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**Renewable Energy Investments
in the Pacific:
A Process Evaluation
New Zealand Aid Programme, Renewable
Energy Sector 2011-2015**

DECEMBER 2015



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Abbreviations

ACA	Activity Completion Assessment
ADB	Asian Development Bank
ADD	Activity Design Document
AusAID	Australian Agency for International Development (prior to 2014)
BOOT	Build Own Operate Transfer
CBA	Cost Benefit Analysis
CDPS	Common Design Principles and Specifications
CIGOV	Cook Islands Government
CIREC	Cook Islands Renewable Energy Charter
DAC	Development Assistance Committee, Organisation for Economic Co-operation and Development
DFAT	Department of Foreign Affairs and Trade, Australia (since 2014)
DPA	Development Partnership Arrangement
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Electric Power Corporation (Samoa)
EPCM	Engineer Procure Construct Manage
ESIA	Environmental and Social Impact Assessment
ESI-OP	Environmental and Social Impacts, Operational Policy
EU	European Union
GDP	Gross Domestic Product
GoS	Government of Samoa
GoT	Government of Tokelau
GOT	Government of Tonga
IC	Infrastructure Committee, Cook Islands
IEE	Initial Environmental Examination
IP	Implementation Plan
IPP	Independent Power Producers
IPSA	Initial Poverty and Social Assessment
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
LBES	Labour Based, Equipment Supplied



LCIP	Least Cost Investment Plan
MFAT	Ministry of Foreign Affairs and Trade, New Zealand
MNRE	Ministry of Natural Resources and Environment, Tonga
MOIP	Ministry of Infrastructure and Planning, Cook Islands
MOU	Memorandum of Understanding
NSDP	National Sustainable Development Plan, Cook Islands
NZ	New Zealand
NZAID	New Zealand Agency for International Development (prior to 2009)
NZDS	New Zealand Defence Service
NZS	New Zealand Standard
O&M	Operation and Maintenance
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
OMIA	Office of Minister for Islands Administrations, Cook Islands
PCC	Project Coordinating Committee, Cook Islands
PCERP	Post Conflict Emergency Reconstruction Project, Solomon Islands
PEC	Pacific Environment Community
PMU	Project Management Unit
PPTA	Project Preparation Technical Assistance
PRIF	Pacific Regional Infrastructure Committee
PSG	Project Steering Group
PV	Photovoltaic
QA	Quality Assurance
QC	Quality Control
RE	Renewable Energy
RFP	Request for Proposal
SIRIP	Solomon Islands Road Improvement Project
TAU	Te Aponga Uira (Rarotonga Energy Authority), Cook Islands
TERM	Tonga Energy Road Map
TPL	Tonga Power Limited
TREP	Tokelau Renewable Energy Programme
SCADA	Supervisory Control and Data Acquisition
UNDP	United Nations Development Programme
WB	The World Bank



Abstract

The purpose of the process evaluation of its 2011-2015 renewable energy infrastructure investments is to independently inform the New Zealand Ministry of Foreign Affairs and Trade (MFAT) of improvements and learnings that can be made to the planning and management of such Activities. This includes the concept, design, implementation and completion phases. The improvements and learnings should be used to improve performance of other energy and non-energy Activities in the Pacific and potentially elsewhere in the world.

This report covers the second stage of evaluation of MFAT's 2004-2015 infrastructure investments in the Pacific. Renewable energy Activities were evaluated in four countries: the Cook Islands, Tonga, Tokelau and Samoa. Extensive document review and stakeholder interviews, including in country interviews, of these Activities were undertaken to inform the evaluation. A number of key findings were identified covering the topics of planning, management, and Activity design, effective capacity building, maintenance and cross-cutting Issues. The findings showed a number of themes consistent with an earlier review of completed infrastructure investments (Stage One of this evaluation) that will be useful for MFAT to learn from in the future. An overarching results framework for renewable energy Activities was also developed identifying outcomes, outputs, indicators and a Monitoring and Evaluation Plan. The implementation of these key recommendations and the application of the overarching results framework will result in better project design and more successful outputs and outcomes that satisfy the Development Assistance Committee (DAC) criteria.



Executive Summary

The New Zealand Aid Programme, Ministry of Foreign Affairs and Trade (MFAT) identified infrastructure investments as one of the enablers of growth in its March 2011 International Development Policy Statement (MFAT 2011). Renewable energy was seen as one of the key underpinnings of its growth strategy (MFAT 2011).

An independent process evaluation was conducted of MFAT's 2004-2015 infrastructure investments in the Pacific. Extensive document review, stakeholder interviews and in-country visits for these Activities were conducted. The evaluation was separated into two stages with distinct purposes as follows:

- Stage One – To identify lessons learned from past infrastructure investments on what worked or didn't work, and why. These investments targeted land transport; maritime transport; water, sanitation and hygiene; solid waste management; and energy.
- Stage Two - To evaluate the Activity planning and management (in concept, design, implementation and completion phases) of the MFAT renewable energy Activities.

This Report covers Stage Two of the evaluation which focused on recently completed or ongoing Renewable Energy Activities in four Pacific countries:

- Tokelau Renewable Energy Programme (TREP) – The construction of solar arrays and battery storage on each of Tokelau's three main atoll islands.
- Tonga's Renewable Energy Solar Activity (Maama Mai Solar Facility) – the construction of solar arrays connected to the Tongatapu grid
- Samoa Renewable Energy Partnership – a programme of Activities including sector support, construction of solar arrays, and rehabilitation of damaged hydro generation schemes.
- Cook Islands Renewable Energy Activity: Airport West Solar and Outer Islands (Northern Group) Solar – the construction of solar arrays connected to the Rarotonga grid, and the construction of solar arrays and battery storage on the six atoll islands in the Northern Group of the Cook Islands.

These Activities have been undertaken over a period of progressive development by MFAT of practice improvements in undertaking renewable energy infrastructure Activities, from the earlier Activities in Tokelau and Tonga to the later work in Samoa and Cook Islands. This included taking more of a sectoral focus rather than management as individual Activities.

Quantitative data on the performance and impact of the Activities reviewed here was not generally available for this evaluation. In some cases, particularly for the Renewable Energy Activities, this was simply because it was too soon after completion of the Activity for data to be available, but in other cases data had not been collected or was not provided. The Evaluation



therefore is based primarily on document review and interviews, supplemented by what data was available.

Key Findings and Lessons Learned

The key findings of the evaluation (Report Section 2) and lessons learned (Report Section 4) in response to the key evaluation questions are:

Activity Planning and Design:

- Providing infrastructure is not, in itself, enough to provide positive impacts on beneficiaries such as affordable and reliable energy. Even if the Activity is intended only to complete a specific task, Activity Design should respond to other sector issues such as stakeholder interests, technical and financial sustainability, cross-cutting themes, and in-country capacity and capability affecting implementation.
- In current conditions tariff structures, diesel prices and subsidies are likely to have more impact on affordability than incremental renewable energy infrastructure investments. This situation may change with future changes in oil prices and further investment in new renewable energy technologies leading to a continued reduction of capital costs.
- Achievement of beneficial cross-cutting Outcomes is constrained where this is not comprehensively considered in Activity design. Adequately scoping and screening of cross-cutting issues in Activity design will identify risks, open up opportunities to avoid harm and to 'do good' as well as enable mainstreaming of both impact management and benefits into the Activity.
- Not enough time has elapsed since completion of the Activities to allow MFAT to fully assess the achievement of planned Outcomes for individual Activities and the impact of the investments in renewable energy.
- MFAT is seen as a niche player, with good relationships with in-country partners and donors. It is able to be flexible and innovative with funding and implementation arrangements, and is working in a manner that is complementary to other donors, to the benefit of the Pacific development partners.
- There are major differences in the difficulties and impacts of renewable energy infrastructure projects connected to extensive grids against those for isolated communities. A different approach to the planning and management of the work is needed for each situation.

Activity Implementation

- Solar projects are generally perceived and therefore assessed as being 'low risk' for cross-cutting themes. Somewhat perversely, this can lead to inadequate scoping and assessment of environmental and social risks and benefits, particularly of indirect impacts such as civil works for equipment transportation and installation or the removal of spent batteries.



- Quality procurement processes are one of the most important keys to success in infrastructure projects. Tight timescales for procurement can result in poorer tender proposals, less local sector involvement, greater costs due to higher levels of risk and reduced competition, and compromised implementation.
- Timeframes for implementation that are too short can lead to risks of increased costs, reduced quality and unplanned delays. Analysis of what timeframes are feasible has not been sufficient at the Activity design stage.
- Clearer definition of Roles and Responsibilities within MFAT and the wider project team during Implementation would reduce risk and improve efficiency.

Activity Completion

- Documentation and processes for handover of assets to infrastructure owners need to be more effective if infrastructure investments are to be sustainable. Future maintenance and renewal needs for new infrastructure are not sufficiently understood by the asset managers.
- Maintenance, other than relying on partner governments, following Activity completion was not considered across all the Activities evaluated. In Tonga and Tokelau asset monitoring and maintenance has been outsourced to the contractor for an interim period (Meridian and Powersmart).

Activity Evaluation and Monitoring

- Recent initiatives for improved evaluation and monitoring of Activities, and for documentation and sharing of findings will be beneficial in improving Outcomes from future MFAT Activities.
- Baseline and monitoring data needed to evaluate Impact is not consistently being collected. In some Activities the monitoring of indicators is not commencing until after completion of the infrastructure construction.

Conclusions

The following major conclusions from the evaluation (Report Section 3) were:

Activity Goals and Design

- The Activities all contribute to the expected outcome of 'increased access to clean, efficient and affordable energy' under MFAT's Strategic Plan theme of 'improved economic wellbeing' (MFAT 2012).
- All activities contribute to in-country strategies and plans for the energy sector and sustainable development. There is a clear focus on reducing dependence on diesel fuel by installing solar and solar/diesel hybrid infrastructure on grids and mini-grids. There is some focus on



institutional strengthening within the energy sector, particularly in Samoa and the Cook Islands.

- Activities focussed on installation of energy generation in a 'fast-track' programme for completion. Activities were well designed for this specific focus and intent.
- Implementation effectiveness has been impacted at project design stage by limited consideration of economic and stakeholder analysis, cross-cutting issues, problem analysis and risk assessment, sustainable operations and maintenance support (including capacity building), analysis of feasible time frames for tendering, procurement and construction.
- There is growing knowledge and understanding in the implementation and management of infrastructure Activity Design in MFAT through experience and application of learnings from previous projects. This could be further improved by documenting and applying all relevant lessons, such as procurement, and those of other donors.

Activity Management

- The Activities have been well managed and implemented by MFAT. Solar systems have generally been installed to budget and on programme, although the timeframes for procurement and construction of some systems were unrealistic in the case of the Northern Cook Island budget needed to be increased relatively significantly following market engagement. It was recognised at an early stage that to deliver a portfolio of projects within the timescales promised that additional staffing was required.
- There is not a 'one size fits all' method of delivery, and every project needs to be assessed on an individual basis. Lessons learned from the project delivery method should be contextualised before replicated elsewhere.
- MFAT control of procurement and project management provides efficiencies and time savings, but reduces the learning experiences and capacity development of in-country partners. Tight timescales for procurement and construction resulted in less local sector involvement and income/employment opportunities.
- Structuring procurement to align with project risks and liabilities would lead to a more competitive tender process and a wider pool of tenders. Activity risk registers were kept live by MFAT on some projects and were used actively as a project management tool.

Results and Impact

- Installed solar capacity on larger islands where it contributes only a small proportion of the grid has not resulted in improved access to energy or affected reliability and affordability to the consumer.



- The investments have achieved a reduction in diesel consumed and greenhouse emissions. The replacement of diesel is not yet at a scale that will ease the countries vulnerabilities to fluctuating diesel supply or diesel prices.
- The contribution of solar generation to each grid will assist each country to eventually meet its goals of energy security and reduce reliance on imported fuels. The investments have helped build capacity and knowledge in the sector, and provide impetus for further investment in solar and renewables.
- Installed solar/diesel hybrid capacity in the atolls (Tokelau, Northern Cook Islands), where it is the primary source of electricity generation, has led to a significant reduction in diesel imports (although less than planned for Tokelau) and reduced vulnerability to diesel supply and price.
- In the case of Tokelau, improved reliability and duration of energy supply has led to increased energy consumption and household spending on energy. This also emphasises the need for demand side management and appropriate tariff setting. Higher demand has resulted in the systems being operated differently to the design, with more wear and tear on batteries.
- Commercial enterprise has not changed in Tokelau because reliability and affordable energy is not the only significant barrier to private enterprise. In the Northern Cooks more available and reliable electricity has the potential to improve the freezing and storage of seafood for trade.
- Renewable energy does not necessarily translate into a reduction in tariff in small islands because there are a number of other influences on electricity price. Approaches to tariff setting vary across the Pacific and the tariff can include subsidies and omission of some costs that mean it is not self-sustaining.
- Outcomes for capacity development have been restricted because of the focus on infrastructure building and fast-track construction. Capacity building has been mainly based on operation and maintenance training incorporated into the handover of assets. Learnings from infrastructure commissioning have led to further support to utilities for training and operations and management support.
- Appropriate governance structures and resources are needed for the operation and maintenance of new mini-grids on atolls. A risk for sustainability occurs where such governance and resources are not in place.

Cross-cutting Themes

- Cross-cutting issues in Cook Islands and Tokelau were not scoped in detail during Activity design, leaving issues to be identified, assessed and managed during implementation. This 'reactive' approach appears



to be changing, as an Initial Environmental Assessment informed the more recent Samoa Activity Design. There is a risk to MFAT that significant issues will be missed or mismanaged if not identified early in the Activity cycle, causing impacts on fragile environments and vulnerable communities.

- While the cross-cutting focus has been to safeguard against adverse impacts, opportunities to mainstream gender, human rights, environment and climate change issues into Activity design were not commonplace. Mainstreaming these issues, and a focus on maximising cross-cutting benefits, could improve development outcomes and impact.
- Climate change mitigation is a significant outcome from renewable energy Activities, albeit on a small scale. However it does not appear in results frameworks.

Recommendations

The following actions are recommended (see Section 5 for more detail):

Activity Concept and Design

1. Allocate resources to adequately scope cross-cutting issues and beneficiary needs to maximise benefits and avoid / mitigate negative impacts through good Activity design (responsibility of MFAT).
2. Include realistic assessment of future increase in use and demand side management of energy for beneficiaries (residential and non-residential) as part of Activity designs (responsibility of MFAT).
3. Undertake a local sector and partner capacity assessment to ask 'How can this Activity be designed to maximise local involvement' (responsibility of MFAT).
4. Coordinate with development partners and other Donors to take a sector-wide approach and ensure that MFAT's investments fit, and are well coordinated (responsibility of MFAT, other Donors).

Activity Implementation

5. Contracting strategies should identify the key project risks and share and allocate those risks to those parties best placed to manage them (responsibility of MFAT).
6. Provide support for in-country resources through supervision and monitoring of work undertaken by in country partners (responsibility of MFAT).
7. Make improvements to more regularly update Activity programmes and risk registers to assess impacts of delays both to project risk, programme and dates, in line with current best industry practice (responsibility of MFAT).



8. Develop clear project management structures with clear roles and responsibilities of all parties involved in the implementation including authority matrix and relationship / communications strategy (responsibility of MFAT).
9. Assign clear roles and responsibilities for implementation and monitoring of cross-cutting actions (responsibility of MFAT, PMU Consultants, and Contractors).

Activity Completion

10. Provide understandable comprehensive handover documentation to the utility/asset owner for the future operation, maintenance and renewal of the asset along with supporting training (responsibility of MFAT, implementing agency).
11. Include plans for future funding needs as part of asset management plans so that all future funding requirements for sustainability of the infrastructure are understood and planned for (responsibility of MFAT, implementing agency).

Activity Evaluation and Monitoring

12. Adopt the Energy Sector Results Framework as the basis for Activity monitoring and evaluation (responsibility of MFAT).
13. Collect more documentation of lessons learned from completed Activities that are available to MFAT staff (responsibility of MFAT).



1. Introduction/Background

1.1 The Activity

The New Zealand Aid Programme, Ministry of Foreign Affairs and Trade (MFAT) have identified infrastructure investments as one of the enablers of growth (MFAT 2012). Of these, renewable energy is seen as one of the key underpinnings of the New Zealand Aid Programme's growth strategy. Introducing clean and affordable energy technologies is a high priority for the Pacific region and this is reflected in MFAT's Energy Sector Priorities. Expected outcomes from these initiatives include: sustainable energy and reduced reliance on imported fuels; and increased numbers of people with access to clean, reliable and affordable energy services.

An independent evaluation was conducted of selected infrastructure investments completed by MFAT from 2004-2013, and its renewable energy infrastructure investments undertaken from 2011-2015 in the Pacific. The purpose of the evaluation is to learn from these investments and advise improvements that can be made to the future planning and management of such projects, particularly for renewable energy. This includes the concept, design, implementation and completion phases of the investment.

The Evaluation was conducted in two parts: Stage One (completed infrastructure 2004-2013) and Stage Two (renewable energy Activities 2011-2015). The Terms of Reference for this evaluation are:

- Stage One - identify lessons learned from past infrastructure investments on what worked or didn't work, and why. MFAT targeted the following infrastructure subsectors as part of this evaluation: land transport; maritime transport; water, sanitation and hygiene; solid waste management; and energy
- Stage Two - evaluate the Activity planning and management (covering concept, design, implementation and completion phases) of the MFAT renewable energy Activities to improve performance and for learnings that can be applied to other energy and non-energy Activities in the Pacific and potentially elsewhere in the world.

The evaluation of completed infrastructure (Stage One) was concluded in March 2015 and the report finalised in November 2015¹. The Executive Summary of that report is given in Appendix One.

This Report covers Stage Two of the evaluation.

¹ Infrastructure in the Pacific: Learnings from Completed Investments 2004-2013. MWH, November 2015



1.2 Evaluation Purpose and Design

1.2.1 Purpose

The purpose of this process evaluation is to independently inform MFAT of improvements that can be made in the Activity planning and management (concept, design, implementation and completion phases) of MFAT's renewable energy (RE) Activities. The aim is to improve performance and for learnings that can be applied to other energy and non-energy Activities in the Pacific and potentially elsewhere in the world.

For the purposes of the evaluation it has been assumed that the Renewable Energy Sector includes all Activities relating to the goal of 'increased access to affordable, clean, reliable energy'. The Activities evaluated all involved infrastructure builds, and focus on solar, with some grid and mini-grid connections. However, Overarching Findings and Lessons learnt translate to the broader Renewable Energy Sector (not just installations of infrastructure), and the overall sector goal.

The objectives of this evaluation (Stage Two) are to:

1. Assess whether lessons learned are being applied to current or new renewable energy Activities
2. Identify lessons learned from the design, implementation and management of current renewable energy Activities
3. Develop an overarching results framework including a monitoring and evaluation plan, for current and future renewable energy infrastructure Activities.

The evaluation described here is based on review of four renewable energy Activities identified in the Terms of Reference in the Cook Islands, Tonga, Tokelau and Samoa, with the addition of one further Output for the Cook Islands Activity.

This Evaluation is an evaluation of MFAT's overall processes and practices for renewable energy Activities rather than being an evaluation of individual Activities.

1.2.2 Scope

The evaluation focusses on the following recently completed or ongoing renewable energy Activities:

- Tokelau Renewable Energy Programme (TREP), 2011 – 2012: The construction of solar arrays and battery storage on each of Tokelau's three main atoll islands
- Tonga Renewable Energy Solar Activity (Maama Mai Solar Facility), 2011 – 2017: the construction of solar arrays connected to the Tongatapu grid
- Samoa Renewable Energy Partnership, 2014 – Present: a programme of Activities including sector support, construction of solar arrays, rehabilitation of damaged hydro generation schemes, and new hydro generation schemes.



- Cook Islands Renewable Energy Activity, 2011 – present: Airport West Solar, and Outer Islands (Northern Group) Solar – the construction of solar arrays connected to the Rarotonga grid. The construction of solar arrays and battery storage on the six atoll islands in the Northern Group of the Cook Islands.

With the exception of the Cook Islands Outer Islands Solar, these were identified in the Terms of Reference. The Cook Islands Outer Islands (Northern Group) Solar Activity was added later to the Evaluation because of its commonality with the other Activities covered by the Evaluation. The Cook Island Airport West Solar and the Cook Islands Outer Islands (Northern Group) Solar are two parts of the single Cook Islands Renewable Energy Activity. The Activity also included a small third component to assist the Enabling Environment for Energy Sector Development. The naming of the overall Activity varies between the Activity Design Document (ADD) (Cook Islands Renewable Electricity Activity) and the more commonly used Cook Islands Renewable Energy Activity. The latter name is used here.

The Activities have been undertaken over a period of progressive development by MFAT of practice improvements in undertaking renewable energy infrastructure Activities, from the earlier Activities in Tokelau and Tonga to the later work in Samoa and Cook Islands.

A summary of the nature and scope for each of the four Activities is in Appendix Two. A summary of project expenditure is given in the table below.

Project and Country Statistics

Project	Duration	Budget Cost	Partner / Amount	Country Population	GDP/capita (USD)
Tokelau Renewable Energy Programme	2011 - 2012	NZ\$8.5m	MFAT NZ\$8.5m	1,383 (2013)	\$1,000 (1993)
Tonga Renewable Energy Solar Activity	2011 – 2017	NZ\$9.24m	MFAT NZ\$9.24m	105,323 (2013)	\$4,427 (2014)
Samoa Renewable Energy Partnership (Photovoltaic energy projects)	2014 – Present	NZ\$26.5m	MFAT NZ\$14.5m	190,372 (2013)	\$4,212 (2014)
Cook Islands Renewable Energy Activity:				10,900 (2011)	\$9,100 (2005)
Airport West Solar	2011 – 2015	NZ\$3.5m	MFAT NZ\$3.5m		
Outer Islands (Northern Group) Solar	2014 – Present	NZ\$19.5m	MFAT NZ\$19.5m		
Enabling Environment for Energy Sector Development	2014-2015	NZ\$304,000	NZ\$304,000		



Note: More recent published data for Tokelau GDP was not found. The TREP was significantly larger than the annual country GDP.

1.2.3 Design

A mixed methodology approach was taken to reviewing the projects and data collection for the evaluation. This comprised the following key tasks:

- Document review (MFAT and other donors) - A list of the documents reviewed is given in Appendix Three
- Meetings with relevant Wellington MFAT staff - This was predominately undertaken at the same time as the Stage One meetings
- In country interviews with MFAT Post staff
- In country interviews with national stakeholders and other donor staff
- Interviews via telephone were undertaken where it was not possible to meet with stakeholders.

Quantitative data on the performance and impact of the Activities reviewed for this evaluation was not generally available. In most cases this was simply because it was too soon after completion of the Activity for data to be available. In other cases data had not been collected or was not provided. The Evaluation therefore is based primarily on document review and interviews, supplemented by what data was available.

Detailed information on the evaluation design is contained in the Evaluation Plan.²

1.3 Overarching Results Framework for Energy

As part of this evaluation, an overarching results framework for MFAT's renewable energy Activities in the Pacific has been prepared, along with supporting guidance notes. This is contained in a separate document. This results framework is based on the Evaluation results that are contained in this report.

² Evaluation Plan for Evaluation of Infrastructure Investment in the Pacific, November 2014

2. Overarching Findings

The four Activities evaluated are similar in their technical scope, being all centred around construction of new solar generation, but in some cases with additional elements of renewable energy sector support and generation.

The findings for the evaluation have been grouped below under the key evaluation questions contained in the Terms of Reference, with additional reference to Development Assistance Committee (DAC) Criteria for Evaluating Development Assistance (OECD DAC 1991).³

2.1 What are the Renewable Energy Activities Trying to Achieve?

(DAC Criteria – Relevance)

The Activities all contribute to the Expected Outcome “Increased access to clean, efficient and affordable energy” under the Strategic Theme of “Improved Economic Wellbeing” within the MFAT Strategic Plan 2012-2015.

The goal for Samoa Renewable Energy Partnership Activity is “Efficient, reliable, safe, cost effective and sustainable electricity supply for Samoa”, reduced reliance on diesel fuels”. The Activity is consistent with, and contributes to, the Samoa Energy Sector Plan. The outputs are:

- Least-Cost Investment Plan (LCIP) completed and approved by Government of Samoa (GoS) (in progress)
- Pricing review with Office of the Energy Regulator (dropped)
- Energy Sector strengthened through provision of technical assistance (to be completed)
- Project Management Unit (PMU) established in Electric Power Corporation (EPC) (completed)
- Hydro-power projects commissioned- new and rehabilitated (in progress)
- Wind energy generation installed on Upolu (dropped after initial testing)
- Tranche One photovoltaic installations (250kWp of photovoltaics installed on the Faleata Sports Complex roof April 2014, 2.2MWp array installed at the Faleata Racecourse October 2014, Apia, and 140kWp array installed at Salelologa Power Station on Savai’i October 2014)
- Tranche Two photovoltaic energy generation on Savai’i and Upolu (dropped due to site access issues).

The goal for Cook Islands Renewable Energy Activity is “An enabling environment for sustainable economic growth through improved energy security” with the long term outcome of “improved energy security”. The

All Activities have contributed to achieving expected outcomes within the MFAT Strategic Plan

³ Objective 4, Question 6 from the Terms of Reference “Are the investment outcomes sustainable and making and impact on the intended beneficiaries” has not been included because this issue is covered by other questions in Section 2.7 and 2.8 in this Report.

project aligns with the Cook Islands Renewable Energy Charter (CIREC) and National Sustainable Development Plan (NSDP). The outputs are:

- 961kWp photovoltaic solar facility on the Rarotonga grid at Airport West
- Mini-grid photovoltaic solar facilities with diesel back up on six Northern Group Islands, commissioned between October 2014 and June 2015. 100% diesel supply has been replaced on Manihiki, Nassau, Penrhyn, Rakahanga and Palmerston with solar-diesel grid networks. Pukapuka has had roof-top solar replaced with a solar-diesel grid network
- Other 'non-infrastructure' outputs i.e. 'enabling environment':
 - Assistance with developing and finalising the Cook Islands Renewable Energy Charter (CIREC) (completed/published)
 - Implementation Plan (IP) and Renewable Energy Mini-grid Common Design Principles and Specifications (CDPS) (completed)
 - Providing financial support to the position of an Energy Commissioner, project management support, and other technical assistance to the Rarotonga energy authority (Te Aponga Uira, TAU) as required. (The role of Energy Commissioner has since been transferred to the Chief of Staff in the Office of the office of the Prime Minister for the Cook Islands)
 - A least-cost generation and associated network development plan for Rarotonga and Aitutaki (in progress)
 - Creating an enabling policy regulatory environment, and institutional governance arrangements to support development of renewable energy (laws, regulations, power purchase agreements, confirm institutional arrangements) (in progress).

The goal for TREP is "For Tokelau to achieve energy independence in the power sector and to provide high quality electrical power to all residents". The long term outcomes are "Significant and sustainable reduction in use of imported petroleum for electricity generation leading to greater energy security and cost reduction"; and "For Tokelau to have one of the highest percentages of renewable electricity supply in the world". The Activity contributed to Tokelau's National Energy Policy and Strategic Action Plan (2004) goals of achieving energy independence. The outputs were photovoltaic/diesel hybrid systems installed on all three atolls to replace diesel supply. The total photovoltaic capacity is 930kW (Fakaofu 365 kW, Nukunonu 265 kW, and Atafu 300 kW).

The goal for the Maama Mai Solar Facility in Tonga is "Construction of Tonga's first 1MW solar power plant and 5-year finance lease – lending to transfer ownership of the plant to Tonga Power Limited (TPL), or another entity as determined by the Government of Tonga, at the end of the 5 year period" (MFAT April 2014). The purpose of the Activity was to plan, develop, construct and commission a 1.3 MW_{DC} (~1MW_{AC}) photovoltaic solar facility at



the Popua Power Station site to supply solar generated electricity into TPL's Tongatapu power system"⁴.

The long-term outcomes articulated in the Activity Monitoring Assessment September 2012, are: 'decreased reliance on diesel', 'reduction in power prices' and 'minimise environmental footprint'.

Energy is a priority sector under the NZ/Tonga Joint Commitment for Development. This project is part of the Tonga Energy Road Map (TERM) 2010-2020 as part Tonga's strategy to reduce its reliance on imported fuels for its energy requirements.

The delivered output is 1.3 MW (DC)/ ~1MW AC grid-connected solar PV power plant built and connected to the Tongatapu energy grid.

It is noted that none of the Activities aimed to improve the efficient use of energy or considered how to maximise the impact of renewable energy and improved access to energy at the household/business/consumer level.

2.2 How Well are the Renewable Energy Activities Designed?

(DAC Criteria – Relevance)

The Samoa Renewable Energy Partnership and the Cook Islands Renewable Energy Activities are focussed on both the construction of renewable energy infrastructure and sector support from technical assistance. The earlier TREP and Maama Mai Solar Facility Activities are very specific in their scope, being focussed on construction of identified solar generation plant (and associated training).

The earlier TREP and Maama Mai Activities focussed on construction but the later Samoa and Cook Islands work is broader.

TREP stakeholders note that there had been a lot of effort in scoping and designing the project⁵, but it is not apparent that this extended beyond the technical infrastructure aspects of the work. No Environmental or Social Impact Assessment (ESIA) was undertaken and there is no Activity Design Document (ADD) available, but a Results Framework was prepared. Monitoring proposed in the Results Framework is limited to issues of technical performance of the installed plant and the impact on diesel consumption. Implementation issues with site suitability and the additional resources required for civil works and project management, and the wider issues regarding the structure of the energy sector, were not identified in this phase of the Activity cycle. Undertaking an EISA may have raised concerns regarding the infilling of a swamp with coral. However due to a shortage of land and that there was a building already in the area it is likely this specific location would still have been chosen.

In contrast, the Cook Islands Renewable Energy Activity has a comprehensive ADD. The Results Framework includes Outputs to achieve

⁴ Popua Solar Farm Project Agreement

⁵ Stakeholder Interview 1

Outcomes in an enabling environment that facilitates renewable energy development and increases the capacity for Cook Islands to operate and manage the infrastructure. Actions were also proposed to mitigate key risks. Some of these initiatives such as the appointment of an Energy Commissioner have not been as successful as envisaged. This does not necessarily detract from the benefits of a wider view in Activity design than was taken for TREP despite the Cook Islands Activity having a very short timeframe for implementation and a primary focus on construction of new infrastructure. However, this appears to be diminished by the focus of the monitoring on indicators that are based only on the construction outputs. For example, the indicator for stakeholder communication is solely around the stakeholders associated with the solar array sites and not the wider community of power users; and the indicator for land access, regulatory and tariff regime is solely whether land is available.

The Long Term Outcome for the Cook Islands Renewable Energy Activity is "Improved Energy Security". This does not appear to reflect the actual intent of what was a much wider Activity where greater access and availability of electricity supply has been the main focus of the Outputs and Short Term Outcomes.

Better project management systems were planned and implemented for the Cook Islands Activity than for the earlier TREP, including an appointed Project Manager and oversight by MFAT, although there is only very limited consideration of cross-cutting issues in the ADD (refer to Section 2.10).

The Samoa Renewable Energy Partnership is another widely focussed Activity. The Long-Term Outcome of greater efficiency and security through reduced reliance on diesel is supported by a suite of Outputs including sector management improvements and a mix of renewable energy technologies (i.e. not just solar generation). However, the problem analysis in the ADD focuses on needing to improve electricity generation, and it appears that the sector improvements through technical assistance have then had less priority in implementation. Similarly to the Cook Islands, more adequate provisions are included for project management systems and resources than for TREP.

As with the Cook Islands ADD, consideration of stakeholders for the Samoa Renewable Energy Partnership was limited to the government agencies with involvement in the project and does not identify communities, power users or similar affected parties/beneficiaries. This appears to follow through to an absence of communication on the actual benefits and impacts of the projects. One consequence of this is a general misunderstanding in the community of the impact of solar generation on the tariff cost of electricity.

The Maama Mai Solar Facility Activity in Tonga was initiated by Meridian Energy, and MFAT entered later to support the project in implementation. As a consequence, Activity design was not done through MFAT processes, and assessment of the Activity by MFAT was effectively a due diligence process on the Meridian proposal.

Better project management is evident in the later Samoa and Cook Islands Activities



There are several areas that were consistently omitted or not fully considered in the Activity design.

Some aspects of Activity design were commonly omitted or not fully considered in the Activities

- Economic analysis of the Activity costs and benefits – Some financial information is included in the design documentation, but this does not show an explicit assessment of the financial justification for the investment. The Maama Mai Solar Activity is an exception because the project was initiated by Meridian as a private investment and more extensive financial analysis was a priority.
- Project selection is generally done by proposals from development partners – While this is an appropriate mechanism, the problem analysis and assessment of whether the Activity is justified to proceed can be too limited as a result.
- Analysis of the feasible timeframes is not sufficient. There is no apparent justification for the proposed programmes being realistic, and several stakeholders highlighted over-optimistic programmes resulting in negative outcomes such as reduced quality and increased costs. The Activities are generally completed later than programmed.

2.3 Have Lessons From Previous Infrastructure Investments Been Applied?

(DAC Criteria – Relevance)

Lessons learned are reported on in the ADDs for the Cook Islands Renewable Energy Activity and the Samoa Renewable Energy Partnership. Documentation of this is not available for the earlier Maama Mai Solar Facility and TREP.

The Cook Islands ADD refers to lessons on technology from previous solar and renewable energy systems, and to the need for strategies to ensure effective operation. There is some reference to the earlier TREP Activity, but it is not clear how this has informed and influenced the work on the isolated atolls of the Northern Group Solar. It would have been expected that specific responses to experiences with land suitability, logistics and timeframes were included, for instance, but this is not apparent. Lessons from TREP were incorporated though during the implementation through the experience of the contractors who undertook both projects.

The ADD for the Samoa Renewable Energy Partnership refers to lessons from previous Activities about developing a Least Cost Investment Plan (LCIP) or a similar strategic document. An LCIP was one of the Outputs planned. Lessons on addressing maintenance needs for long term sustainability are also identified, and the Activity therefore includes capacity building as part of the Technical Assistance activities. Across the Activities there is a strong focus on the resilience of assets against future natural disasters, which has been developed through learnings on other MFAT Activities.

Interviews with stakeholders suggest there is a growing knowledge within MFAT and the other participants of the best practice in implementing renewable energy Activities. The individual participants have responded to



There is evidence of increasing knowledge of best practice for infrastructure projects being developed over time within MFAT

their experiences and learnings in previous projects. However, these experiences can sometime deceive – the perception of a relatively straightforward implementation of TREP led to an expectation that similar success would follow in the Cook Islands and Tuvalu⁶. This has not been the case, where there have been greater logistics and programme difficulties to overcome that were not foreseen.

A lessons learned workshop was held on the 26th February 2014 primarily focussing on the procurement of the Cook Islands, Tuvalu and Samoa projects. The Evaluation has not covered projects that have been procured following the holding of this workshop so at this stage it is hard to comment on whether the lessons have been transferred on to other projects.

Stage One of this Evaluation identified a number of lessons learned from infrastructure Activities undertaken prior to 2010. While these lessons were only comprehensively identified in that Evaluation, they have previously been available to inform other MFAT Activities. There is evidence of some of these lessons being applied in the Activities covered in this evaluation (Stage Two), especially in following country strategies, donor coordination and project implementation processes. Other lessons such as the need for more effective capacity and capability building, stakeholder involvement and matching project design to in-country capability have not generally been recognised and incorporated into these Activities.

2.4 How Well are the Renewable Energy Activities Being Managed and Implemented?

(DAC Criteria – Efficiency)

Procurement of Infrastructure

The type of procurement modality was unique for each project. The Faleata Racecourse Solar Array (Apia, Samoa), Cook Island Airport West Solar and Northern Group Solar were procured by MFAT using the NZS3910 form of contract. Contracts were directly with MFAT Wellington and managed by a Project Management Unit (PMU) led by a New Zealand Project Management Consultant (BECA/OPUS) with Quality Assurance / Quality Control (QA/QC) support from an Solar Specialist Consultant (CAT Projects/IT Power).

Solar infrastructure for TREP was procured and project managed directly by the Government of Tokelau (GoT) with MFAT simply providing funding to the GoT. The contract between Powersmart and GoT was described as being simple and informal. There was no QA/QC other than a Solar Specialist Consultant (IT Power) providing support to the solar contractor (Powersmart). Following concerns over in-country project management the contractor sent an on-the-ground project manager to Tokelau to manage the construction of the civil works, at their own expense.

⁶ Stakeholder interview 2, Stakeholder interview 3

The procurement of TREP was tendered using minimal commercial conditions⁷ and a simple functional specification. Final commercial conditions and price were negotiated following receipt of bid price. It is understood that the majority of the negotiations mainly centred around payment terms.

The Maama Mai Solar Facility in Tonga was procured and project managed by Meridian Energy with no QA/QC provided. The infrastructure was procured as a Build Own Operate and Transfer (BOOT) type arrangement. Meridian Energy undertook the role of the Engineer Procure Construct Manage (EPCM) contractor and provided operations and maintenance support to TPL for five years post-commissioning.

A number of common themes came through which are documented below:

- Generally the procurement processes were well run and transparent. However the lack of time to tender had a number of effects which led to increases in the programme and / or costs⁸
- Short timescales to prepare tender documents led to ambiguities and mistakes which either had to be sorted out prior to contract finalisation or were a variation during construction
- Short timescales for tender, with no pre-tender site visit, transferred additional risk to the contractor which led to little or no tenders and greater costs.

Insufficient time for best tender processes has been a common problem

The procurement of the Cook Islands Airport West Solar and Faleata Racecourse Solar Array (Samoa) was relatively simple as they were on land with straight forward lease arrangements close to a main city with little to no access or geotechnical issues. In these cases the solar supplier led the project as the prime contractor and subcontracted the civil and electrical works. In these situations this approach is appropriate.

The same principle was applied for the Cook Islands Outer Islands Solar where the prime contractor was the solar supplier (Powersmart) who subcontracted the civil works to a civil contractor. The risk of awarding a significant volume of work to Powersmart (where the value of the works was significantly in excess of the company turnover) was recognised and mitigations were put in place, such as letters of comfort from Powersmart's bank and monthly monitoring of the company's overall position.

The Cook Islands atoll environments provided additional access and geotechnical challenges and were a significant proportion of the works. It therefore may have been more appropriate for the work to have been led by a civil contractor with greater experience in logistical planning on the atolls rather than the solar supplier, although this capability was supplemented from the PMU.

Short tender periods limited involvement of local contractors

A lack of local sector involvement was identified in a number of Activities; this was attributed on a number of occasions to the short timescales for both

⁷ Stakeholder interview 1

⁸ Stakeholder interview 1, Stakeholder interview 2, Stakeholder interview 3



procurement and construction. This was specifically highlighted in the Cook Islands Northern Group Solar⁹. The Cooks Steering Group (MFAT and CIG) explicitly looked to maximise opportunities for local contractor involvement through local advertising and compiling a list of local contractors and capabilities that was provided to bidders. However, the successful contractor did not have sufficient time to explore how these contractors could be used. Using MFAT's Energy Panel to procure design and project management services (to save time not having to prequalify bidders) also led to a number of local suppliers feeling left out of the tender process¹⁰.

Project Management

Generally the project management during implementation was seen as successful, but a number of observations were made on the project management structure. It was unclear who was in charge on a number of construction projects with there being a Wellington MFAT Project Manager, Post MFAT representative, contractor Project Manager, PMU Consultant Project Manager, Local Partner Project Manager and the Consultant undertaking the QA/QC role¹¹.

Communications/Relationship Management

Communications varied quite differently over the Activities from very little communication during TREP to what was deemed too much communication during the installation of Faleata Racecourse Solar Array in Samoa¹².

For the Faleata Racecourse Solar Array relationship management was key as the original Project Manager, who had a good relationship with the stakeholders, left the project. The replacement Project Manager did not have the same level of diplomatic skills. Contingency plans were put in place and the original project manager brought back as 'relationship manager' with clearer lines of communication drawn out between MFAT and the key stakeholders¹³.

Participation / Engagement by and with stakeholders

The feedback from energy sector institutional stakeholders that were interviewed for the evaluation was that they felt they were engaged in the process. There was little evidence that the end users (and typically the beneficiaries of the Activities) were engaged in Activity design or implementation.

On the Samoa Renewable Energy Partnership and Cook Islands Renewable Energy projects there has been cross fertilisation of experience and ideas with MFAT and the ADB attending Project Steering Group (PSG) meetings when there has been a crossover of projects within the same sector. In Samoa there are multiple donors operating in the energy sector (ADB, MFAT,

Project management is generally good but the project management structure involves many parties with sometimes relatively unclear roles and responsibilities

Stakeholder engagement has not generally included end users well, but has otherwise been effective

⁹ Stakeholder interview 4, Stakeholder interview 1

¹⁰ Stakeholder interview 5

¹¹ Stakeholder interview 6, Stakeholder interview 7

¹² Stakeholder interview 1, Stakeholder interview 8

¹³ Stakeholder interview 6



Australia, Middle East, JICA, Chinese, EU) and MFAT relies heavily on the Ministry of Finance Aid Coordination Division.

2.5 How are the Learnings from the Planning and Design Phase Being used to Improve the Management and Implementation (and Maintenance?) of the Renewable Energy Activities?

(DAC Criteria – Efficiency)

The ADD is used to document and transfer learnings. However from the document review and interviews there does not seem to be a clear process of handover between those persons involved in the planning and design, and those involved in the management and implementation, specifically highlighting key learnings.

The fast tracking between the Design Phase and Implementation Phase can result in learnings being lost. This was demonstrated in the Cook Islands Outer Island Activity where the original technical designs were developed around local sector capacity, i.e. power station sizes designed around locally available roof trusses. On MFAT taking over the project it appears that this aspect of the Outputs was lost and the focus was on early completion of construction. In addition, lessons from the previous design and lack of tenderer involvement were not learned. Instead, the original tender documents and specifications were packaged as a similar document and issued but the same specifications and apportionment of risks still applied, resulting in only a single over-budget tender being received. A large number of risks and issues were identified by the Tenderer which had to be resolved and negotiated prior to final contract agreement¹⁴.

2.6 What Results Have Been Achieved?

(DAC Criteria – Effectiveness, Impact and Sustainability)

Samoa Renewable Energy Partnership

The Faleata Racecourse Solar Array (Apia, Samoa) is providing approximately 3% of the total electricity generated on the Upolu grid (data on energy and diesel saved was not provided by EPC). The three solar plants (Faleata Racecourse, Faleata Sports Complex and Savai'i contribute approximately 5% of the total electricity needs of Samoa. This contribution has had no impact on tariffs¹⁵. EPC staff have received training on the operations and maintenance of solar farms.

The rest of the energy programme (technical assistance led by NZ, hydropower plant upgrades and new hydropower plants led by ADB) is in progress, with no results to date.

The Activities evaluated here represent a record of efficient project completion and implementation of increased renewable energy generation

¹⁴ Stakeholder interview 1

¹⁵ Stakeholder interview 12



Tonga Renewable Energy Solar Activity

The Maama Mai Solar Facility supplies approximately 4% of the electricity demand on the Tongatapu grid (population approximately 70,000) and 3.5% of all of TPL's electricity (when including the other island grids). The solar facility produces approximately 2,000MWh of electricity annually, saving approximately 5 million litres of diesel. However, during October 2013 to September 2014, overall demand for Tongatapu rose by 1.1% from a year earlier, masking some of the fuel savings contributed by Maama Mai.

A 3.33 seniti/kWh reduction in the tariff is attributed to Maama Mai (approximately 3% reduction), although the tariff fluctuates with the diesel prices masking this reduction from a consumer perspective.

Initial training to TPL staff during commissioning was limited to 4-6 generation staff. These same staff were observers/participants to varying degrees in aspects of commissioning.

Other results include the construction of a public walking track provided to the nearby wharf as a community benefit.

Tokelau Renewable Energy Programme

The photovoltaic/diesel hybrid systems are providing a total of 1411 people/294 customers with electricity from which 92% is from renewable energy sources. Data on reliability is not available, but black outs have reportedly reduced¹⁶.

Local energy teams have been trained in solar panel operations and maintenance.

At the design stage (using 2008 data) the installed capacity of solar panels exceeded total demand across Tokelau, and it was designed to supply 90% of demand from solar energy. At the time of installation the load had increased by 15% above baseline and electricity demands on the islands have increased further since commissioning (Fakaofu load increased by 37% (1002 kWh/day to 1443 kWh/day), Nukunonu 24% (698 kWh/day to 920 kWh/day) and Atafu 11% higher (776 kWh/day to 907 kWh/day)¹⁷). This means the system is relying more heavily on both the battery storage and the diesel back up than was intended in the original design. For Tokelau, 1383 tonnes of carbon dioxide emissions were avoided in the first full year of operation and a reduction of 536,000 litres of diesel consumed¹⁸.

¹⁶ Stakeholder interview 9

¹⁷ Tuvalu Energy Corporation. 2014. Tokelau Study Tour. Brief Report. Prepared for PIGGAREP.

¹⁸ Reported in the EECA Awards 2014 Application. It reports 'carbon dioxide', not 'carbon dioxide equivalents'.



Cook Islands Renewable Energy

Manihiki, Penrhyn, Rakahanga, Nassau, and Palmerston now (at the time of writing the evaluation) have access to continuous reliable electricity for longer periods each day, with the replacement of diesel generation by photovoltaic as the primary source of electricity. Pukapuka electricity is now more reliable and available for longer each day/week because the grid has been installed to replace aging roof top solar. It is too soon to measure or analyse the results of the new infrastructure as at the time of the evaluation the installations were not complete. TAU has not provided energy production data to the evaluation team so there is no data available for this evaluation on the population serviced, changes to reliability, or reduction in diesel consumption.

The common design principles developed for solar generation projects have been successful across the Activities

In Rarotonga there has been no change to the tariff, according to interviewees¹⁹. Interviewees have mentioned that diesel consumption has not significantly reduced on Rarotonga because generation sets now operate at a lower efficiency.

The Common Design Principles used for TREP and the Cook Islands work are being used in other Activities, such as the Tuvalu Outer Islands Solar, and distributed to other donors. They are contributing to efficiencies and consistency in the energy sector.

Cross-cutting

Environmental benefits from the Activities are a reduction in:

- Diesel consumed
- The risks of diesel spills from transportation, particularly in the Northern Cooks and Tokelau
- Noise emissions from diesel generators, and
- Greenhouse gas emissions.

No data has been provided to measure the benefits/impacts.

2.7 How Have the Activities Impacted on Beneficiaries?

(DAC Criteria – Effectiveness, Impact and Sustainability)

The electricity customers (residential and commercial) on Rarotonga, Savai'i and Upolu have not received tariff benefits directly attributable to the installation of solar plants on the grid. There has been no impact on the tariff that has affected affordability because the proportion of solar on the grid is currently too small. In Nuku'alofa the 3.3seniti/kWh reduction in tariff attributed to the Maama Mai Solar Facility is overshadowed by fluctuations to the diesel prices²⁰. Tariffs on each grid will continue to be influenced more

Direct benefits to electricity consumers on grid supplies have been limited because of the limited scale of RE generation, tariff structures and current low diesel prices

¹⁹ Stakeholder interview 5, Stakeholder interview 10, Stakeholder interview 11

²⁰ Stakeholder interview 13



by diesel price than by the savings from these solar plants. Consumer representatives who were interviewed (civil society, Chambers of Commerce) still consider electricity to be expensive in these markets. In all markets (including Tokelau and Northern Cooks), stakeholders noted that there was general confusion or misinformation that renewable energy (particularly solar) was free, and that consumers generally expected reduced tariffs once solar plants were installed.

Comments from electricity users suggests that there has been no impact on reliability of electricity supply to customers in Rarotonga, Nuku'alofa and Upolu / Savai'i as a result of the solar plant installations.

Tokelau has benefitted from a more reliable electricity supply, but demand has increased in response to this

However, the electricity consumers in Tokelau have benefitted from more reliable energy supply. The diesel generators were in a "state of disrepair"²¹ and black outs have been reduced. The tariff is subsidized and villages set the price of electricity; there has been no change in tariff price and therefore no impact on the affordability of electricity. Since the installation of the solar plants, household consumption of whiteware and electronics has increased to help with household chores, refrigeration and access to leisure activities and media (television, DVDs). This increase has led to an increase in electricity consumption per household and higher total loads than before the installation of new plants (see above)²².

There is no evidence that there are any impacts on commercial activities (improved productivity or outputs) or new businesses in Tokelau. There is little commerce and enterprise in the country due to distance to markets and a shortage of resources to develop for export.

It is too early to measure the impacts on electricity consumers in the Northern Group of the Cook Islands. Anecdotal evidence from interviewees suggest that more reliable electricity will encourage people to buy whiteware and electronics to assist with household chores and leisure activities, as well as improving the opportunities to freeze fish for consumption or trade that depends on reliable electricity. There is an assumption by stakeholders and MFAT that the villages will have reduced energy costs because of the reduction in diesel; however the size of savings could be affected by the overall increase in energy consumption (similar to Tokelau) and by requirements for the tariff charged to meet depreciation of the assets. The Gender Analysis Report (CAT Projects 2013) did not identify any significant business opportunities from the renewable energy investments (despite the ability to freeze fish) because of the distance to market and scarcity of resources on which to build commercial enterprise.

²¹ Stakeholder interview 1

²² Stakeholder interview 9

Some local residents in the Northern Cooks and Tokelau have gained skills and temporary income from working on the construction of the energy plants. Others have been trained in operations and maintenance of solar equipment. Actual numbers have not been provided. While these are beneficial outcomes, they can come at a cost to small communities. For example, the TREP was being undertaken at the same time as Infrastructure Development Programme activities. It put significant pressure on the village, and the ability to take care of ongoing village responsibilities (Activity Completion Assessment for Tokelau Renewable Energy Programme). In the Northern Cooks there was competition for labour and resources due to other community development projects happening at the same time. This would have impacted on the programming and/or success of other projects; however this is anecdotal and not measured. Comment was made by an interviewee²³ that renewable energy supply may not have been the most important need of the community particularly from a cost/ benefit perspective but this was not assessed in Activity design. It is relevant here that the Activity costs are a large proportion of (or exceed) GDP per capita, with a consequential large commitment for available local resources in Activity delivery.

2.8 Are we Gaining Optimal Impact, and the Sustainability of New Zealand's Interventions?

(DAC – Effectiveness, Impact, Sustainability)

There has only been limited formal monitoring of Outcomes for the Activities, and in many instances the results are only just starting to occur. It should be noted that this is a process evaluation, not an impact one, and the limited outcomes monitoring is directly related to the fact that the projects have only recently been completed and not yet reached a full year of operation (for the Cook Islands and Samoa)

Impact of Infrastructure on Energy Sector

The impact of the TREP has been considerable and positive changes to lifestyles of the beneficiaries, resulting in increases in power consumption, are reported elsewhere in this report.

The Maama Mai Solar Facility has assisted in meeting renewable energy generation targets and provided a starting point for grid solar generation that has now been supplemented by a separate solar array installation. There has been little impact on affordability of electricity as discussed above.

Similar observations can be made about the solar generation installation as part of the Samoa Renewable Energy Partnership and the Airport West solar installation in the Cook Islands.

²³ Stakeholder interview 14

The Cook Islands Outer Island Solar installations are only recently completed and it is too soon to be able to assess the impact and sustainability of these new generation systems.

Sector development
Outputs have been
limited

Sector Development

The focus of the Activities evaluated here has been on development of generation infrastructure, and the sector development Outputs have been limited to date. Most notably in Tonga, the Maama Mai Activity was solely an Activity for solar generation that had been initiated by the private sector and TPL. The effects of a lack of sector development initiatives in the TREP has been noted above, and is now being addressed separately by the Government of Tokelau.

In the Cook Islands, the key initiative of establishing and supporting the position of Energy Commissioner has not been wholly successful as the now vacant position is not intended to be filled again. The statutory position has been retained but transferred to within the Office of the Prime Minister. Other elements of NZTA are continuing with work on sector planning. It is understood though that the separate ADB funded renewable energy project for the Southern Group of the Cook Islands that is now commencing will also address sector development needs²⁴.

The Samoa Renewable Energy Partnership has had the greatest amount of sector development with further Outputs still programmed for 2015 and 2016. Technical assistance has allowed EPC to procure private sector generation contracts and therefore work towards the long term outcome for greater renewable energy generation. However, the most potentially significant sector development Output of the Least Cost Investment Plan has not yet been completed.

Technical Sustainability

The technical sustainability of the new infrastructure depends on maintenance to avoid premature deterioration of the assets. The 'build-neglect-rebuild' paradigm has been well documented (PAIC, 2013).

In the Activities evaluated here, development assistance has focussed on funding construction of new assets and has only provided limited support for the maintenance of infrastructure. Assistance with operation and maintenance was not within the scope of the installation contractors for the Samoa Renewable Energy Partnership and the Cook Islands Renewable Energy infrastructure. In the Cook Islands, it has been recognised that new management structures will be needed for the Outer Islands Solar systems because of the new technology and a shift in future funding and management from operational driven diesel to capital renewal driven solar.

Support for
maintenance and
operation has been
effective where
provided even though
limited in its scope

²⁴ Stakeholder interview 15



However, management systems are still not agreed and resources are not identified²⁵. This is a responsibility of the Cook Islands Government and work on this is underway. It will require legislative change and agreement on new tariff structures.

In Tonga, TPL have had ongoing support from Meridian Energy and their inverter supplier through a five-year operation contract. TPL has therefore been able to progressively develop the expertise they need in operating the systems and to assess what ongoing support they will require after that²⁶.

In Tokelau, the solar supplier (Powersmart) have a 3-year rolling contract for operation and maintenance support. Routine maintenance tasks by in-country staff for transmission and diesel systems is variable according to whether key senior managers are on site.²⁷

Financial/Economic Sustainability

The financial sustainability of energy infrastructure is dependent on having a funding stream for future costs. Electricity tariffs that are affordable and cover the costs of operating and maintaining the infrastructure are key to this. Analysis undertaken by the different utilities and financial controllers suggests that the current costs of solar generation (including capital costs) are not significantly less than the costs of diesel generation at current fuel prices. In all cases, the impact of new renewable energy systems on tariff prices has been small, because of the relatively low proportion of electricity provided by renewable energy in most cases, and because there is only a limited reduction in total generation costs²⁸.

Financial sustainability depends on funding streams from tariffs, but there are different approaches to tariff setting that include factors beyond cost recovery and in some cases do not cover all funding needs

Setting of tariffs is the responsibility of the Independent Regulator, Government or local Councils. There are varying approaches across the different countries involved to setting tariffs that incorporate renewable energy costs.

In Samoa the electricity tariff includes for recovery of the costs of debt, operation and diesel fuel without subsidy. Future renewal costs or funded capital costs are not included, and the regulator sees renewable energy as the key to increasing affordability by donor funding of capital costs.

In the Outer Islands (Northern Group) of the Cook Islands tariffs for diesel generation systems were previously set by each Island Council and incorporated various subsidies. In Rarotonga the tariff is set by the utility and there is no subsidy. There has been no change to tariffs in response to the Airport West Solar and Outer Islands Solar installations. New tariff

²⁵ Stakeholder interview 14, Stakeholder interview 17

²⁶ Stakeholder interview 16

²⁷ Stakeholder interview 9

²⁸ Stakeholder interview 12, Stakeholder interview 13, Stakeholder interview 14



structures are currently being developed and may include recovery of capital costs²⁹. Previously the costs of fuel for generators against the set tariff charges and a lack of debt collection had made some of the Island Councils insolvent.³⁰

The tariff in Tonga is recalculated monthly based on the agreed tariff structure for fuel and non-fuel costs. This structure was in place before Maama Mai Solar Facility was completed. There have been reductions to the tariff in 2015 that have been a result of falling diesel prices, but because solar generation makes up only a small part of the overall generation it has had little effect on tariff. The tariff structure is currently being reviewed. The view of the utility is that the capital cost of solar generation is rated at \$0 because the best technology and costs at the time of future replacement is not known.³¹

In Tokelau the tariff is set by village Councils, currently at around 50 cents (NZ) per kwh. This is currently subsidising the real cost of electricity and is not self-sustaining for the power utility.³²

Capacity and Capability Building

Operation and maintenance training has been incorporated in all the Activities. It has been largely focussed on staff training and handover of the new generation assets. Ongoing maintenance support through the 5-year operation period associated with the Maama Mai solar array appears to have provided support to TPL that has better built their capability for longer term operation even though there will still be a requirement for specialist support from overseas for some high technology components and tasks.

Outcomes for capacity and capability building have otherwise been restricted because of the scope of the Activities, notably:

- Activities have been focussed on infrastructure construction to achieve target dates for completion
- Implementation was by MFAT rather than agencies of the country partner – TREP and the future hydro components of the Samoa Activity are the exceptions here
- Fast track programmes for construction procurement and completion mitigated against involvement of in-country construction resources for best capability building
- New technologies are unfamiliar and do not build on the existing in-country capability – it is unlikely that it will be possible to develop and maintain expertise in-country for all future maintenance.

Capacity and capability building has focussed on staff training and handover for the new infrastructure, and has not addressed all needs for future sustainability

29 Stakeholder interview 14

30 Stakeholder interview 17

31 Tonga Power Limited

32 Stakeholder interview 1



2.9 How are the Learnings from the Implementation Phase Being Used to Improve the Results Phase?

(DAC Criteria – Effectiveness, Impact and Sustainability)

Most of the Activities subject to this review are still within the Implementation Phase or have just passed in to the Results Phase. Therefore there was little evidence of a transfer of learnings. Infrastructure is usually constructed during Activity implementation, and only operational in the Results Phase of an Activity. Therefore, much of the learnings about outcomes come from the Results Phase.

A specific example is the Cook Islands Renewable Energy Activity. In this case the ADB have been taking an active interest/ participation in the Outer Islands PSG meetings that have facilitated learnings across donors/projects³³.

Lessons during implementation that have been transferred on to the Results Phase have also been contractor-driven. A number of the solar contractors have identified, and intend to implement, the need for additional training six months after the commissioning. With the focus on commissioning, training became secondary³⁴ and was delivered in a rush, with asset operators getting little value out of this training.

The Government of Tokelau have identified many learnings from the Results Phase of the TREP. A review and monitoring report in 2013 identifies a number of recommendations for the ongoing sustainable management of the energy sector:

- Creating a utility
- Setting a tariff
- Metering all loads
- Independent assistance for operation and maintenance.

Furthermore, as part of a UNDP-funded Activity, energy efficiency education is being developed to help households reduce electricity use.

2.10 How have Cross-Cutting Themes Been Addressed?

(DAC Criteria – Effectiveness, Impact and Sustainability)

In this Section, the approach to screening and integrating cross-cutting themes into design, and managing cross-cutting issues during implementation is considered generally, and then each cross-cutting theme is discussed separately.

³³ Stakeholder interview 18

³⁴ Stakeholder interview 19

Training needs can be rushed and secondary to a focus on commissioning at the time of handover of new infrastructure



All Activities except TREP included screening or scoping of cross-cutting issues at the Activity design phase. Roles and responsibilities for ongoing management of cross-cutting issues were not generally identified, and measurement of cross-cutting outcomes and results were not included in results frameworks

Evidence of screening and scoping of cross-cutting issues at the Activity design phase was found for all Activities except for Tokelau. Maama Mai EIA and EMP were prepared by Meridian and potential environmental risks understood by MFAT prior to preparing the Programme Activity Authority and signing the Project Agreement. For Samoa, a 'high level' Initial Environmental Assessment³⁵ was conducted on potential solar and wind investments during Activity Design. The Land Acquisition Framework for hydropower upgrades had already been prepared because ADB was already involved, and the information regarding land acquisition risks was considered in Activity Design.

Analysis of issues and risks relating to cross-cutting items in the Cook Islands occurred after design and appraisal (Renewable Energy Gender Analysis³⁶, environmental and social impact screening^{37,38}). This meant that decisions were made during implementation regarding the management of risks and issues, including budgets and responsibilities. They were either integrated into the implementation (MFAT adjusted the Activity budget to manage waste batteries) or excluded from the MFAT Activity and left to the implementing Agency or government to address (e.g., land acquisition for Cook Islands Outer Island Solar and Airport West Solar was the Cook Islands Government's responsibility).

Roles and responsibilities for identifying and managing cross-cutting issues, including preparation of licensing documentation, undertaking studies, supervision, monitoring and reporting, were not made clear in any Activity documentation, including Activity Designs and project agreements. The PMU was required to supervise cross-cutting issues³⁹, but from interviews with MFAT staff and external stakeholders there was uncertainty about who was responsible for supervising cross-cutting issues or impact management plans, what information needed to be reported, to whom, etc. Cross-cutting outcomes were not measured or reported in any results framework.

It is noted that the evaluation team did not receive Impact Management Plans, environmental permits or compliance reporting documentation for any of the Activities, which may be due to record keeping rather than these being proprietary documents. Impact Management Plans were required to be prepared by contractors and provided to the PMU's who were responsible for managing these requirements. Documents being held by contractors may not yet be handed over because the projects are not yet closed out.

³⁵ Opus. 2013. PES Samoa Opus Environmental Final Report. Initial Environmental Assessment.

³⁶ CAT Projects. 2013. Gender Analysis in relation to the proposed establishment of renewable energy systems on the northern group of the Cook Islands.

³⁷ Opus. 2013. PES Cook Islands Opus Environmental Final Report. Initial Environmental Assessment.

³⁸ Beca. 2014. Cook Islands Renewable Energy Project. Environmental and Social Impact Assessments. Unpublished Memo.

³⁹ Stakeholder Interview 22



Human Rights

Human rights was assessed as 'not targeted' in Activity assessments meaning that it was not an outcome of an activity. Human rights were not included in the results frameworks and were not monitored or reported. It was generally assumed that human rights were not targeted, but that improved quality of life through better access to energy was an improvement in human rights, particularly those in remote communities who were considered more vulnerable (Cook Islands Renewable Energy Activity, Samoa Renewable Energy Partnership).

Human rights issues were not targeted, and land access was the responsibility of the partner government and external to the Activity

Access to land for infrastructure was a key issue that could impact on human rights. Land access was always secured by the in-country partner and was external to the Activity (no budget or responsibility was assigned within the Activity). Government or utility-owned land was prioritised on main islands (Rarotonga, Tongatapu, Savai'i and Upolu) to avoid land access issues. Samoa Renewable Energy Partnership was the only Activity where a framework or plan for land access/acquisition was prepared, because ADB was the lead donor on the hydropower component and its involuntary resettlement policy was followed.

Access for all infrastructure projects implemented to date has been secured without significant incidents.

No significant human rights issues from land acquisition or loss of access to resources were identified during the evaluation. Documentation and interviewees⁴⁰ suggest that land access for all sites was legally secured by the relevant Government agency. There is no evidence of due diligence by MFAT that this was the case.

The right to participate in public affairs is a human rights (and gender) issue that has not been fully addressed in these Activities. The mainstreaming of participation and engagement of all parties into the energy sector decision making and policy development area has not featured strongly in design or implementation.

Gender

Specific gender analysis was not done for any Activities as part of Activity design. Gender issues discussed in the ADD were informed by MFAT staff with knowledge and awareness of gender and energy issues. Generally, it was anticipated at the design phase that improved access to affordable and reliable energy was going to improve the lives of women and children. Gender equality was evaluated as 'not targeted' in Activity assessments meaning that it was **not an outcome** of an activity, and not mainstreamed into Activity design. Gender impacts and benefits were not included in the results frameworks and were not monitored or reported.

⁴⁰ Stakeholder Interviews 6, 8, 19, 20, 21

A Gender Analysis report (CAT Projects 2013)³⁶ was prepared for the Cook Islands Outer Islands Solar Project during project implementation. The analysis was informative and provided a baseline of roles and responsibilities for both genders in the outer islands. In most cases the labour force was recommended by the Island Councils, to ensure distribution of opportunity for income across families. There was also an issue with insufficient working age labour on several islands.

In both the TREP and Cook Islands Northern Group Solar there was no evidence to show that women were provided with opportunities for employment during construction or for ongoing maintenance.

There are many gender issues in the Pacific Islands countries, notably that women are often excluded from decision making in village or public affairs and decision making in relation to land. They are also underrepresented in private enterprise and formal employment. It is also well understood that women who run the household affairs are most likely to manage budgets, pay the power bill and use the majority of energy in a house. None of these issues were identified as key or mainstreamed into the Activities except the Samoa hydropower upgrades, where the ADB insisted on a target of 15% women in the workforce to mainstream improved representation of women in the formal workforce.

Climate Change

Climate change was classified as either 'Significant' or 'Principal' in the renewable energy Activity assessments, indicating it was one of the main outcomes from the Activities. Renewable energy has a direct impact on the greenhouse gas emissions from the energy sector and this was noted in all Activity designs. Diesel savings and greenhouse gas reductions were calculated for the projects and were identified in the ADDs. However climate change was not included in any results frameworks.

Environment

Environmental and social impact screening was informed by 'Initial Environmental Assessments' for Cook Islands (during previous Activity design for 3 islands and at the mobilisation phase of implementation for 3 islands) and Samoa (during design), and by an EIA and EMP in Tonga (during design). A recurring assumption in Activity Designs was that renewable energy is 'pro-environment' and therefore will have a net benefit and that solar installations are considered low environmental and social impact.

The Environmental and Social Impacts Operational Policy (ESI-OP) was applied to the Samoa, Tonga and Cooks Activities. In-country permitting and EIA processes were followed in Tonga, Cooks and Samoa. No evidence was found that the ESI-OP was followed in Tokelau (in the absence of environmental laws)



Environment as a cross-cutting theme has been evaluated differently in each of the Activities, relative to the potential scale and significance of impacts. Environment was evaluated as 'Significant' in Activity assessments for Tonga where there were low environmental and social risks, and 'Not Measured' for the Cook Islands where there were potentially high environmental and social risks.

The processes and responsibilities for the identification, supervision and reporting of potential issues or incidents is not clear for any Activity.

Project management reporting from contractors and consultants did not always include impact management progress or incident reporting. Generally it appears that MFAT are informed of significant issues. For example MFAT staff were aware of the rare bird habitat identified in one of the Samoa hydropower sites, and the issue of used batteries in the Northern Cooks. However other environmental issues, such as using coral rock to fill in 'swamp' in Tokelau, and the use of large amounts of fill initially proposed in the Northern Cooks (but deleted in the initial implementation phase) were not highlighted as risks in documentation or during interviews. These are potentially significant environmental impacts, particularly where reefs may have been damaged to source aggregate.

The ongoing management of environmental and social impacts from solar plant operations is generally covered by in-country environmental permits (Samoa, Tonga, Cook Islands) and MFAT does not have an ongoing supervision role. The risks are generally low and manageable. In Tokelau there is some ongoing tree trimming, and potentially some ground stabilisation work that may be required, but there is no management plan that guides the appropriate compensation or mitigation measures.



3. Evaluation Conclusions

Activity Goals

- The Activities all contribute to the Expected Outcome 'Increased access to clean, efficient and affordable energy' under the Strategic Theme of 'Improved Economic Wellbeing' within the MFAT Strategic Plan 2012-2015.
- All activities contribute to in-country strategies and plans for the energy sector and sustainable development. There is a clear focus on reducing dependence on diesel fuel by installing solar and solar/diesel hybrid infrastructure on grids and mini-grids. A secondary focus is on institutional strengthening within the energy sector in particularly two of the four countries (Samoa and Cook Islands).
- The Activities are not focussed on energy efficiency and improving the way that people access and use energy.

Activity Design

- Activities have been focussed on installation of energy generation within a fast track programme for completion of Outputs. Activities have been well designed for this specific focus and intent.
- Activity design has not fully met the stated goals and the medium and long term outcomes for the Activities which, in some cases, have been outside the potential of the Outputs for the Activities to achieve.
- Consideration of some aspects of Activity design has been too limited. These aspects include economic analysis, stakeholder analysis, cross-cutting themes, problem analysis and risk assessment, integration of sustainable operations and maintenance support (including capacity building) and analysis of feasible time frames. This impacts on implementation effectiveness.
- In some cases, it appears that issues arising from limitations in the Activity design, such as in country project management support, were overcome by a project team that was prepared to add extra resources and effort – this should be taken as an exception and not expected to be repeated in other situations.
- Design of more recent Activities has included improvements in the implementation and management arising from experience in earlier work, and shows increasing understanding by MFAT of the requirements for good management of infrastructure projects in the Pacific.

Applying Lessons from Previous Investments

- There is growing knowledge within MFAT through experiences and learnings in previous infrastructure Activities. There is evidence of documentation of lessons learned from procurement.
- However, the Activity design processes are not comprehensively incorporating all relevant lessons. There is no evidence to suggest



whether this may be a consequence of the fast track implementation of specific outputs, or shortcomings in approaches to Activity design.

- The coordination of donors in the energy sectors is assisting with the application of lessons from other projects or countries.

Activity Management

- In general the renewable energy Activities have been well managed and implemented. Almost all solar systems have been installed to budget and generally on programme. However timescales for procurement and implementation of a number of systems were unrealistic and driven by political needs. In some cases funding had to be increased to cover the cost impact of shorter timescales.
- It was recognised at an early stage that to deliver a portfolio of projects within the political timescales promised that additional staffing was required. Without this NZ would not have been able to meet commitments.
- There isn't a "one size fits all" method of delivery and every project needs to be looked at on an individual basis. The lessons learnt from the methodology should be put into context when considering whether it was a success or not, and before it is replicated elsewhere.
- MFAT control of procurement and project management reduces the learning experiences and capacity development of in-country partners, although it has shown to provide efficiencies and time savings.
- Tight timescales for procurement and implementation resulted in less local sector involvement. Less time to tender means contractors engage those they already know rather than seeking out local alternatives, so an opportunity to improve the local sector capacity and employment/income opportunities is lost.
- Structuring procurement to align with the project risks and liabilities would lead to greater success and a more competitive tender process. A review of the project risks and where the actual liabilities lay with the Cook Islands Northern Group Solar installations was undertaken and mitigations were put in place. However this was mainly driven around the concern of awarding the contractor too much work and their financial sustainability, not their ability to actually deliver the project.
- Activity Risk Assessments were kept live and updated on the Cook Islands Northern Group and Tuvalu Projects and were used as a project management tool throughout the projects.

Using Learnings from Planning and Design

- There is no formalised process of 'handing over' from the Planning and Design Phase to Implementation including the transfer of lessons.
- The fast tracking between the Design Phase and Implementation Phase can result in learnings being lost. There was little evidence of learnings documented in the ADDs.



Results and Impact Achieved – Installed Solar Capacity on Island Grids

- Installed solar capacity in Upolu, Savai'i, Nuku'alofa and Rarotonga, where it is a small proportion of the grid, has not resulted in improved access to energy, or affected reliability and affordability of electricity for the consumer/beneficiary. To achieve these results on a grid a greater percentage of renewable energy is required, and/or other interventions in the wider energy sector are also required (as discussed elsewhere in this report).
- The investments have achieved a reduction in diesel consumed and greenhouse gas emissions which have (minor) climate change benefits
- The replacement of diesel is not at a scale that will ease the countries' vulnerabilities to fluctuating diesel prices or diesel supply.
- The contribution of renewable energy generation to each grid will assist each country to eventually meet its goals of energy security and reduced reliance on imported fuels. The investments have assisted to build capacity and knowledge in each sector, and provide impetus for further investment in solar and renewables.

Results and Impact Achieved – Installed Solar/Diesel Hybrids on Atolls

- Installed solar capacity in Tokelau, where it is the primary source of electricity generation, has led to a significant reduction in diesel imports and made a significant difference to Tokelau's vulnerabilities to diesel prices and supply issues. This has not affected the tariff/affordability and households are consuming more energy because reliability has improved. This has led to higher household spending on energy and durable goods. Higher demand has resulted in the system being operated differently to the design, with a proportion of energy being generated from 'back up' diesel, and more wear and tear on batteries.
- The results have also inspired other small island states, and remote outer islands, to see the potential in a solar/diesel hybrid grid and provide a body of knowledge and learning for the industry.
- In the Cook Islands Outer Islands the increased reliability and duration of electricity is predicted to result in more flexibility in the timing of daily chores, improve schooling through access to media and the internet, and improve the ability to freeze and store seafood for trade.
- Commercial enterprise has not changed in Tokelau, and is not likely to be realised on other remote atolls as a result of renewable energy, because reliable and affordable energy is not the only significant barrier to private enterprise.
- Renewable energy does not necessarily translate into a reduction in tariff in small atolls because there are a number of other influences on the price of electricity. Approaches to tariff setting vary across the Pacific and the tariff can include subsidies and omission of some costs that mean it is not self-sustaining.
- Private businesses and many locals did feel they hadn't seen any reduction in tariff rates following installation of the renewable energy



projects, but in most cases this was not a planned outcome of the Activity. The general public perception that renewable energy should reduce tariffs is more attributed to not actually knowing or being communicated the true costs of projects.

Gaining Optimal Impact and Sustainability

- The renewable energy infrastructure has had beneficial impacts contributing to the development of the energy sectors in partner countries through the introduction of new technologies and in progress toward national renewable energy targets.
- MFAT's development assistance has focussed on funding construction of new assets and not the maintenance of infrastructure.
- In the Cook Islands new management structures and resources needed for operation and maintenance of the Outer Islands Solar mini-grids are not yet resolved and this uncertainty poses a risk to the sustainability of the new infrastructure.
- Approaches to tariff setting vary across the Pacific and the tariff can include subsidies or omission of some costs that mean it is not self-sustaining.
- Outcomes for capacity and capability building have been restricted because of the scope of the Activities and the pressure for fast-track implementation. Capability building has been mainly based on operation and maintenance training incorporated into handover of the assets.

Applying Learnings from Implementation to Results Phase

- Learnings from solar infrastructure commissioning have led to further support to utilities, such as additional training and operations and maintenance support.
- In Tokelau the operation of the solar infrastructure has identified other issues, such as demand side energy management, and the need for a utility and a new tariff structure. These lessons are transferable to all Outer Island Solar installations.

Addressing Cross-cutting Themes - General

- The uncertainty of roles and responsibilities for supervision and management of cross-cutting issues, and the limited screening and scoping during design, are likely causes as to why there is an inconsistent approach to cross-cutting risk management during implementation.
- Cross-cutting issues in Cook Islands and Tokelau were not scoped in detail during Activity design, leaving issues to be identified, assessed and managed during implementation. This appears to be changing as an Initial Environmental Assessment informed the more recent Samoa Activity Design. There is a risk to MFAT that significant issues will be missed, or mismanaged, causing impacts on fragile environments and vulnerable communities, if not identified early in the Activity cycle.
- While the cross-cutting focus has been to safeguard against adverse impacts, opportunities to mainstream gender, human rights,



environment and climate change issues into Activity design were not commonplace. Mainstreaming these issues, and a focus on maximising cross-cutting benefits, could improve development outcomes and impact.

Addressing Cross-cutting Themes - Human Rights

- No human rights impacts or issues have been identified, but MFAT remains at arm's length from risky activities such as land acquisition.
- Prioritising Government and Utility-owned land on main islands has reduced the social and human rights risks compared to acquiring communally-owned land.
- There is little evidence of due diligence by MFAT to ensure appropriate participation in decision making around land use. People affected by the Activity may be left vulnerable to potential injustices, even where land acquisition processes are carried out by government agencies or under local laws and customs.

Addressing Cross-cutting Themes - Gender

- The assumptions regarding benefits and impacts on women at the design phase and the results to date indicate that the benefits are overstated and generalised.
- Gender equity and women's empowerment has not been mainstreamed, but could be given the potential benefits of improved access to energy.

Addressing Cross-cutting Themes - Climate change

- Climate change mitigation is a significant outcome from renewable energy Activities, albeit on a very small scale. However it does not appear in results frameworks, monitoring data or Activity reporting.

Addressing Cross-cutting Themes - Environment

- The assumptions in Activity Design that renewable energy is "pro environment" and solar in particular has "low environmental and social impact" overshadows potentially high risk indirect impacts. For example, civil works is a large part of solar installation and used batteries are a hazardous waste legacy issue. Impact Management Plans that recognise and mitigate these risks are essential.
- Several environmental benefits have been achieved from the Activities such as a reduction in diesel consumed and reduced risks of diesel spills. Data on benefits and impacts have not been collected to demonstrate the results.



4. Lessons Learned

The outcomes of the renewable energy Activity Evaluation (Stage Two) confirmed the lessons learned identified for other infrastructure (Stage One⁴¹). These were:

- A guiding partner government country strategy is needed for prioritisation of energy and infrastructure investment
- Strong leadership and management is essential to achieve good outcomes
- Good coordination with and among donors improves outcomes, and poor coordination undermines outcomes
- Adherence to good project processes improves outcomes
- Procurement modalities may be adapted to suit special requirements but departure from normal practices compromises some outcomes
- Project design practices need to take in the big picture and not focus on completion of a single task
- Involving stakeholders in design improves outputs and outcomes
- MFAT practices affect the long term impact and sustainability of infrastructure investment
- Better matching of project design to in-country capability will improve outcomes
- More effective capacity building will improve long term outcomes and sustainability of infrastructure investment
- More effective provision for maintenance is needed for infrastructure investment to be sustainable
- Lessons are transferable but need to be interpreted to recognise differences in social, political and environmental conditions
- Climate change, environmental impacts, human rights and gender aspects of projects have been addressed differently in each of the four Activities.

These lessons were also evident from the four Activities covered in Stage Two of the Evaluation and confirmed to have general relevance to infrastructure Activities undertaken by MFAT.

New learnings and more developed learnings from Stage Two are set out in Sections 4.1 to 4.4.

⁴¹ Infrastructure in the Pacific: Learnings from Completed Investments 2004-2013, MWH, March 2015.

4.1 Activity Concept and Design

Providing infrastructure is not, in itself, enough to provide positive impacts on beneficiaries such as affordable and reliable energy.

Activity designs that focus on a small number of construction Outputs can omit items that are needed to achieve longer term Outcomes. Even if the Activity is intended to complete a specific task, it is beneficial if Activity Design responds to other related issues as well, such as stakeholder interests, technical and financial sustainability, cross-cutting themes, and in-country capacity and capability affecting implementation. A sector-wide analysis of issues is required to identify any gaps in institutional capacity and capability, and other tasks needed to support the proposed Outputs. Technical assistance and other forms of support should be provided with the infrastructure.

Tariff structures, diesel prices and subsidies can have more impact on affordability than incremental new renewable energy infrastructure investments.

Recent decreases in the cost of diesel fuel have been the main contributor to better affordability of electricity in the Pacific. Tariff structures and subsidies are also commonly being used to set a tariff that is deemed affordable to the serviced communities. Investments in new renewable energy infrastructure have not yet had a significant impact on affordability because of the relatively small contribution that renewable energy makes to overall generation, and the minimal difference in the total costs of renewable energy generation to diesel generation. This situation may change with future changes in oil prices and further investment in new renewable energy technologies. However, in the shorter term, successful Outcomes for improved affordability will not solely be achieved by new renewable energy infrastructure.

Achievement of beneficial Cross-cutting Outcomes is constrained where this is not comprehensively considered in Activity design.

Adequately scoping and screening of cross-cutting issues early in the Activity cycle will identify risks, open up opportunities to avoid harm and 'do good' and enable mainstreaming of both impact management and benefits into design. Delaying gender and human rights analysis and environmental and social impact assessment until implementation has required an adaptable approach to Activity management, requiring additional budget, resources or extended timeframes. The opportunity to mainstream issues into design, and/or design out impacts, may be lost once the Activity is underway.

Evaluation and Monitoring of Activities has not yet been sufficient to allow MFAT to fully assess the achievement of planned Outcomes for individual Activities and the impact of the investments in renewable energy.



There has been minimal formal monitoring of Activities against the indicators identified in Activity planning. Monitoring should be started during Activity design, or at Activity commencement and not delayed until the Activity is considered sufficiently complete. Baseline data on energy use and needs of potential beneficiaries would assist in Activity design, monitoring and evaluation, and in preparing more targeted Activities.

MFAT is working in a manner that is complementary to other donors, to the benefit of the Pacific development partners.

MFAT is seen as a niche player, with good relationships with in country partners and donors. It is able to be flexible and innovative with funding and implementation arrangements. These are advantages that can be exploited for the benefit of in-country partners.

There are major differences in renewable energy infrastructure projects connected to extensive grids against those for isolated communities.

Installation of renewable energy infrastructure has proceeded without difficulty on the main islands with electricity grids; e.g. Rarotonga, Samoa and Tongatapu. However, everything becomes harder when working on remote atolls, as was the case for Northern Group of the Cook Islands, Tokelau and currently on Tuvalu. In those cases the logistics difficulties need a different approach to the planning and management of the work, including allowing more time for completion and different resourcing and contingency planning. MFAT has recognised these differences, but responses have sometimes been restricted by constraints such as imposed milestone dates.

The access and reliability impacts for beneficiaries are greater for the small communities served by new generation on mini-grids than supplementing existing grid systems with a small component of renewable energy generation.

4.2 Activity Implementation

Solar projects are generally assessed as being 'low risk' for cross-cutting themes, but this can lead to inadequate scoping and assessment of environmental and social risks.

Land is scarce in fragile atoll environments and competing land uses can create conflict. Potential ancillary activities such as filling land with locally sourced coral rock to install equipment, or the dredging of channels or ports for transport of equipment, can have far reaching impacts on natural habitats and climate change resilience (note that this did not occur to any significant degree in the Activities evaluated here). Long term implications of battery renewal and disposal have not generally been incorporated in the Activity design.

Tight timescales for procurement can result in poorer tender proposals, less local sector involvement, greater costs due to higher levels of risk and reduced competition, and compromised implementation.



Quality procurement processes are one of the most important keys to success in infrastructure projects. Procurement periods that are too short can compromise best-for-project outcomes. The procurement periods often are not sufficient for the complexity of the Activity, and the uncertainties in the work and the environment.

Timeframes for implementation that are too short can lead to risks of increased costs, reduced quality and unplanned delays.

Analysis of the feasible timeframes has not been sufficient. There is no apparent justification for the proposed timeframes of the programmes that have been set. Over-optimistic programmes result in negative outcomes such as reduced quality and increased costs. The Activities are generally completed later than originally programmed. Timeframes for implementation should be set objectively, based on previous experience and include allowances for risk.

Clearer definition of roles and responsibilities within MFAT and the wider project team during Implementation would reduce risk and improve efficiency.

Project management structures have sometimes been unclear and responsibilities have been shared among several stakeholders. Although no significant problems have arisen, this success was more attributed to those involved and their general attitude and enthusiasm to get the job done and solve issues rather than the efficiency of the structure. In a more commercial environment large management chains without clear lines of responsibility have led to misunderstanding in scope, role and who has the authorisation to act under the contract. Clearer roles and responsibilities would also lead to more effective supervision and oversight of cross-cutting issues.

4.3 Activity Completion

Documentation and processes for handover of assets need to be more effective if infrastructure investments are to be sustainable.

Future maintenance and renewal needs for new infrastructure are not sufficiently understood by the asset managers. Operation and maintenance manuals are often not in a form that can be readily understood by operators, and directions on management of cross-cutting issues after completion are not transmitted to the organisations that will manage the assets. Clearer detailed programmes for ongoing maintenance and renewal of infrastructure assets need to be provided as part of the handover documentation at project completion if country partners are to be able to understand, fund and plan future maintenance and renewal.

4.4 Activity Monitoring and Evaluation

Transfer of lessons learned from completed Activities has been limited by documentation and dissemination of these.

Learnings from previous Activities are not always recognised or taken action on. Recent initiatives for improved monitoring and evaluation of Activities,



and for documentation and sharing of findings, will be beneficial in improving Outcomes from future MFAT Activities.

Baseline and monitoring data needed to evaluate Impact is not being collected.

In some Activities the monitoring of indicators is not commencing until after completion of the infrastructure construction. Collecting and reporting on basic energy sector data will assist in monitoring and evaluating impacts. This can be standardised across the energy sector Activities. Climate change and environmental data is not being collected, collated and reported in order to measure the impacts and benefits.



5. Recommendations

The outcomes of the renewable energy Activity Evaluation (Stage Two) confirm the earlier Recommendations for completed infrastructure (Stage One). The Stage One Recommendations are summarised in Appendix One. Those Recommendations are not otherwise repeated here, but are endorsed as still applicable and recommended for adoption.

The following recommendations are made in addition to those provided in the Stage One report on completed infrastructure. These are both new issues and more detailed proposals than are covered in the Stage One report.

5.1 Activity Concept and Design

Allocate resources to adequately scope cross-cutting issues and beneficiary needs (responsibility of MFAT).

The objective is to maximise benefits and avoid / mitigate negative impacts through good activity design based on evidence, while avoiding overstating or generalising the potential results and impacts to beneficiaries. This includes collecting baseline data.

Include realistic assessment of future increase in energy use, and demand-side management (e.g. education on energy use, billing and energy efficiency) for beneficiaries (residential and non-residential) as part of future Activity designs (responsibility of MFAT).

Historically when access to power is made more available usage increases. Activity design should include a realistic assessment of future energy based on both historic trends and likely new behaviours linked to more favourable supply (the purchase and use of more appliances, additional commercial ventures). Building more generation capacity is one response, but not the answer on its own. Mitigations should be put in place to minimise the impact of increased use.

Undertake a local sector and partner capacity assessment to inform the project design, ask the question 'How can this Activity be designed to maximise local involvement?' (responsibility of MFAT).

Local sector and partner involvement is critical to maximising long term outcomes, benefits and sustainability. Within programme and budget constraints Activity design can be informed by what the local sector or partner can deliver both individually and supported internationally.

Coordinate with development partners and other donors to take a sector wide approach (responsibility of MFAT, other donors).

Working in partnership with all stakeholders, ensures that MFAT's investments fit, and are well coordinated. Multiple donors working within the same sector can result in assets designed to different standards.



Commonality in operation and maintenance has significant positive impacts on the costs and ease of operation and maintenance.

5.2 Activity Implementation

Undertake specific contracting and procurement planning for infrastructure components (responsibility of MFAT).

Contracting strategies should identify the key project risks and to share and allocate those risks to those parties best placed to manage them. Allow for realistic timeframes for planning the work, procurement and construction based on complexity of project and market conditions. Logistically complex projects require more time to plan and bid. Shorter timescales increase project risk for the bidder and results in less bidder interest and higher prices.

Where works are undertaken by in country partners provide support for in country resources for supervision and monitoring of work (responsibility of MFAT).

In-country coordination, especially in small isolated atolls, can be very challenging. Identify periods when additional supervision is required.

Actively use the Activity programme and risk register, and update these regularly to assess impacts of delays both to project risk, programme and dates (responsibility of MFAT).

Active programme and risk management is critical for understanding final project costs. Activity delays are common and understanding the impact of these delays in the medium to long term allows realistic reforecasting and rebudgeting as appropriate. More active use of risk registers would better meet current best industry practice.

Develop clear project management structures including authority matrix and relationship/communications strategy (responsibility of MFAT, PMU Consultant, Implementing Agency).

Complex and large management structures can result in confusion and miscommunication. Roles and responsibilities of all parties involved in the implementation of the Activities should be made clear, i.e. who can decide what. Key roles should be staffed with persons that have the right skills. Mitigations should be put in place for if key personnel leave or are unavailable.

Assign clear roles and responsibilities for cross-cutting issues (responsibility of MFAT, PMU Consultants, Contractors).

Provide clarity in the ADD as to the roles and responsibilities for Impact Management Plan implementation and supervision, and the supervision and oversight of other cross-cutting outputs and outcomes, both internally within MFAT and with in-country partners, consultants and contractors. Include cross-cutting issues in all reporting documentation (project managers' progress reports, MFAT Activity Assessments etc).



5.3 Activity Completion

Provide understandable comprehensive handover documentation to the utility/asset owner for the future operation, maintenance and renewal of the asset along with supporting training (responsibility of MFAT, Implementing Agency).

This will assist in ensuring that the mitigation of ongoing impacts from operations and maintenance is mainstreamed into 'business as usual'. Operation and maintenance manuals should be in a form that can be readily understood by operators. Detailed programmes for ongoing maintenance and renewal of infrastructure assets need to be provided so that partners are to be able to understand, fund and plan future maintenance and renewal.

Include plans for future funding needs as part of asset management plans so that all future funding requirements for sustainability of the infrastructure (through maintenance, renewal and decommissioning) are understood and planned for (responsibility of MFAT, implementing agency).

Where new assets are provided at no cost to the recipient the future costs for operation and maintenance (including renewal or depreciation) may not be clearly identified to them. In some cases this means that development partners are not funding the long term sustainability of assets for eventual renewal or decommissioning. Continued funding and support is required to bridge the gap to make infrastructure sustainable.

5.4 Activity Monitoring and Evaluation

Adopt the Energy Sector Results Framework as the basis for Activity monitoring and evaluation (responsibility of MFAT).

Ensure baseline data is collected before implementation begins and data is collected as part of project management.

Complete more documentation of lessons learned from completed Activities that are available to MFAT staff (responsibility of MFAT).

Undertake workshops following the Activity completion phase to review the Activity against the key indicators. Invite parties involved in the Activity to the workshops, including consultants, contractors and in country partners to identify lessons learned. Have the workshops facilitated and document discussions and findings in a manner that can be implemented on other Activities.



Appendices



Appendix One – Executive Summary: Infrastructure in the Pacific: Learnings from Completed Investments 2004-2013

(This is an extract from "Infrastructure in the Pacific, Learnings from Completed Investments 2004-2013", MWH New Zealand Ltd, March 2015)

The New Zealand Aid Programme, Ministry of Foreign Affairs and Trade (MFAT) has identified infrastructure investments as one of the enablers of growth, with renewable energy as one of the key underpinnings of the Aid Programme's growth strategy (MFAT March 2011).

MFAT has commissioned a two-stage evaluation of infrastructure Activities in the Pacific to:

- Identify lessons learned from past infrastructure investments on what worked or didn't work, and why? These investments targeted land transport; maritime transport; water, sanitation and hygiene; solid waste management; and energy (Stage One).
- Evaluate the Activity planning and management (in concept, design, implementation and completion phases) of the MFAT renewable energy Activities (Stage Two).

This Report covers evaluation of completed infrastructure. Evaluation of completed infrastructure involved document review and interviews with key stakeholders, and focussed on four established or completed Activities in the Pacific. It also included review of infrastructure evaluations of other donor agencies, other MFAT evaluations, and other relevant documentation.

The evaluation of completed infrastructure focussed on four Activities (Appendix 1 of this report), that were diverse in their technical scope and unique in the circumstances that applied to them:

- Solomon Islands Road Improvement Programme (SIRIP) (2007-2013) / Post Conflict Emergency Reconstruction (roads and bridges) (PCERP) (2006-2008) (Transport) with the Asian Development Bank (ADB) and Department of Foreign Affairs and Trade (DFAT) – a large and successful programme of works to upgrade the main roads and bridges, designed as part of the recovery from the impacts of a conflict period in the Solomon Islands.
- Development Partnership Arrangement (DPA) for Cook Islands Outer Islands. Development Infrastructure Construction and Upgrade (2005-2008) – this was a framework process for infrastructure project decision making (management protocols, programme planning, project selection and implementation) to overcome problems arising from the absence of clear processes and responsibilities in the Cook Islands, under which 11 separate Activities were completed.
- Tonga (Popua) Dump Site Rehabilitation (2004-2008) (Solid waste) – a defined task for closure and remediation of an old refuse dump site on Tongatapu.
- Niue Power Station Rebuild (2006-2008) (Energy) – an emergency response for rebuilding the diesel power generator on Niue following a fire and equipment breakdown which impacted the whole community.



Key Findings and Lessons Learned

The key findings of the evaluation (Report Section 2) and lessons learned (Report Section 4) in response to the key evaluation questions are:

What is good practice?

- A guiding country infrastructure strategy belonging to the aid recipient is needed to prioritise infrastructure investment to get the best outcomes and impacts, and aid in resource allocation for the recipient and donors.
- Good coordination with and among donors improves outcomes, and poor coordination undermines outcomes – this applies to coordination between donors and coordination of donors by recipient governments.
- Adherence to good project processes improves outcomes – key elements are strong leadership and management, ownership by stakeholders, effective secretariat or project management unit, clear and logical roles, and supported oversight committees.
- There is not a best procurement modality for all situations and modalities may be adopted to suit the specific situation. There are advantages in each approach and disadvantages that need to be mitigated.
- Project design practices need to take in the big picture by identifying linked projects and separate needs triggered by the outcomes of the core project.
- Involving stakeholders in design improves outputs and outcomes – this takes time and is sometimes limited for expediency where there are time constraints or in an emergency response.

What could have been done better?

- Detailed financial and economic analysis on the MFAT-led Activities would lead to better development outcomes for both the recipient Government and the beneficiaries.
- MFAT's focus on infrastructure construction and limited maintenance support practices may affect the long term impact of infrastructure investment – greater support in ongoing maintenance would improve outcomes and sustainability.
- More effective provision for maintenance is needed for infrastructure investment to be sustainable – including addressing financial constraints, establishing accountability and incentives, building capacity and better focus on practical maintenance methods in infrastructure design and construction.
- Better matching of project design to in-country capability and capacity and effective long term capability/capacity building would improve long term outcomes and sustainability – in-country capability and capacity needs to be realistically assessed and appropriate responses included in the project design.

What lessons can be applied elsewhere?

- Lessons are transferable but need to be interpreted and adapted to recognise differences in cultural, social, political and environmental condition.

How have cross cutting themes been addressed?

- Climate change, environmental impacts, human rights and gender aspects have been addressed on an ad hoc basis in each of the four Activities – this reflects the diverse nature of the infrastructure Activities in the evaluation, but also reflects an inconsistent approach to good practice by MFAT. It is noted that these Activities preceded MFAT's 2011 strategy to strengthen the integration of cross cutting issues.



- Activity outcomes were more beneficial to communities and the environment where cross cutting issues were addressed early and integrated into the project design, were monitored by MFAT or other donors, and leveraged through contractual agreements.
- Activities were more likely to have adverse social and environmental impacts when the issues (such as land access) were excluded from the Activity, and / or no ongoing mitigation and monitoring followed Activity closure.

Recommendations

The following actions are recommended (see Section 5 for more detail).

Infrastructure Planning

1. Each country should have a national infrastructure plan or strategy to guide infrastructure investments (responsibility of recipient country government, MFAT).

Procurement

2. Procurement modalities for each Activity should be adopted to fit the specific circumstances of the Activity, institutional structure and local capacity (MFAT).

Community Involvement

3. Beneficiary communities and other stakeholders impacted by the infrastructure should be consulted from the beginning of the Activity design process following an agreed Communications Plan (implementing agency, MFAT).

Financial / Economic Analysis

4. MFAT should require a complete financial and economic analysis for all Activities (MFAT).

Capability and Capacity Building

5. A full capability and capacity analysis should be undertaken at the start of each Activity to identify skill and resource gaps and the capacity building inputs needed to implement the infrastructure programme (MFAT).

Effective Provision for Maintenance

6. Greater emphasis should be given to good asset maintenance and factored into Activity design, with consideration given to post-construction phase support of asset management (MFAT).

Transfer of Successful Practices

7. Transfer of successful practices into a new situation must be carefully planned to adapt to the new geography, climate change, institutional and community, social and cultural, land tenure, capability and capacity factors (MFAT).

Management of Cross-cutting Issues

8. Mechanisms should be included in formal documents with provision for adequate supervision and monitoring by MFAT to provide incentives and leverage to achieve cross-cutting outcomes in infrastructure Activities (recipient government, implementing agencies, MFAT).



9. Management of ongoing cross-cutting issues (after Activity closure) should be operationalised into the implementing agency's asset management plans, design manuals, and other institutional policies and procedures (implementing agency, MFAT).
10. In-country and MFAT requirements for Environmental Impact Assessments should be harmonised where possible to ensure all donor and recipient country requirements are met effectively and efficiently (recipient government, MFAT).
11. Resolution of land issues should begin at the start of the Activity and adequate time given in the programme for resolving such issues and / or access to resources) before construction starts (implementing agency, MFAT).



Appendix Two – Summary Description of Activities

The following information is intended to provide a general description of the four Activities covered in the evaluation and some key events, solely for the purpose of understanding this report. It is not intended to be a complete account of the Activities. The information here is drawn from project reports and information supplied by stakeholders.

Tokelau Renewable Energy Programme

Location of project (town/country) - Fakaofu, Nukunonu and Atafu atolls: Tokelau

Date started – 2010

Date completed – 2013

Renewable energy source – Solar power

Technology and scale – Photovoltaic/Diesel Hybrid. Photovoltaic capacity – Fakaofu 365 kWp, Nukunonu 265 kWp, Atafu 300 kWp, Total 930kWp.

Project Budget – NZ\$8.45 million

The Tokelau Renewable Energy Project (TREP) was led by the Government of Tokelau and supported and co-funded by the New Zealand Ministry of Foreign Affairs and Trade and the Government of Tokelau. It has seen the construction of a photovoltaic/diesel hybrid system on each atoll in the Pacific island nation of Tokelau. Previously, the atolls used diesel generator sets to provide electricity on a centralized distribution network. The new solar power systems were designed to provide at least 90% of the islands' electricity needs from solar power.

Main features of the project:

- Prior to the TREP systems being installed, all three atolls had their power provided by diesel generator sets
- A photovoltaic/diesel hybrid system was decided upon to help Tokelau meet its National Energy Policy and Strategic Action Plan (2004) goals of achieving energy independence
- The Government of Tokelau approached the New Zealand Ministry of Foreign Affairs and Trade to secure a NZ\$7 million advance on its aid allocation to fund the project
- The photovoltaic systems were designed, supplied, and installed by Powersmart Solar NZ Ltd, with assistance from IT Power (Australia) Pty Ltd
- The photovoltaic systems were designed to provide 90% of each island's annual electricity needs through solar power, with the balance of electricity being provided by the diesel generators when the batteries are at a low state of charge after several days of cloud cover.

Tonga Renewable Energy Solar Activity (Maama Mai Solar Facility)

Location of project (town/country) – Popua Power Station, Tongatapu: Tonga

Date started – 2010

Date completed – 2017 (5 years following completion of construction)

Renewable energy source – Solar power

Technology and scale – 1.3 MW_{DC} (~1MW_{AC}) photovoltaic solar facility



Project Budget – NZ\$9.24 million

The Tonga Renewable Energy Solar Activity was developed and under a joint project agreement between Tonga Power Limited, Meridian Energy Limited, New Zealand Ministry of Foreign Affairs and Trade and the Government of Tonga. The project saw the construction of a 1MW photovoltaic solar facility adjacent to the existing Popua Power Station. The Plant is connected to Tongatapu energy grid (population approx. 70,000) and supplies 4% of the energy demand.

Main features of the project:

- The Popua Solar Farm specifically aligns with MFAT priorities, GOT priorities, TPL's strategic plan. Energy is also a priority sector under the NZ/Tonga Joint Commitment for Development and renewable energy is the largest area of New Zealand support to Tonga
- This project is part of Tonga Energy Road Map (TERM) 2010-2020 as part of Tonga's strategy to reduce its reliance on imported fuels for its energy requirements. This project contributes to this by providing solar energy to the grid, thereby reducing diesel consumption
- Meridian is the owner of the solar facility until 2017 and provides Asset Management, Advisory and Support Services to TPL
- The photovoltaic systems were designed, supplied, and installed by Reid Technology NZ Ltd. Project Management was undertaken by Meridian Energy
- In 2013 the Solar facility saved approximately 480,000 litres of diesel at a cost of around NZ\$600,000.

Samoa Renewable Energy Partnership

Location of project (town/country) – Various: Samoa

Date started – 2013

Date completed – 2019

Renewable energy source – Solar power, hydro power, wind power, sector support

Technology and scale – Various

Project Budget – NZ\$14.5 million

At the Pacific Energy Summit in March 2013, the Government of Samoa (GoS), the New Zealand Ministry of Foreign Affairs (MFAT), and the European Union (EU) committed to working in Partnership to increase the generation of energy in Samoa from renewable sources.

As part of this commitment, MFAT and the EU announced up to NZ\$26.5m (NZ\$14.5m from New Zealand and NZ\$12m from EU) in funding for a range of proposed renewable energy design concepts for Samoa. The Activities include:

i. Samoa Energy Sector Support

- Development of a least-cost energy investment plan for the energy sector
- Technical assistance and capacity building to EPC as required for implementation of the least-cost energy investment plan and implementation, monitoring and management of energy projects
- Contracting a Project Management Unit for implementation, monitoring and management of energy projects



- Technical assistance to the Office of the Regulator to assist the supervision of power purchase agreements and pricing review.
- ii. Photovoltaic Energy Projects
 - Funding of approximately 2.5MWp of PV generation capacity installed prior to the Small Island Developing States conference (PV – Tranche One)
 - Facilitation of private sector investment in additional PV generation capacity (PV – IPPs).
 - Funding for further PV generation capacity (PV – Tranche Two).
- iii. Wind Energy Generation
 - Feasibility and design work to confirm viability
 - Dependent on the above, installation and implementation.
- iv. Hydro Power
 - Investment in ADB-led Hydro-Power Generation and Rehabilitation Project which includes:
 - Rehabilitation of three Cyclone Evan-damaged hydro-power infrastructure on Upolu with a combined output of 4.69 MW; and
 - Construction of three new hydro schemes (two on Upolu and one on Savai'i) with a combined capacity of 0.81 MW.

Cook Islands Renewable Energy Activity

Rarotonga Airport West)

Location of project (town/country) – Rarotonga Airport, Rarotonga: Cook Islands

Date started – 2014

Date completed – 2015

Renewable energy source – Solar power

Technology and scale – 900kWp photovoltaic solar facility

Project Budget – NZ\$3.5 million

The project involved the construction of a 900kWp solar facility at Rarotonga Airport. The project was implemented by MFAT under a NZ3910 contract and involved the design, supply, construction and installation of the solar array. The project involved companies both from New Zealand and the Cook Islands.

The project aligns with the Cook Islands Renewable Energy Charter (CIREC) and National Sustainable Development Plan (NSDP).

Outer Islands (Northern Group) Solar

Location of project (town/country) – Northern Group of Islands, Manihiki, Pukapuka, Nassau, Penrhyn, Rakahanga and Palmerston: Cook Islands

Date started – 2014

Date completed – 2015

Renewable energy source – Solar power

Technology and scale – mini-grid photovoltaic solar facilities on each island

Project Budget – NZ\$19.5 million

The project involves the construction of six mini-grid PV solar facilities on the Northern Group of the Cook Islands. Previously all the islands, with the exception of Pukapuka



which had old rooftop mounted solar, were reliant on old generators and expensive imported diesel. Power was only provided at certain periods during the day.

For a number of years CIGOV had been trying to use Pacific Environment Community (PEC) funding to develop renewable energy infrastructure in two Northern Group islands. However it became apparent that the combination of challenging logistics and small project size meant that it was unlikely that contractors would be willing to deliver.

Following discussions involving CIGOV, MFAT, ADB and the EU, it was determined that CIGOV would withdraw from the use of PEC funds for the Northern Group. It was also agreed that it would make a more commercially attractive proposition if all Northern Group islands were to be developed under a single package, and Southern Group islands under a different package. It was subsequently agreed that MFAT would facilitate renewable energy development in the Northern Group on behalf of CIGOV, with the EU and ADB facilitating renewable energy development in the Southern Group.

The project was implemented by MFAT under a NZ3910 contract and involved the design, supply, construction and installation of the solar array. The project involved companies from New Zealand with some support from the Cook Islands.

The project aligns with the Cook Islands Renewable Energy Charter (CIREC) and National Sustainable Development Plan (NSDP).

Enabling Environment for Energy Sector Development

Location of project (town/country) – Cook Islands

Date started – 2014

Date completed – 2015

Project budget – NZ\$304,000

The project covers energy sector development activities including but not limited to: policy development, stakeholder consultations and communications, institutional capability building, and asset management and maintenance arrangements. It also covers OEC/REDD operational costs; and battery and/or other waste removal (if necessary) or other similar mutually agreed activity.



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Appendix Four - List of Persons Consulted

Tokelau Renewable Energy Programme

- Robin Pene, Tokelau Director of Energy
- Mike Basset-Smith, Director, Powersmart
- Simon Franklin, IT Power
- Sonya Cameron, Development Manager Tokelau, MFAT, Wellington
- Roger Cornforth, Deputy Director Tokelau/Niue/Cook Islands, MFAT, Wellington
- Joseph Mayhew, former Development Manager Energy, MFAT

Maama Mai Solar Facility

- Elena Noyes, Development Manager Tonga, MFAT, Wellington
- Katie Petrie MFAT, Wellington
- Martin Garrood, Development Manager Energy, MFAT
- Alison Riley, Development Programme Coordinator, MFAT, Samoa
- Robert Matthews, CEO, Tonga Power Limited
- Johnny Lillis, Project Delivery Manager, Tonga Power Limited
- Nikolasi Fonua, Strategic Development Manager, Tonga Power Limited
- Michael Lani 'Ahokava, Power Generation Manager, Tonga Power Limited
- Dr. Tevita Tukunga, Head of the Energy Department, Tonga
- Asipali Palaki, CEO, Ministry of Lands, Survey & Natural Resources
- Viliame Takau, CEO, Chamber of Commerce, Tonga
- Emeline Siale 'Ilolahia, Civil Society Forum of Tonga
- Saia Faletau, ADB, Tonga
- Inoke Vala, Director of the Tonga Energy Road Map
- Murray Hill, Alliance Project Manager, Meridian Energy
- David Reid, Reid Technology
- Simon Franklin, Project Manager, IT Power

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- Tangi Tereapii, Director, Renewable Energy Development Division, Cook Islands
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- Bob Taylor, CEO, Edgewater Resort, Cook Islands
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