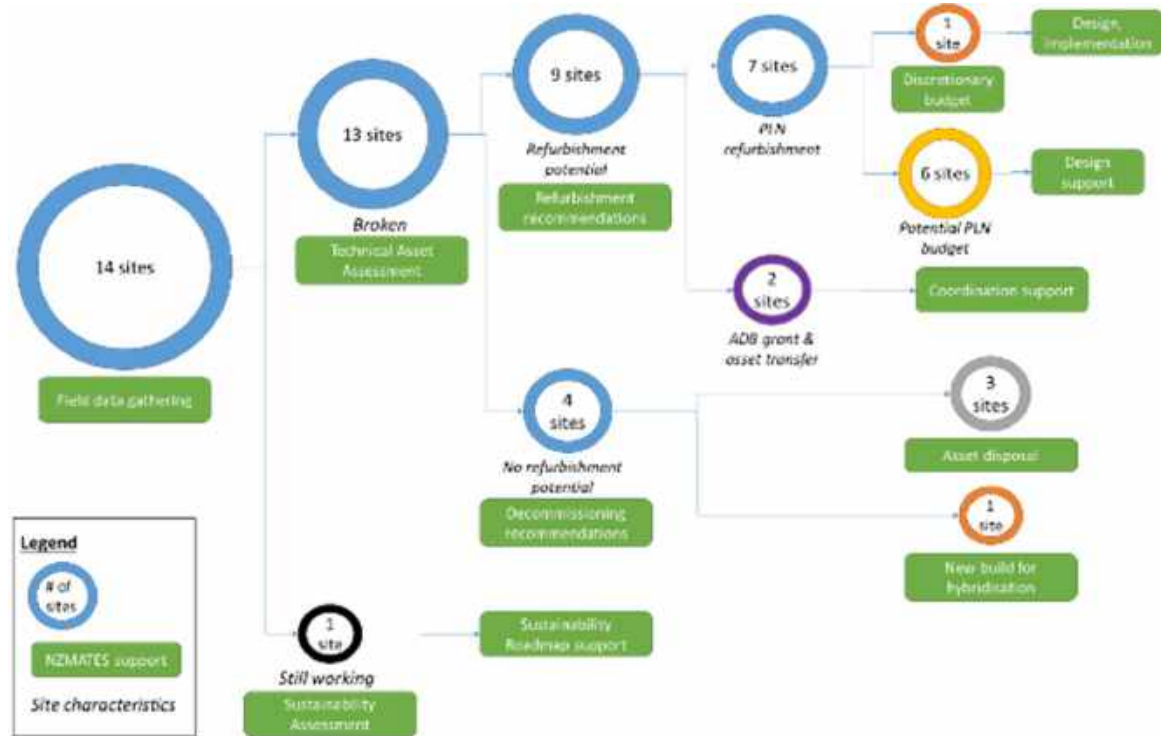


Figure 11: Summary of off-grid sites progressed in year 2.

Through this process of assessment of broken PLTS, NZMATES has gathered valuable information and lessons learned related to the sustainability of PLTS in Maluku and common causes of failure. Using this information, for many of the remaining projects in the NZMATES pipeline, NZMATES was able to carry out desk appraisals and identify which sites have good refurbishment potential and which do not. This means that resources could be focused on sites with a clear path forward towards refurbishment, rather than visiting all 42 sites. Such desk appraisals were carried out for the remaining 19 EBTKE sites, and different potential pathways forward were identified based on their current electrification status, geography, and reports of asset status.

For those without good refurbishment potential, these have either been recommended as decommissioning projects, which NZMATES will support with information on recycling and disposal of assets, or they have been included in new groups of potential new-build, refurbishment or hybridisation locations which NZMATES will conduct pre-feasibility studies on.

The pathways for these 19 sites are summarised in the figure below.



Figure 12: Summary of characteristics and next steps for 19 EBTKE broken asset sites.

From all visited and broken PLTS, NZMATES has gathered valuable information and lessons learned regarding common causes of failure as well as factors that lead to sustainability of PLTS in Maluku. These lessons learned will inform the development of Mini-Grid Sustainability Guidelines, to be developed in year 3 – for more on this see Section 3: Lessons Learned.



Figure 13: PLTS in Tahalupu



Figure 14: NZMATES survey team with Camat at PLTS in Lokwirin (Pulau Kur)



Figure 15: NZMATES technical team testing batteries on the PLTS in Lirang



Figure 16: NZMATES team with Dinas ESDM in Erersin

### 1.6 Output 4: Grid-connected RE projects progress smoothly through the project pipeline

No.	Indicator	Year 1	Year 2	LOP target
<b>04.1</b>	Number of grid-connected RE projects in the NZMATES pipeline that have made progress towards funding.	0	1	8
<b>04.2</b>	Number of grid-connected project assessments, studies or surveys conducted to support project progress through the pipeline and approved by partners.	0	2	NA

NZMATES received requests to support only two grid-connected sites (Wae Mala and Banda), however an additional site was added to the grid-connected pipeline when a field visit revealed that one site originally categorised as off-grid was in fact grid-connected (Elat).

Two reports were delivered during the past year regarding grid-connected projects: a Technical Asset Assessment report for the broken PLTS in Elat, and a Due Diligence Report on a pre-feasibility study conducted for a proposed small hydro project in Wae Mala. The Wae Mala report found errors in the economic calculations and recommended that the project not proceed due to very high Levelised Cost of Energy (LCOE). For this reason, only one project is reported as having made progress towards funding (Elat). NZMATES is now awaiting feedback from PLN regarding the recommendations for Elat in order to progress further.

The Banda PLTS has not yet been assessed due to PLN request to prioritise other sites. It is hoped that this potential refurbishment site can be visited in year 3.

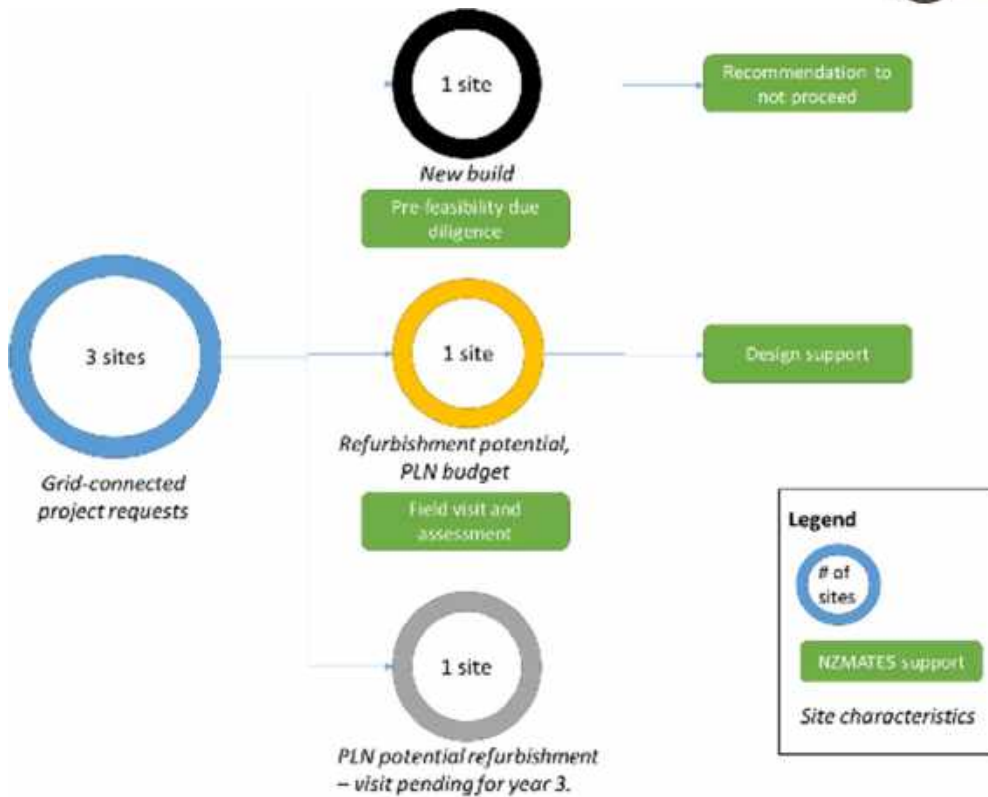


Figure 17: Summary of progress of grid-connected projects in the NZMATES pipeline



Figure 18: NZMATES and PLN staff at the Elat PLTS.

In the latest Results Framework review, NZMATES has proposed combining the off-grid and grid-connected pipelines into a single Output, given the often blurred lines between types of projects. A single pipeline will facilitate keeping track of initiatives in a single structure.

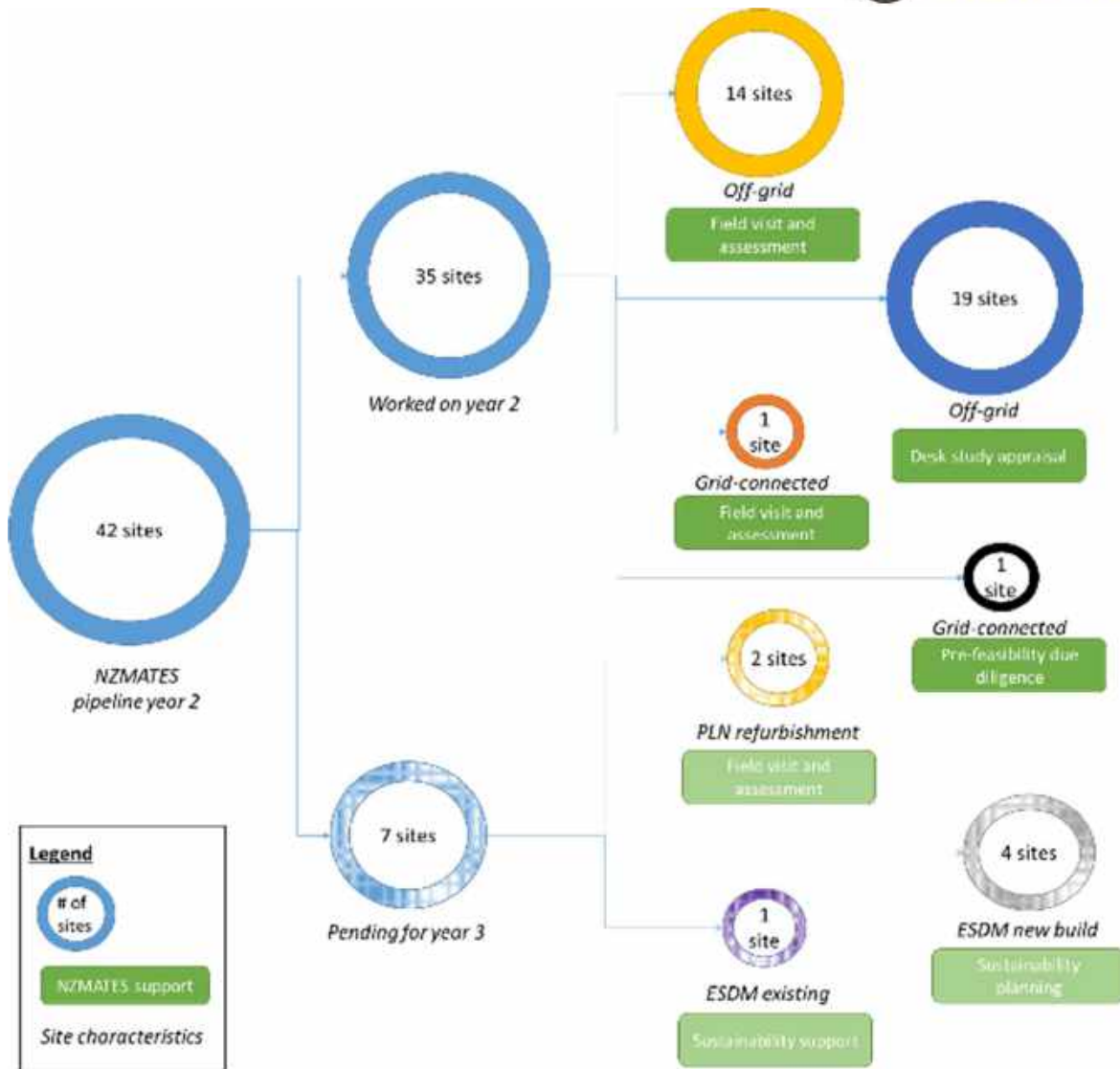
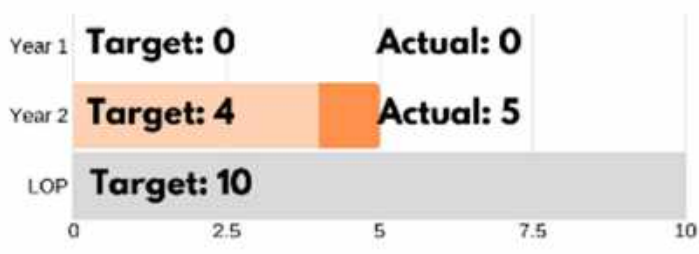
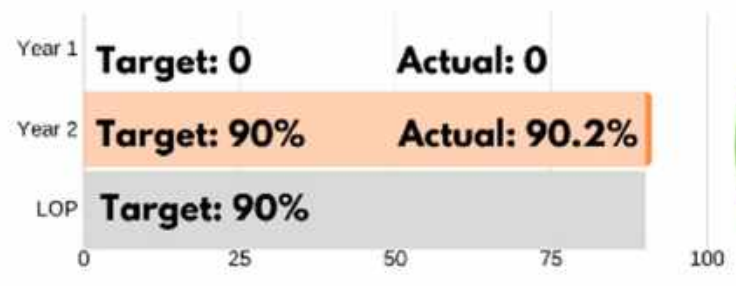


Figure 19: Summary of overall progress / status of 42 NZMATES pipeline projects from year 2.

# Output 5: Training and Mentoring Provided According to RE Skills Gaps Identified



**O5.2**  
Number of training activities conducted aligned with identified skill gaps.



**O5.4**  
Percentage (%) of people reporting satisfaction with the relevance of training.

## 1.7 Output 5: Training and mentoring provided according to RE skills gaps identified

No.	Indicator	Year 1	Year 2	LOP target
<b>05.1</b>	Number of people who receive training and/or mentoring through NZMATES	2	147 (20 women)	60
<b>05.2</b>	Number of training activities conducted aligned with identified skill gaps.	0	5	10
<b>05.3</b>	Number of training arrangements established between Indonesian and NZ universities or other educational institutions	0	0	1
<b>05.4</b>	Percentage (%) of people reporting satisfaction with the relevance of training.	-	90.2%	90%



*Figure 20. Training on Solar Minigrids at the 9<sup>th</sup> IndoEBTKE Conex in Jakarta, (November 2019)*

NZMATES continues to deliver training and mentoring to local key partners, i.e. PLN MMU and Dinas ESDM Maluku, and a total of 5 group training activities were held in the past year. A training workshop on PLTS good practices for PLN and Dinas ESDM was held in Ambon in May 2019. Then, NZMATES conducted a more in-depth follow-up training on sustainability of solar minigrids in November 2019. This training covered Design, Assessment, and Operation of PLTS and was targeted at a smaller group of key partner

staff, in order to have a more participatory forum to discuss real-life examples and experiences from the field in Maluku. These workshops were delivered by NZMATES Programme Manager Mauricio Solano Peralta with Infratec Engineer and Energy Storage Specialist Dr. Andrew Crossland.

In November 2019 NZMATES participated in and delivered a training at the eighth IndoEBTKE ConEX in Jakarta. The training was on Solar Mini-grids: Good Practices and Experiences from Maluku and was delivered by NZMATES Programme Manager and Infratec Project Engineer, Micah Sherman.

Collaborations with educational institutions in Maluku have also progressed well over the past year. NZMATES signed an MoU with Pattimura University in May 2019, and began to develop plans for developing a solar PV training centre. As UnPatti identified a lack of physical infrastructure as a challenge in developing such a facility, and given the lack of any functioning PLTS near Ambon where most engineering students working in Maluku are trained, a discretionary budget proposal was prepared for installing a solar PV training laboratory, complete with a small off-grid PV array and training equipment. UnPatti chose a site and classroom for the lab and has carried out necessary renovations.



At the time of writing this report the tender process for the solar installation was underway, though slight delays have been experienced due to the Covid-19 pandemic.

As part of the preparation for the training centre, NZMATES and Pattimura University co-organised a three-day training on Introduction to Solar PV for students of Mechanical and Electrical Engineering department as well as University laboratory staff. The training was co-delivered by Dr. Andrew Crossland and Lecturer of Pattimura University, Antoni Simanjuntak. Training materials will serve as model for future trainings to be delivered as part of the curriculum to support the solar laboratory installation.

In July 2019 NZMATES also delivered a short pilot training on PLTS at Politeknik Negeri Ambon, with whom an MoU was signed in September 2019. A follow-up 3-day introductory solar PV training was to be delivered in collaboration with Politeknik Negeri Ambon in March 2019, but this was also postponed due to the COVID-19 situation.

NZMATES also expanded its networking with educational institutions by planning a training and socialisation on renewable energy for students and staff of Ambon's 4<sup>th</sup> Vocational High School (*Sekolah Menengah Kejuruan*/SMK 4). SMK 4 has plans to begin to offer Renewable Energy as a study option using the approved curriculum, and an MoU for NZMATES collaboration is under preparation. The collaboration with SMKs in particular provides an opportunity to engage with a training entity that could prepare local operators.



Figure 21. Solar energy training in Pattimura University (November, 2019)

One challenge in delivering the NZMATES training programme has been reaching the target of 20% participation from women. So far, of the 147 people who have received training or mentoring through NZMATES, only 20 have been women, or 13.6%. When we look at individual events, the percentage of women participating ranges from 0% to 32.4%, as shown in Figure 22 below.

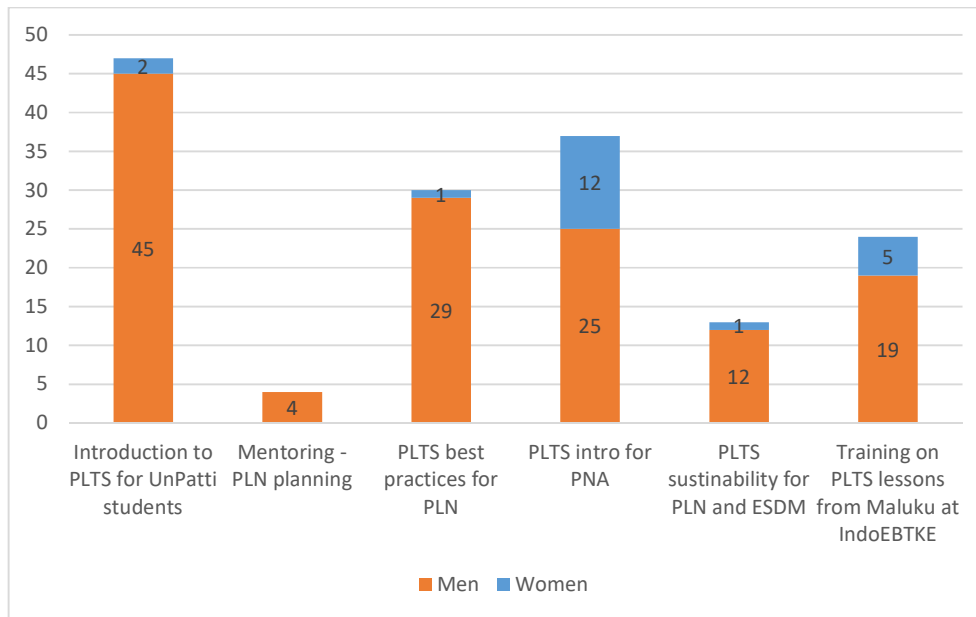


Figure 22: Number and gender of NZMATES training participants by event

NZMATES will continue to strive to improve the participation of women in training activities by actively encouraging partners to nominate women participants.

## 1.8 Progress towards short-term outcomes

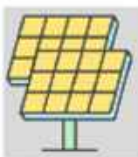
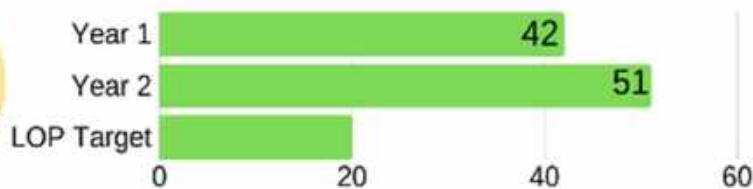
In NZMATES' second year of operation, the programme moved from its establishment phase and into implementation of activities. This means some small steps towards progress can be seen towards short-term outcomes.

# SHORT-TERM OUTCOMES



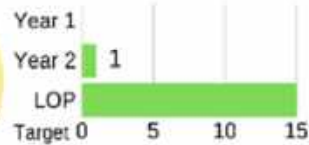
**ST1. NZMATES recognised as the go-to office for RE support that operates effectively within partner plans and objectives**

**ST1.1**  
Number of project assistance requests from private sector, government or community



**ST2. Off-grid projects are funding-ready**

**ST2.1**  
Number of off-grid projects meeting funding-ready criteria



**ST3. grid-connected projects are funding-ready**

**ST3.1**  
Number of grid-connected projects meeting funding-ready criteria

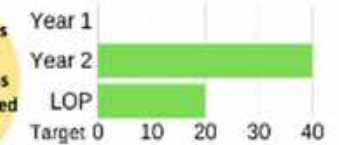


**ST4. Skills and knowledge of key government, education and industry partners increases**

**ST4.1**  
Number of PLN and ESDM staff with increased skills and knowledge



**ST4.2**  
Number of individuals from other organisations with increased RE skills and knowledge



### 1.8.1 Short-term outcome 1: NZMATES recognised as the go-to office for RE support that operates effectively within partner plans and objectives

No.	Indicator	Year 1	Year 2	LOP target
ST1.1	Number of project assistance requests from private sector, government or community	42	51	20

In the past year, NZMATES received 9 new project requests, in addition to the 42 received in the first year. This shows that partners continue to value the support provided by NZMATES, and that partners are largely satisfied with the quality of deliverables provided so far.

The nature of the new requests is different from the original 42, which were mostly refurbishment of off-grid PLTS. The new requests were:

- Due diligence on two grid-connected solar PV IPP proposals (2 projects, 2 sites).
- Pre-feasibility studies for four groups of potential sites for hybridising diesel mini-grids with solar PV (4 projects, 60 sites).
- Pre-feasibility studies for two groups of potential new solar PV mini-grid sites (2 projects, 62 sites).
- Support in the selection and development of grid-connected rooftop installations at various sites in Ambon (1 project, up to 12 sites).

This leaves the NZMATES pipeline with a total of 51 projects (up to 180 sites), 37 of which are considered active. Those which are no longer active consist of Wae Mala (cancelled due to high LCOE as mentioned above) and several of the broken EBTKE sites, which have been moved into other project groups to advance.



Figure 23: The NZMATES team meets virtually as all programme staff work from home due to Covid-19.

This includes 12 locations that already have electricity access through diesel mini-grids, which have been moved into the groups of potential hybridisation sites, one which has been moved to a group of potential new PLTS sites, and one which could be electrified by the PLTS refurbishment in a neighbouring location. Thus NZMATES will further examine ways forward for these locations as part of the new groups of projects.

Overall demand from partners continues to be high, and they have indicated that they see the deliverables provided so far as very valuable. In fact, NZMATES continues to

receive out-of-scope requests for support outside of Maluku Province. While NZMATES is not able to accept these requests, they are indications that demand for NZMATES services continues to be high.

### 1.8.2 Short-term outcome 2: Off-grid projects are funding-ready

No.	Indicator	Year 1	Year 2	LOP target
<b>ST2.1</b>	Number of off-grid projects meeting funding-ready criteria	0	1	15

The only project from the NZMATES pipeline that has reached funding-ready status so far is the Pulau Tiga PLTS refurbishment project. NZMATES conducted a social and technical assessment in Pulau Tiga, and worked collaboratively with PLN to agree on an overall approach and system size for the project. A proposal has been submitted to MFAT for the use of NZMATES' discretionary budget to refurbish the site as a showcase location close to Ambon.

Other off-grid projects approaching funding-ready status include the remaining PLN PLTS refurbishment locations assessed by NZMATES. The assessment reports for these locations are being reviewed by PLN and once an agreed approach and design has been decided they can be prepared for fund-matching.



Figure 24: The broken PLTS at Pulau Tiga

It has taken longer than expected to move projects through the pipeline to the funding-ready stage. This is in part due to the large amount of time invested in developing methodologies for technical assessment and reporting, which was a collaborative process where iterative modifications were made based on partner input, as well as changes in PLN personnel that delayed the decision-making process on next steps for the assessed locations. However, these delays are not

expected to affect the programme's ability to achieve its LOP target of 15 off-grid funding-ready projects by June 2023. However if Covid-19 restrictions causing the delay of PLN investment continues in the medium term, it could pose a risk to the achievement of this target. One requirement for a project to be funding-ready is agreement from the relevant partner that the project should be prioritised, and if PLN is not willing to prioritise pipeline projects this could be a barrier.

### 1.8.3 Short-term outcome 3: Grid-connected projects are funding-ready

No.	Indicator	Year 1	Year 2	LOP target
<b>ST2.2</b>	Number of grid-connected projects meeting funding-ready criteria	0	0	5

From all grid-connected projects in NZMATES, only PLTS Elat has made significant progress so far. The Technical Asset Assessment report was delivered to PLN however next steps are still under discussion, thus funding options cannot yet be explored in detail.

Several grid-connected support requests were sent to NZMATES in the end of the second year, such as due diligence of grid-connected IPP proposals, and support for EBTKE's rooftop solar programme in Ambon. Thus, NZMATES is still confident that this outcome can still be reached.

### 1.8.4 Short-term outcome 4: Skills and knowledge of key government, education and industry partners increases.

No.	Indicator	Year 1	Year 2	LOP target
<b>ST4.1</b>	Number of PLN and ESDM staff with increased skills and knowledge after participating in training activities through NZMATES.	0	20	40
<b>ST4.2</b>	Number of individuals from other organisations (companies, communities, educational institutions) with increased RE skills and knowledge after participating in training activities through NZMATES.	0	40	20

As noted above, NZMATES held 5 training events with a variety of participants from across key partner organisations and educational institutions in the past year. However, participation alone is not enough to ensure that NZMATES contributes towards its intended outcome of increasing the skills and knowledge of key partners. That is why at key training events NZMATES administers pre- and post-tests to see if participants are in fact picking up key messages and learnings. Note that these tests are not given at short trainings due to time limitations, and some participants who arrive late or leave trainings early are not able to complete the tests.

In the past year, the number of PLN and ESDM staff who gained skills and knowledge through NZMATES training is 20, which is half of the LOP target for short-term outcome 4.1. Meanwhile the number of individuals from other organisations showing improvements in post-tests is 40, which is double the original LOP Target. This is due to high participation from academic institutions, especially students.



Figure 25: Summary of those showing improved scores in post-training tests.

## 2 CROSS-CUTTING ISSUES

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### 2.1 Human rights

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In its second year, NZMATES continued to focus on promoting human rights by grounding all activities in a strong understanding of social, cultural and economic context, including any underlying structures of power or vulnerability, to avoid contributing to human rights violations.

This was enhanced in year 2 by the Baseline Survey, which provided rich contextual information on a variety of target locations, as well as NZMATES' own socioeconomic assessment tools, which were refined and applied in all site assessments.

NZMATES has also continued to strengthen its protection of human rights through safeguarding measures, which are constantly reviewed and improved. Currently this includes the development of Community Accountability Reporting Mechanisms (CARM), and the preparation and application of additional safeguarding tools such as risk assessment guidelines for use as more projects move to implementation stage.

As NZMATES moves its first projects from assessment to implementation, there is also a focus on ensuring participation of different groups within the target communities, through Community meetings, trainings on household energy management and productive uses and other consultation and participation activities. This ensures different populations are represented, involved and are able to advocate for their own needs and aspirations.

The NZMATES Team also raised funds and volunteered in providing a rapid response to the Ambon earthquake in September 2019, and was able to deliver dozens of food and basic needs packages to affected people.

### 2.2 Gender

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NZMATES continues to strive for gender balance within its own team, and progress has been made on this in the second year, through hiring an extremely talented woman engineer, Maryam Karimah, as a Renewable Energy Technical Specialist. NZMATES staff is now 50% women and 50% men, with representation in all sections of the team, management, community engagement, technical specialists, and admin.

As mentioned above, achieving 20% female participation in training events has been a challenge, and this target was not reached in year 2. For most of the institutions NZMATES has targeted for training activities so far, the number of women in eligible roles is very small compared to the number of men. In year 3 NZMATES will strive to improve performance in this area.

NZMATES had identified a strong female engineering student at Pattimura Univeristy and had planned to implement an internship involving field travel to NZMATES sites, however the Covid-19 pandemic has meant this could not be implemented as intended. Some mentoring has still been provided and NZMATES is looking for ways to adapt the relationship to the current scenario.

At the community level, NZMATES continues to ensure that women's needs, strengths and aspirations are considered in socio-economic assessments, including those of female-headed household and female-owned businesses. Participation of women in engagement activities during project implementation will also be a priority.

### 2.3 Environment and Resilience

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Mitigating climate change and environmental impact is at the heart of the NZMATES Programme, which aims to support the Government of Indonesia's targets:

- Increasing renewable energy to 23% of the total energy supply by 2025 and 31% by 2050 (NEP, 2014);
- Reducing unconditionally 26% of its greenhouse gases against the business as usual scenario by the year 2020 (UNFCCC, 2015) and conditional reduction of up to 41% reduction by 2030 (COP21, 2015).

In its second year, NZMATES has had a strong focus on the sustainability of renewable energy projects, in particular small island mini-grids. This involved conducting assessments on failed systems and drawing lessons-learned to ensure that both refurbished and new projects are resilient and sustainable into the future. Assessments and design always take into account future load growth as well as environmental factors such as sea-level rise, potential for natural disasters, or changes in resource availability due to climate change (e.g. reduced water flow in the case of hydro projects).

NZMATES has also been working on improving waste management protocols for decommissioning of remote solar mini-grids that have reached their end-of-life, including through identifying supply chains for recycling lead acid batteries and other components, to avoid hazardous solid waste remaining in remote communities and contributing to environmental degradation.

Finally, the NZMATES Team joined the Governor of Maluku's initiative to make Maluku free of plastic rubbish, joining beach clean-up days and by making all NZMATES events plastic-free. In addition, for the EPC works in the University Lab a waste management plan was requested along with a minimization plan of plastic use.



### 3 KEY LESSONS LEARNED

As an adaptive programme, learning and reflection play an important role in NZMATES' planning and management approach. Over the past year, the NZMATES team has ensured time is taken to analyse challenges and successes, and if necessary adapt activities to better serve the programme's intended outcomes and goal.

The sub-section below provides a brief look at one of the programme's key learnings of the past year, related to the sustainability of solar mini-grids. Following that, a summary of other lessons learned across the other aspects of the programme is provided.

#### 3.1 Sustainability of solar mini-grids

One of the key findings during field assessments was the high rate and extremely fast failure of PLTS managed under a community-based or local non-PLN electrification model. Out of 25 locations, 23 of them are non-operational and the remaining two operate with limitations. Failure of systems was reported from as early as 1 month after commissioning while the best-performing site worked for a maximum of 3 years. On average systems have ceased to function (technically or administratively<sup>4</sup>) after around 1 year, showing that, at least in Maluku, the community-based model has not proven successful. While many PLN-operated systems have also reached their end of life, these systems have operated successfully for more than 4 years on average, a considerable difference.

Many donors, government agencies, and NGOs in Indonesia and worldwide have pushed remote villages to take a community-based approach to electricity service provision. Notwithstanding, while this model is intended to empower communities, it more often ends up creating a burden, an inefficient use of resources, and can even cause conflict within communities. Maintaining reliable and affordable access to electricity for communities is a task that even existing utilities struggle with, and yet remote communities are expected to learn the tasks of an electric utility in the best case within 1-2 years and then be able to independently and effectively manage electricity provision for their population.

Failure of these remote solar mini-grids is not only technical, and in several cases has also been driven by very poor management, implementation and operational models, design challenges, lack of a supply chain for even minor spare parts, no operational budget, or other external factors. For example, several sites have assets that are still in good technical condition, but these cannot be used due to inadequate operational frameworks. Technical capacities in basic operation can be developed through training at local



*Figure 26: Infratec Engineering Manager Keith Scoles helps the NZMATES technical team to develop technical assessment tools for broken solar mini-grids.*

<sup>4</sup> On some sites assets are still in OK condition, but community has decided to cease operations due to factors such as lack of tariff payment, minor technical issues, complaints from village or management challenges.

level, but more advanced aspects such as specialised technical troubleshooting, access to spare parts and management of payments can place a heavy burden on communities, and positive results are hard to achieve for organisations that are not equipped to provide a specialised technical service. Moreover, economic conditions in remote locations mean that, no matter who is responsible for electricity provision, there is a strong need for cross-subsidies to be able to offer affordable tariffs to households, while being able to maintain a good service in remote areas. From the community perspective, many people have expressed that their interest is less in being able to generate their own electricity and more on being able to use the electricity service to improve their economic and social well-being.

It remains clear that a community approach or relying on local district or sub-district governments to manage solar mini-grids has a very high risk of early failure in Maluku. For this reason, NZMATES has opted to depart from the models being promoted by other donors, NGOs, a few private-sector initiatives, and some government agencies, and instead emphasise PLN's capacity. PLN has the benefit of an existing network of technical staff, a broad geographic spread, and the ability to access a cross-subsidy for end-user tariffs. By law all PLN clients should pay a universal tariff, which in the case of Maluku is already highly subsidised, even in Ambon.

Therefore, NZMATES has opted to channel ESDM/EBTKE (or other government/donor) project development into collaboration with PLN as the safest and most reliable long-term sustainable approach. NZMATES' collaboration with PLN will aim to raise their operational capacity on renewables, increase their confidence, know-how of tools and technologies, and experience with renewable energy technologies, in order to strengthen their capacity as the primary provider of renewable energy services to remote communities.



*Figure 27: Sunset over the PLTS at Adaut.*

NZMATES has discussed these challenges and lessons learned with ESDM and EBTKE and other key stakeholders, and is currently working on developing set of Sustainability Guidelines to disseminate among actors in Maluku. It is hoped that this engagement will help to ensure that all actors are aware of the challenges and limitations of the popular community RE generation model and that we can work together to promote more sustainable and effective solar mini-grids going forward.