MONITORING AND EVALUATION FRAMEWORK FOR THE TUVALU COMMUNITY BIOGAS PROJECT

SPREP
Secretariat of the Pacific Regional Environment Programme

The **Pilot Program for Climate Resilience: Pacific Regional Track (PPCR-PR)** is a regional program which aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes (i.e. 'climate change and disaster risk mainstreaming').

The PPCR-PR is implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank (ADB) and is funded through the Climate Investment Funds (CIF).

SPREP
Secretariat of the Pacific Regional Environment Programme

SPREP LIBRARY CATALOGUING-IN-PUBLICATION DATA

Monitoring and evaluation framework for the Tuvalu community biogas project. Apia, Samoa : SPREP, 2017.

30 p. 29 cm.

ISBN: 978-982-04-0712-1 (print)
978-982-04-0713-8 (ecopy)

1. Renewable energy – Biogas – Tuvalu.
2. Energy development – Monitoring & evaluation – Tuvalu – Oceania.
3. Climatic changes – Tuvalu – Oceania.
I. Pacific Regional Environment Programme (SPREP).
II. Pilot Program for Climate Resilience : Pacific Regional Track (PPCR-PR).
III. Title

333.79415 968 2

MONITORING AND EVALUATION FRAMEWORK FOR THE SUSTAINABLE COMMUNITY-BASED BIOGAS SCHEMES FOR DOMESTIC ENERGY AND IMPROVED LIVELIHOODS (TUVALU COMMUNITY BIOGAS) PROJECT

CONTENTS

INTRODUCTION	1
DEFINITION OF THE TUVALU COMMUNITY BIOGAS PROJECT	3
KEY EVALUATION QUESTIONS	6
THE MONITORING PLAN	8
THE EVALUATION PLAN	11
CONCLUDING REMARKS	16
APPENDIX 1. DRAFT TERMS OF REFERENCE FOR THE TERMINAL EVALUATION	19
APPENDIX 1.MONITORING AND EVALUATION FRAMEWORK	21
APPENDIX 2. DATA COLLECTION FORMATS	22
APPENDIX 3. FULL RISK TABLE	23

Introduction

The Government of Tuvalu (GoT) is about to begin a new project titled the 'Sustainable Community-Based Biogas Schemes for Domestic Energy and Improved Livelihoods' project. This project, hereafter referred to as the Tuvalu Community Biogas project, is being implemented with support from the Pacific Community (SPC) and German International Co-operation Agency (GIZ) and is part of a regional programme funded by the European Union (EU) titled the 'Adapting to Climate Change and Sustainable Energy' (ACSE) programme.

This document is the monitoring and evaluation (M&E) framework for the Tuvalu Community Biogas project. The purpose of this framework is to guide monitoring and evaluation of the project in a structured and systematic fashion. An emphasis of the framework is to support learning by the GoT, particularly of lessons for improving the design of future biogas-related project(s), if needed/ appropriate.

The M&E Framework follows the approach outlined in a draft *Guidance Note for Developing Monitoring & Evaluation Frameworks for Overseas Development Assistance (ODA) projects in Tuvalu.* This approach goes beyond preparing standard logical framework (LogFrame) matrices and monitoring plans (developed as normal practice for externally assisted climate change adaptation and development projects in Tuvalu) in an effort to more effectively support the learning needs of the GoT.

This M&E framework document is organised as follows:

1. Definition of the Tuvalu Community Biogas project
2. Key Evaluation Questions that provide direction for activities and an analysis of the M&E work.
3. The Monitoring Plan
4. The Evaluation Plan
5. Basic Communication and Knowledge Management Plan
6. Concluding remarks

In addition, Appendix 1 outlines a draft Terms of Reference for the terminal evaluation of the Tuvalu Community Biogas project to be undertaken in 2018, and Appendix 2 includes data collection formats to facilitate these monitoring activities by responsible persons.

A key activity in developing the M&E framework was a two-day participatory workshop conducted in Funafuti in May 2016. A report documenting this workshop is available from GoT upon request.

Development of the M&E framework was supported by the Strategic Programme for Climate Resilience: Pacific Regional Track (SPCR-PR) and Coping with Climate Change in the Pacific Islands Region (CCCPIR) programmes. The SPCR-PR and CCCPIR are both regional programmes which aim to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes (i.e. 'climate change and disaster risk mainstreaming').[1]

Development of the M&E framework was also supported by Teuleala Manuella-Morris, who is currently undertaking PhD research on biogas systems through the University of the South Pacific (USP) Pacific Centre for Environment and Sustainable Development (PACE-SD). The intention is that this M&E framework will employ methodologies consistent with the PhD research where appropriate and that both areas of research work will mutually reinforce each other to the extent practicable.

1 The SPCR-PR was implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) and Asian Development Bank (ADB) and funded through the Climate Investment Funds (CIF). The CCCPIR is being implemented by SPC and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and is funded through the Federal Ministry for Economic Cooperation and Development (BMZ).

Definition of the Tuvalu Community Biogas project

PROBLEM STATEMENT

The primary 'problem' the project is seeking to address is an undersupply of energy (for cooking applications) from biogas technologies (i.e. inefficient mix of technologies for producing or sourcing gas energy). Currently, most energy used for cooking is sourced from imported LPG and kerosene. These sources of cooking energy are relatively expensive, especially in outer islands where transport adds significantly to these costs. Many poorer households cannot afford this energy and must spend substantial periods of time collecting and preparing firewood.

There are a number of reasons why biogas technologies are not used as much as they could or should be, despite biogas being a more cost-effective[2] option. The key reasons or underpinning causes of this problem include:

- a lack of financial, economic, social, and environmental information available to households (and Falekaupule and Kaupule) to demonstrate the 'business-case' for adopting biogas systems;
- a lack of technical information available to households (and Falekaupule and Kaupule) explaining the 'how to' of purchasing, installing and operating biogas systems[3];
- a lack of available hands-on training to teach interested persons how to properly install, operate, maintain, etc.; and
- the relatively large up-front capital investment (around AUD 6,500 per system) required for installing biogas systems which acts as a barrier, especially for households who cannot easily access finance/credit.

OBJECTIVE STATEMENT

The high-level objective of the project as stated in the project design document is to 'strengthen the capacity of Tuvalu's outer island communities' to adapt to the adverse effects of climate change and to enhance the use of appropriate biogas technologies regionally'. The project will contribute to this by increasing the (resilient and sustainable) supply of energy from biogas technologies in Tuvalu.

Secondary objectives of the project also include to:

- increase agriculture production utilising the residue bi-product of the biogas system; and
- reduce pig waste-related environmental impacts/problems experienced in the outer islands.

DESCRIPTION OF STRATEGIES

The project design focuses on strategies to fill information (and training) gaps identified as constraining uptake of biogas technologies. The key strategies comprise:

- demonstration of biogas system installation and operation;
- a biogas "how-to toolkit" which will cover all relevant technical information needed by households (and Falekaupule and Kaupule) to source, install, operate, and maintain the biogas system;
- formal technical vocational trainings on the installation, operation, and maintenance of the technology; and
- scientific technical report on methane production from the technology.

2 Refer to the CBA report at [x].

3 What equipment is needed, where to source this equipment, how to properly install, how to properly maintain and operate, etc.

The project design also includes a strategy to reduce barriers presented by high up-front establishment costs. This strategy is to provide guidance material for preparing applications for UN small grant funding and will be linked to the “how-to toolkit”.

The project strategies will be implemented over a twoyear period and will target seven islands: Vaitupu, Niutao, Nui, Nukufetau, Nukelaelae, Funafuti, and Niulakita.[4]

In addition, a feature of the project is its governance arrangements. In particular, ownership, management, and oversight of the demonstration systems will be undertaken by the Falekaupule and Kaupule.[5] The project includes a number of technical vocational training modules to support the Falekaupule and Kaupule in this governance role.

The logic of the project design—i.e. the cause-effect linkages between key strategies of the project design to achieve the intended intermediate, end-of project, and longer-term changes/outcomes—is illustrated in Figure 1.

Note this logic model is consistent with the ‘LogFrame’ included in the project design document. The reason to use this logic model here rather than the LogFrame is to more clearly show the linkages between the strategies and the various levels (i.e. intermediate, end-of project, and longer-term) of changes/outcomes sought. LogFrames are harder to understand and use when there are more than two levels of outcomes, as is the case in this project.

Note also that the intermediate, end-of project, and longer-term outcomes illustrated in the logic model below all align with relevant sector plans (i.e. the Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu; and the draft Tuvalu National Agriculture Sector Plan) as well as the Ta Kakeega III.

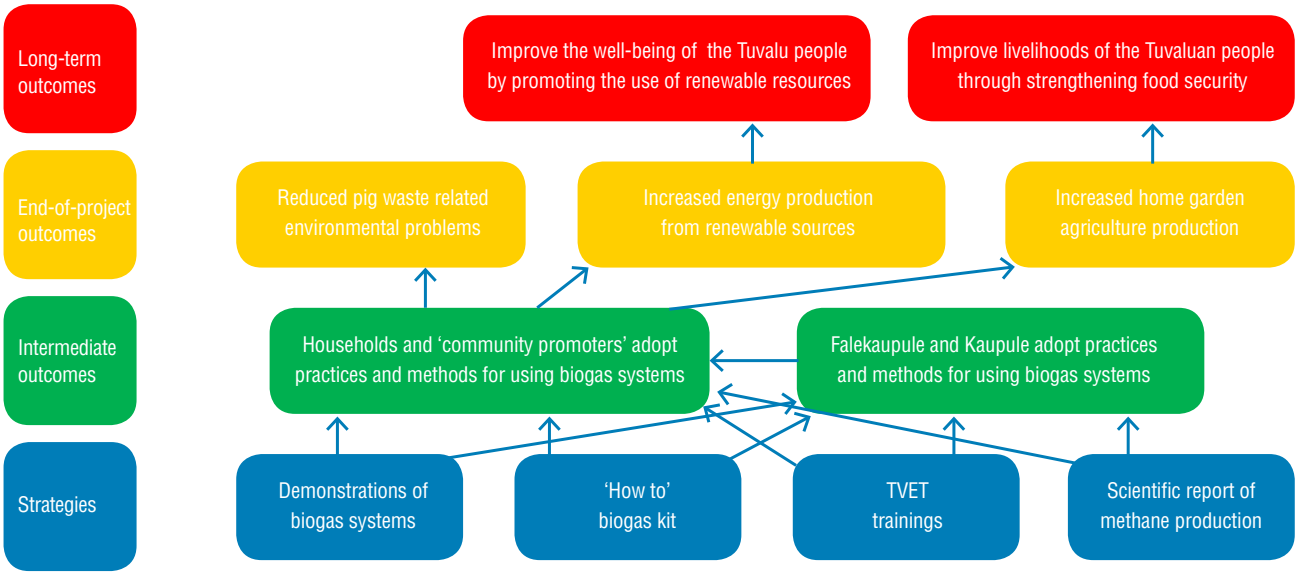


FIGURE 1. SIMPLE LOGIC MODEL FOR THE TUVALU COMMUNITY BIOGAS PROJECT

4 Note, Nanumea and Nanumaga already have some systems in place.

5 This is notable given the biogas systems are small household-scale systems for which the majority of financial benefits (approximately 96%) accrue to those households at which the systems are installed. That is, the systems have private-good characteristics and not public-good characteristics.

ASSUMPTIONS

A key assumption is that households, Falekaupule, and Kaupule face the correct incentives to efficiently operate, maintain, and acquire new biogas systems.

EXTERNAL FACTORS AND RISK

There are a number of external factors that may adversely affect the delivery of the Tuvalu Community Biogas project and achievement of its intended outcomes. Key factors, their associated risks, and how they will be treated/managed are summarised in the Risk Table below. A more detailed and comprehensive Risk Table is provided in Appendix 3.

TABLE 1. RISK TABLE FOR THE TUVALU COMMUNITY BIOGAS PROJECT

#	Risk description	Risk Type[6]	Implications & Rating: Likelihood (L) & Impact (I) (1 = low; 5 = high)	Mitigation	Contingency
1	Drought	3	Drought will slow the implementation of the project on the islands. The boat only visits each island at least 2 to 3 weeks apart so the team has to conduct the training and install the 8 biogas units and pig pens have to be completed within the duration in order to cover the islands in time. Loss of production. (L = 2) (I = 5)	Properly maintained and managed water tank use	Use of greenwaste as input substitute
2	Cyclone	3	Damage to biogas infrastructures. Loss of production. (L = 2) (I = 5)	Do not use contaminated pig dung	Expel gas from the digester prior to the cyclone
3	Sea level rise and storm surge	3	Loss of production. (L = 2) (I = 5)	Site digesters and pig pens away from storm surge zone	Do not use contaminated pig dung
4	Negative cultural perceptions regarding biodigester systems	4	This impact was not measured; however, from the experience on Nanumea, only one unit was highly used. The others were only used when gas was short on the island or when it was raining. The problem progressed such that now none are used on Nanumea. This problem was unlikely on Nanumaga where the units were highly used by 6 households. (L = 3) (1 = 5)	Monitor community perceptions	Increase advocacy in islands identified as high risk sites (as understood from previous projects)
5	Politics within Kaupule	3	Political process could slow the implementation of the project on the islands.	Make dedicate awareness activity to explain to Kaupule rationale for criteria, and importance for project success	

NB: the format of this risk table is as per the GIZ project design document requirements.

6 See section 6.7 Risk Management in The Guide for a list of suggested risk type categories.

Key Evaluation Questions

Key evaluation questions are the questions that are most important to primary stakeholders for their learning and strategic decision-making needs. These are the questions to which stakeholders, and in particular the GoT, 'really need to know' the answers. These evaluation questions provide direction and focus for the M&E work.

The key evaluation questions for the Tuvalu Community Biogas project were formulated and agreed upon by participants during the workshop conducted in May 2016 and follow-up meetings held immediately after the workshop. This discussion was guided by the logic model and summary of project risks outlined in the section above.

The key evaluation questions cover all evaluation criteria or domains as developed by the Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (i.e. appropriateness, impact,[7] effectiveness, efficiency,[8] and sustainability[9]).

The evaluation questions and sub-questions are outlined in Table 2.

TABLE 2. EVALUATION QUESTIONS AND SUB-QUESTIONS FOR THE TUVALU COMMUNITY BIOGAS PROJECT

REFERENCE #	QUESTION
APPROPRIATENESS	
1.	Was the project design right?[10]
IMPACT	
2.	To what extent has the project contributed to, or is expected to contribute to, the wider uptake of biogas systems across Tuvalu? What factors[11] led to change or contributed to lack of change?
3.	Were there any unintended impacts[12] generated from the project, or expected to be generated from the project?
EFFECTIVENESS	
4.	To what extent has energy production from renewable sources increased as a direct result of the demonstration systems? Similarly, to what extent has consumption of LPG and kerosene been reduced? What factors contributed to, or prevented, achievement of this change?
4.a	To what extent were key climate risk-reduction strategies effective in preventing related damages and losses from any climate hazard events (e.g. storm surge, cyclone, drought) if these events occurred during project implementation? What worked well and what did not work so well? Why?
5.	To what extent has home garden agriculture production increased as a result of the demonstration systems? What factors contributed to, or prevented, achievement of this change?

7 Impact is a measure of the extent to which longer-term outcomes were achieved or are expected to be achieved.

8 Efficiency is a measure of how inputs (funds, expertise, time, etc.) are converted to outputs.

9 Sustainability is a measure of the continuation of the project benefits beyond the project lifetime.

10 Did the project design:
- directly address the main causes and drivers of the project problem?
- incorporate available lessons learned from the evaluation of the Alofa Tuvalu Small is Beautiful project, the EU USP GCCA project, and other similar projects previously implemented in Tuvalu?
- incorporate available lessons learned from similar projects previously implemented in other parts of Pacific?
- incorporate relevant findings and recommendations from the cost-benefit analysis study (Binney 2015)?

11 Key factors to consider here include, but are not limited to:
- whether the project has established an expectation that all (upfront capital costs of) biogas systems (and other similar private infrastructures) will be paid for by Government/aid projects—which in turn may limit further uptake by non-participating households; and
- whether information and capacity building (provided as part of the SCBBSfDEaIL project) to develop small grant proposals has been sufficient for Kaupule and lower income households to successfully attract funding for new systems if no other projects or small-grant funding is forthcoming.

12 For example, is the project expected to establish a precedent and expectation that all (upfront capital costs of) for private infrastructures of this type (biogas systems, household rainwater tanks, pig pens, etc.) will be paid for by Government/aid projects , which in turn may act as a disincentive for households to take their own initiative to undertake these type of activities? Or, has the project caused any conflicts of any type (e.g. disputes between households that were selected to receive a biogas system and households that were not)?

REFERENCE #	QUESTION
6.	To what extent has the project reduced pig waste-related environmental problems experienced in the outer islands? What factors contributed to, or prevented, achievement of this change?
7.	To what extent have households 'adopted' practices and methods for using biogas systems? What factors[13] contributed to, or prevented, achievement of this behaviour change?
a.	Have key climate change and disaster risk reduction measures been adopted by households? If not, why not?
8.	To what extent have Falekaupule and Kaupule 'adopted' practices and methods for managing biogas systems? What factors[14] contributed to, or prevented, achievement of this behaviour change?
EFFICIENCY	
9.	To what extent were outputs delivered on time? What were the main reasons for any variances?
a.	Has oversight and management from Falekaupule and Kaupule adequately supported delivery of this project?
b.	What has been the Department of Agriculture's (DoA's) contribution to the delivery of project outputs? Has this been co-ordinated with other relevant extension services provided by DoA to target households? Is there benefit in doing this?
SUSTAINABILITY	
10.	Is the production of biogas from installed systems expected to continue after the completion of the twoyear Tuvalu Community Biogasproject?
a.	What measures have been put in place to ensure the biogas toolkit continues to be easily accessible? Are they adequate?
b.	Will the TVET courses continue to be provided after the 2-year Tuvalu Community Biogasproject has been completed? Has a well-developed strategy to sustainably finance the TVET course been developed and approved by relevant decision-makers?
c.	What assurance/confidence is there that Kaupule will allocate necessary budget for ongoing maintenance, etc., after the twoyear period – especially considering the majority of benefits generated from biogas systems accrue to private households?
d.	Would an alternative ownership and management structure (where households have full responsibility for operation and maintenance) be more likely to generate ongoing benefits, taking into account that the majority of benefits generated from biogas systems accrue to the households where systems are installed?
11.	Are any other strategies needed to achieve wider uptake of biogas systems in Tuvalu?
a.	Are additional initiatives and efforts needed to address barriers presented by high establishment costs of systems and accessing credit/finance for this purpose (e.g. similar to the Fiji Department of Energy and Development Bank Biogas Loan Scheme)?
12.	Should biogas be included as a priority technology in the Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu 2012-2020 – when it is next updated in Q3 of 2018? If so, what are the key recommendations to achieve sustainable and efficient production of energy from biogas systems into the foreseeable future?

Note that the list of evaluation questions is perhaps longer and more comprehensive than what would normally be answered for a project in Tuvalu of this scale. This is because learning is a key focus of this project and because this work is linked to PhD research work by Teuleala Manuella-Morris (USP, PACE-SD). [13][14]

13 In particular: • Was the 'business case' for adopting biogas systems clear and convincing to households?
- Were the criteria developed to select households to participate (i.e. receive a biogas system) in project appropriate? Were the criteria followed?
- Is information included in the biogas toolkit adequate and communicated in clear and understandable terms suitable for household audience? Was this information adequately disseminated?
- Was content covered in TVET training courses adequate and communicated in clear and understandable terms suitable for households? Were these courses available to households when they were required? To what extent has formal certification of technical training courses contributed to proper operation and use of biogas systems?

14 In particular:
- Was the 'business case' for participating in the project clear and convincing to Falekaupule and Kaupule?
  - Were the criteria developed to select households to participate (i.e. receive a biogas system) in project appropriate? Were the criteria followed?
  - Is information included in the biogas toolkit adequate and communicated in clear and understandable terms suitable for Falekaupule and Kaupule? Was this information adequately disseminated?
  - Was content covered in TVET training courses adequate and communicated in clear and understandable terms suitable for the Falekaupule and Kaupule? Were these courses available to Falekaupule and Kaupule when they were required? To what extent has formal certification of technical training courses contributed to proper management of biogas systems?

The Monitoring Plan

To be able to properly answer key evaluation questions formulated in Step 3, good quality information and data must be collected and collated. The monitoring plan outlines the basic information[15] that needs to be regularly collected to help answer the key evaluation questions and sub-questions outlined above. Information collected as part of the Monitoring Plan is also the primary information collated and communicated in regular (i.e. quarterly and annual) Progress Reports, to support everyday management decision-making as well as providing (internal and external) accountability.

An abbreviated version of the Monitoring Plan for the Tuvalu Community Biogas project is provided in Table 3. The format used for this Monitoring Plan is consistent with the GIZ Monitoring Plan format specified in the project design document, with an additional number in parentheses included in column 1 to show linkage with relevant evaluation questions (see Table 2).

Note also that for some evaluation questions, particularly questions relating to appropriateness and sustainability dimensions, monitoring information is not collected. Information for these questions will be collected entirely through in-depth evaluative exercises, as discussed in the next section.

TABLE 3. MONITORING PLAN FOR THE TUVALU COMMUNITY BIOGAS PROJECT

Level (relevant evaluation question)	Indicator	Baseline	Target	Means of Verification	Frequency	Responsibility
Objective: 'strengthen the capacity of Tuvalu's outer island communities' to adapt to the adverse effects of climate change and to enhance the use of appropriate biogas technologies regionally'[16] (2)	Indicator O: Number of new biogas systems installed using finance that is external to the Tuvalu Community Biogas project	Baseline: 0	**Target:** 2 systems planned by end of project	Quarterly site visit report, by project officers	Quarterly	Project staff, ICC

15 The basic data collected as part of monitoring is commonly referred to as an 'indicator', which is a quantitative or qualitative variable to measure progress in a specific area of intervention performance.

16 More specifically, increase the (resilient and sustainable) supply of energy from biogas technologies.

17 If direct measurement of cubic metres is problematic, then better to use 'Number and value ($) of bottles of LPG gas and litres of kerosene used per year' as alternate indicators.

18 There is a need to confirm this with the source document. Not specified in version of consultation report document provided by Teu. Note, the CBA study references this information as being in Section 1.2 of a recent consultation report (though there is no Section 1.2 in the consultation report provided by Teu to the M&E team in May 2016). There must be another consultation report that we need to review.

19 For the purposes of this monitoring plan, 'fully adopted' is defined as households actively employing all of the key practices and methods as prescribed in the toolkit and filling in the diary. Key practices and methods are:
1. use pig dung in the prescribed way on a regular basis (approximately every third day);
2. use methane gas in the prescribed way on a regular basis (approximately every third day);
3. collect and use sluggish/residue/digestate in the prescribed way on a weekly basis;
4. maintain pig pen and water tank in the prescribed way on a quarterly basis; and
5. maintain digester tank in the prescribed way on a quarterly basis

20 For the purposes of this monitoring plan, 'fully adopted' is defined as households actively employing all of the key practices and methods as prescribed in the toolkit for managing climate change and disaster risks. Key practices and methods are:
1. siting infrastructure away from flooding hazard zones, based on community mapping;
2. when a pig pen is inundated from coastal flooding, do not use dung until pig pen has been cleaned out;
3. substitute water inputs with greenwaste during drought events, if shortage of water; and
4. expel gas from biogas system when cyclone warning is issued.

21 For the purposes of this monitoring plan, 'fully adopted' is defined as Kaupule actively employing all of the key practices and methods as prescribed in the TVET trainings. Key practices and methods are:
1. biogas-related activities included in Island Strategic Plan;
2. at least AUD 250 allocated to and reported on in Kaupule bi-annual budget;
3. quarterly inspections completed;
4. completing any required maintenance within 2 weeks of problem occurring; and
5. executing prescribed management response for any households that are not 'fully adopting' practices and methods prescribed in toolkit.

22 Baseline cannot be established from the consultation reports undertaken as part of the project design. A baseline survey is required.

23 Risk management as per measures outlined in Annex 4.4

Level (relevant evaluation question)	Indicator	Baseline	Target	Means of Verification	Frequency	Responsibility
Outcome 1: Increase energy production from renewable sources (4, 4a)	Indicator Indicator 1.1: Cubic metres of methane produced per year from demo systems Indicator 1.2: Number and value ($) of bottles of LPG gas and litres of kerosene used per year by participating (i.e. demo) households Indicator 1.3: Loss of production experienced in 6 week period following a storm surge event (cubic metres[17]), disaggregated by island Indicator 1.4: Damage to biogas asset infrastructure (no damage, partially damaged, fully damaged), disaggregated by island Indicator 1.5: Loss of production during drought (cubic metres[17]), disaggregated by insufficient water, incorrect feed stock, and island	Baseline: 0 Baseline: 4 bottles, 125 litres on average[18] Baseline:0 Baseline: 0 Baseline: 0	**Target:** 5 cubic metres of methane produced for 20 households Target:30 per cent reduction from baseline levels **Target:** 0 **Target:** no damage **Target:** 0	Quarterly site visit report, by project officers Daily Diaries, by participating households Quarterly site visit report, by project officers Daily Diaries, by participating households Quarterly site visit report, by project officers	Quarterly Quarterly Project staff, ICC Quarterly Quarterly	Project staff, ICC Project staff, ICC Project staff, ICC Project staff, ICC Project staff, ICC
Outcome 1.1: "Household and community promoters adopt practices and methods for using biogas systems" (7, 7a)	Indicator 1.1.1: Number of households that have 'fully adopted[19]' practices and methods for using biogas systems Indicator 1.1.2: Number of households that have 'fully adopted[20]' key climate risk management practices and methods Indicator 1.1.3: Number of household representatives that have successfully completed relevant TVET trainings (disaggregated by programme, island, gender, and age)	Baseline: 0 Baseline: 0 Baseline: 0	**Target:** 20 households, 18 months from project inception **Target:** 20 households, 18 months from project inception **Target:** 60 people, 16 months from project inception	Daily Diaries, by participating households Quarterly site visit report, by project officers Daily Diaries, by participating households Quarterly site visit report, by project officers Quarterly site visit report, by project officers Enrolment records	Quarterly Quarterly Quarterly Quarterly	Project staff, ICC Project staff, ICC Project staff, ICC
Outcome 1.2: Falekaupule and Kapule adopt practices and methods for managing biogas systems (8)	Indicator 1.2.1: Number of Kaupule that have 'fully adopted[21]' practices and methods for managing biogas systems. Indicator 1.2.2: Number of Falekaupule and Kaupele representatives that have successfully completed relevant TVET trainings (disaggregated by programme, island, gender and age)	Baseline: 0 Baseline: 0	**Target:** 5 Island Kaupule **Target:** 20 people, 16 months from project inception	Daily Diaries, by participating households Quarterly site visit report, by project officers Enrolment records	Quarterly Quarterly	Project staff, ICC Project staff, ICC
Outcome 2: Reduced environmental problems associated with pig waste disposal (6)	Indicator 2.1: Change in populations perception of environmental problems related to pig waste	Baseline: TBD	**Target:** Population note a reduction in environmental problems associated with pig waste	Survey report	Before and after implementation	Project staff, ICC
Outcome 3: Increased Agricultural production (5)	Indicator 3.1: Yield of vegetable (kg) produced by participating home gardens, disaggregated by vegetable type Indicator 3.2: Litres and buckets of digestate/residue produced, disaggregated by island	Baseline: TBD[22] Baseline: 0	**Target:** Amount of yield of vegetables produced by household increases by 5% **Target:** 55 litres (10 buckets) per household per year	Daily Diaries, by participating households Quarterly site visit report, by project officers	Quarterly Quarterly	Project staff, ICC Project staff, ICC

Level (relevant evaluation question)	Indicator	Baseline	Target	Means of Verification	Frequency	Responsibility
Output 1: Domestic scale biogas systems delivered, installed and operational and include specific guidance to reduce risks associated with drought, storm surge and cyclones[23] (9)	Indicator 1.1: Number of demonstration biogas systems installed Indicator 1.2: Cost ($) of constructing demonstration biogas systems, disaggregated by island Indicator 1.3: Annual operating and maintenance cost ($/year) for demonstration biogas systems, disaggregated by island	Baseline: 12 from previous projects, 0 from Tuvalu Community Biogas project Baseline: 0 Baseline: 0	**Target:** at least 5 systems installed 6 months from project inception, 10 systems 12 months from project inception, and 20 systems 18 months after inception of project **Target:** $6,700 per system **Target:** $137 per system per year	Quarterly site visit report, by project officers Toolkit document Quarterly site visit report, by project officers Quarterly site visit report, by project officers Quarterly site visit report, by project officers	Quarterly Quarterly Quarterly Quarterly	Project staff, ICC Project staff, ICC Project staff, ICC Project staff, ICC
Output 2: Production of "How to" biogas toolkit, best practices report and guidance note for accessing small grants funding (three Knowledge products) (9)	Indicator 2.1: Biogas 'toolkit' Indicator 2.2: Guidance Note for preparing (biogas) applications for UN small grant funding Indicator 2.3: Materials to advocate and communicate the financial, economic, social, and environmental 'business case' for adopting biogas systems	Baseline: Not started Baseline: not started Baseline: preliminary CBA and consultation reports complete	**Target:** Toolkit printed 9 months after inception of project **Target:** publicly released 14 months after inception of project **Target:** materials printed, 8 months from project inception	Documents/ materials advocating the financial, economic, social, and environmental 'business case' for biogas systems Guidance note exists Materials to advocate and communicate the financial, economic, social, and environmental 'business case' for adopting biogas systems exist	Quarterly Quarterly Quarterly	Project staff, ICC Project staff, ICC Project staff, ICC
Output 3: TVET trainings developed and delivered (9)	Indicator 3.1: TVET training module materials Indicator 3.2: TVET training modules delivered.	Baseline: 0 Baseline: 0	**Target:** 3 modules 9 months after inception of project **Target:** 14 community/ household training events, 7 Falekaupule/ Kaupule training events 9 months after inception of project	TVET training module materials TVET training event reports	Quarterly Quarterly	Project staff, ICC Project staff, ICC
Output 4: Technical report on "Methane Production" produced (9)	Indicator 4.1: Technical scientific report of methane production from bio-digester systems	Baseline: Not started	**Target:** Technical report publicly released 18 months after inception of project	Daily Diaries, by participating households	Quarterly	Project staff, ICC

As can be seen in Table 3 above, information collected as part of Monitoring is undertaken by participating households, internal staff (i.e. managers and programme staff), as well as USP.

Appendix 2 provides data collection formats to assist responsible persons in undertaking these activities.

The Evaluation Plan

Monitoring information on its own is generally not sufficient to provide for a complete answer to the key evaluation questions. In particular, monitoring information is not able to explain the reasons why or why not objectives (or performance areas more generally) were achieved, or identify specific success factors or barriers. More in-depth information collected at discrete points in time is needed for this.

The Evaluation Plan outlined in this section details the methods for collecting in-depth information. Several methods[24] will be used to solicit in-depth information for most evaluation questions. These methods are:

- analysis of Progress Reports;
- key informant interviews;
- interviews/consultations with island Falekaupule and Kaupule;
- interviews/consultations with participating and non-participating households; and.
- case studies of three participating islands.

In addition, a number of methods will be used to solicit specific information for certain evaluation questions. These methods are summarised in Table 4 below.

TABLE 4. EVALUATION PLAN FOR THE TUVALU COMMUNITY BIOGAS PROJECT

#	QUESTION	SUMMARY OF MONITORING	DATA COLLECTION TOOL/ METHOD
APPROPRIATENESS			
1.	Was the project design right?	None	• Review of documentation relating to the Alofa Tuvalu Small is Beautiful project, the EU USP GCCA project, and other similar projects previously implemented in Tuvalu (e.g. household water tanks). • Literature review of similar projects previously implemented in other parts of Pacific.
IMPACT			
3.	Were there any unintended impacts generated from the project, or expected to be generated from the project?	None	• Brief literature review of experiences from key renewable energy and water projects that have provided household systems to households for free or against very small nominal charges (e.g. PIGGAREP project)
EFFECTIVENESS			
6.	To what extent has the project reduced pig waste-related environmental problems experienced in the outer islands? What factors contributed to, or prevented, achievement of this change?	None	• Before/after survey

24 These evaluation activities will be undertaken for three of the seven participating islands.

25 http://www.sprep.org/Pacific-Islands-Greenhouse-Gas-Abatement-through-Renewable-Energy-Project/piggarep-documents.

26 This is not intended to be an in-depth survey, but just a brief questionnaire of community perceptions. This evaluation question is not a high-priority evaluation question.

#	QUESTION	SUMMARY OF MONITORING	DATA COLLECTION TOOL/ METHOD
EFFICIENCY			
9. a. b.	To what extent were outputs delivered on time? What were the main reasons for any variances? Has oversight and management from Falekaupule and Kaupule adequately supported delivery of this project? What has been the Department of Agriculture's (DoA's) contribution to the delivery of project outputs? Has this been co-ordinated with other relevant extension services provided by DoA to target households? Is there benefit in doing this?	Output indicators 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, and 4.1	• Interviews with DoA staff
SUSTAINABILITY			
10. a. b. c. d.	Is the production of biogas from installed systems expected to continue after the completion of the twoyear Tuvalu Community Biogasproject? What measures have been put in place to ensure the biogas toolkit continues to be easily accessible? Are they adequate? Will the TVET courses continue to be provided after the 2-year Tuvalu Community Biogasproject has been completed? Has a well-developed strategy to sustainably finance the TVET course been developed and approved by relevant decision-makers? What assurance/confidence is there that Kaupule will allocate necessary budget for ongoing maintenance, etc., after the twoyear period – especially considering the majority of benefits generated from biogas systems accrue to private households? Would an alternative ownership and management structure (where households have full responsibility for operation and maintenance) be more likely to generate ongoing benefits, taking into account that the majority of benefits generated from biogas systems accrue to the households where systems are installed?	None	• Critical review of finance strategy document for TVET course • Review of Island Strategic Plans
11. a.	Are any other strategies needed to achieve wider uptake of biogas systems in Tuvalu? Are additional initiatives and efforts needed to address barriers presented by high establishment costs of systems and accessing credit/finance for this purpose (e.g. similar to the Fiji Department of Energy and Development Bank Biogas Loan Scheme)?	None	• Review of Fiji Department of Energy and Development Bank Biogas Loan Scheme and related evaluation reports • Review of other relevant private sector development/incubation initiatives in Tuvalu
12.	Should biogas be included as a priority technology in the Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu 2012-2020 – when it is next updated in Q3 of 2018? If so, what are the key recommendations to achieve sustainable and efficient production of energy from biogas systems into the foreseeable future?	All performance indicators	• Summary analysis of all above-mentioned evaluation activities

Collection of in-depth information will be undertaken by specialist evaluators (external to the project) working with GoT officials interested to build capacity in evaluation. This study will be undertaken at the end of the project period (i.e. around June 2018).

A draft Terms of Reference to further guide the evaluative exercises and synthesise this into a Terminal Evaluation Report is provided as Appendix 1.

The total resources required to undertake evaluation activities are estimated at USD 33,150. This expense should be explicitly included in the project budget.

Basic Communication and Knowledge Management Plan

To gain the maximum value from the M&E Framework, especially in terms of learning for improvement, it will be important to make sure that knowledge generated is effectively communicated and made available in a timely manner. There are many, many examples from the Pacific where evaluations have not been effectively used by stakeholders to inform their decision-making because communication and knowledge management has been lacking.

Of most importance is the terminal evaluation report. This technical report will need to be complemented or 're-packaged' into a number of other communication/knowledge products and disseminated through various mediums, so that decision-makers understand the key learnings and make strategic decisions accordingly.

The strategy for re-packaging, disseminating, and storing the terminal evaluation is summarised in Table 5.

TABLE 5. COMMUNICATION AND KNOWLEDGE MANAGEMENT PLAN FOR THE TUVALU COMMUNITY BIOGASPROJECT

AUDIENCE(S)	REPORT TYPE	TIMELINE (DEADLINE)	HOW REPORTS WILL BE DISSEMINATED	HOW KNOWLEDGE WILL BE MANAGED
Department of Energy (DoE), DoA, Office of the PM, Planning Budgets and Aid Co-ordination (PBACD), Home Affairs, Environment, Development partners (EU).	Terminal evaluation Report	July 2018	Print and digital media	GoT library and archives; USP, regional agencies, international development assistance community storage and dissemination systems, public domain
DoE, DoA, Office of the PM, PBACD	Briefing paper (lessons learned and next step)	July 2018	Print and digital media	DoE knowledge management system
Falekaupule, Kaupule and project beneficiaries	Presentation	August 2018	Visit to islands	Powerpoints stored on DoE knowledge management system
DoE, DoA, Office of the PM, PBD, donors, beneficiaries	Film/radio/ short documentary[27]	August 2018	EU TVET social media outlet Pacific Climate Change Portal	GoT library, EU TVET social media outlet

In addition, effort should be made to co-ordinate communication (and conduct) of the terminal evaluation review with the mid-term review of the Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu scheduled for Q3 of 2018. Ideally, the terminal evaluation for the Tuvalu Community Biogas project should be undertaken just prior to and inform the mid-term review of the Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu.

27 note, material to be included in this film is intended to be collected throughout and at the end of the project. Camera equipment etc is budgeted for in the project. May also be combined with PAC TVET.

Concluding remarks

This framework outlines the approach that GoT and Department of Energy in particular will take to monitor and evaluate the implementation of the Tuvalu Community Biogas project.

A key feature of the framework is to focus the M&E work on answering a number of key evaluation questions and sub-questions. If properly implemented, the framework will provide evidence-based answers to the key evaluation questions. This information in turn will help to improve the design of future biogas-related project(s) and other similar interventions in Tuvalu as well as inform priorities to be included in the Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu when it is next updated.

The intention for this M&E framework is to be a 'living document' that will be updated and adjusted if needed. For example, the data collection templates are yet to be finalised and should be included in this document when complete. Also, it would be beneficial to include the baseline information for all indicators (e.g. agriculture production from home gardens) in this M&E framework document once these data are collected.

For any questions or queries regarding this framework, please contact Kapuafe Lifuka at the DoE.

Appendix 1.
Draft Terms of Reference for the terminal evaluation

DRAFT

BACKGROUND AND CONTEXT

The 'Sustainable Community-Based Biogas Schemes for Domestic Energy and Improved Livelihoods' ('Tuvalu Community Biogas') project is a two-year project.

The Tuvalu Community Biogas project has been implemented by the Government of Tuvalu Department of Energy (DoE) with support from the Pacific Community (SPC) and German International Co-operation Agency (GIZ). It is part of a regional programme funded by the European Union (EU) titled the 'Adapting to Climate Change and Sustainable Energy' (ACSE) programme.

The project aims to contribute to the long-term goal, as specified in the Tuvalu Energy Policy and Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu, to *improve the well-being of the Tuvalu people by promoting the use of renewable resources.*

Within 2 years, the Tuvalu Community Biogas project aims to fill information (and training) gaps identified as constraining uptake of biogas technologies and reduce barriers presented by high up-front establishment costs. The Project Logic is summarised in Figure 1.

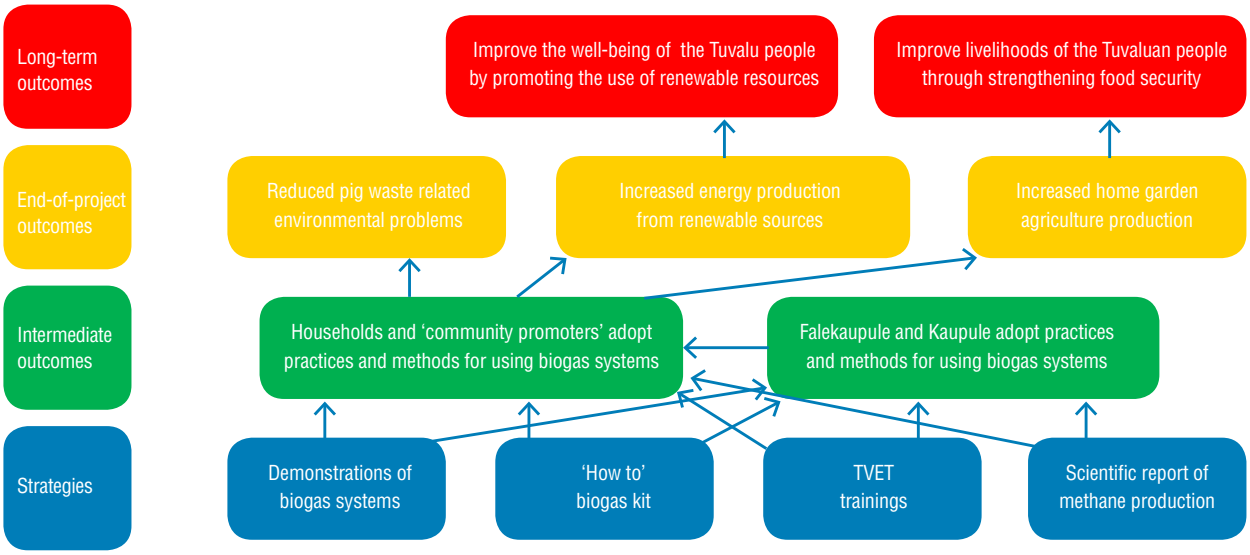


FIGURE 1. PROJECT LOGIC

As can be seen in Figure 1, the key strategies comprise:

- demonstration of biogas system installation and operation;
- a biogas "how-to toolkit" which will cover all relevant technical information needed by households (and Falekaupule and Kaupule) to source, install, operate, and maintain the biogas system;
- formal technical vocational trainings on the installation, operation, and maintenance of the technology; and
- a scientific technical report on methane production from the technology.

The project design also includes a strategy to reduce barriers presented by high up-front establishment costs. This strategy is to provide guidance material for preparing applications for UN small grant funding and will be linked to the "how-to toolkit".

In addition, a feature of the project is its governance arrangements. In particular, ownership, management, and oversight of the demonstration systems has been undertaken by the Falekaupule and Kaupule[28]. The project includes a number of technical vocational training modules to support the Falekaupule and Kaupule in this governance role.

PURPOSE AND USE

The main purpose of this terminal evaluation is learning for improvement. The evaluation will identify practices, opportunities, and lessons learned for any next phase of implementation and to ensure the realization of the expected outcomes.

The findings and recommendations will be used by GoT and its Development Partners to identify key strategic adjustments to the overall approach and/or to the component strategies, if needed.

SCOPE

The Terminal Evaluation covers the entire time period since inception of the Tuvalu Community Biogas project and will evaluate the appropriateness, efficiency, effectiveness, impact, and sustainability of the five main strategies and the three supportive strategies.

The Evaluation will aim to include all the relevant stakeholder groups including the implementing GoT departments (DoE and DoA), participating Falekaupule and Kaupule, community groups, and other private sector actors.

EVALUATION QUESTIONS

During the inception phase, the GoT identified the following key evaluation questions. It is intended that these questions will be the primary focus of the terminal evaluation.

REFERENCE #	QUESTION
APPROPRIATENESS	
1.	Was the project design right?[29]
IMPACT	
2.	To what extent has the project contributed to, or is expected to contribute to, the wider uptake of biogas systems across Tuvalu? What factors[30] led to change or contributed to lack of change?
3.	Were there any unintended impacts[31] generated from the project, or expected to be generated from the project?

28 This is notable given the biogas systems are small household-scale systems for which the majority of financial benefits (approximately 96%) accrue to those households at which systems are installed. That is, the systems have private-good characteristics and not public-good characteristics.

29 Did the project design:
- directly address the main causes and drivers of the project problem?
- incorporate available lessons learned from the evaluation of the Alofa Tuvalu Small is Beautiful project, the EU USP GCCA project, and other similar projects previously implemented in Tuvalu?
- incorporate available lessons learned from similar projects previously implemented in other parts of Pacific?
- incorporate relevant findings and recommendations from the cost-benefit analysis study (Binney 2015)?

30 Key factors to consider here include, but are not limited to:
- whether the project has established an expectation that all (upfront capital costs of) biogas systems (and other similar private infrastructures) will be paid for by Government/aid projects, which in turn may limit further uptake by non-participating households.
- whether information and capacity building (provided as part of the SCBBSfDEaIL project) to develop small grant proposals has been sufficient for Kaupule and lower-income households to successfully attract funding for new systems if no other projects or small-grant funding is forthcoming.

31 For example, is the project expected to establish a precedent and expectation that all (upfront capital costs of) private infrastructure of this type (biogas systems, household rainwater tanks, pig pens, etc.) will be paid for by Government/aid projects, which in turn may act as a disincentive for households to take their own initiative to undertake these type of activities? Or, has the project caused any conflicts of any type (e.g. disputes between households that were selected to receive a biogas system and households that were not)?

EFFECTIVENESS	
4.	To what extent has energy production from renewable sources increased as a direct result of the demonstration systems? Similarly, to what extent has consumption of LPG and kerosene been reduced? What factors contributed to, or prevented, achievement of this change?
4.a	To what extent were key climate risk reduction strategies effective in preventing related damages and losses from any climate hazard events (storm surge, cyclone, drought – if these events occurred during project implementation)? What worked well and what did not work so well? Why?
5.	To what extent has home garden agriculture production increased as a result of the demonstration systems? What factors contributed to, or prevented, achievement of this change?
6.	To what extent has the project reduced pig waste-related environmental problems experienced in the outer islands? What factors contributed to, or prevented, achievement of this change?
7.	To what extent have households 'adopted' practices and methods for using biogas systems? What factors[32] contributed to, or prevented, achievement of this behaviour change?
a.	Have key climate change and disaster risk reduction measures been adopted by households? If not, why not?
8.	To what extent have Falekaupule and Kaupule 'adopted' practices and methods for managing biogas systems? What factors22 contributed to, or prevented, achievement of this behaviour change?
EFFICIENCY	
9.	To what extent were outputs delivered on time? What were the main reasons for any variances?
a.	Has oversight and management from Falekaupule and Kaupule adequately supported delivery of this project?
b.	What has been the Department of Agriculture's (DoA's) contribution to the delivery of project outputs? Has this been co-ordinated with other relevant extension services provided by DoA to target households? Is there benefit in doing this?
SUSTAINABILITY	
10.	Is the production of biogas from installed systems expected to continue after the completion of the twoyear Tuvalu Community Biogasproject?
a.	What measures have been put in place to ensure the biogas toolkit continues to be easily accessible? Are they adequate?
b.	Will the TVET courses continue to be provided after the 2-year Tuvalu Community Biogasproject has been complete? Has a well-developed strategy to sustainably finance the TVET course been developed and this approved by relevant decision-makers?
c.	What assurance/confidence is there that Kaupule will allocate necessary budget for ongoing maintenance etc after the twoyear period, especially considering the majority of benefits generated from biogas systems accrue to private households?
d.	Would an alternative ownership and management structure (where households have full responsibility for operation and maintenance) be more likely to generate ongoing benefits, taking into account that the majority of benefits generated from biogas systems accrue to the households where systems are installed?
11.	Are any other strategies needed to achieve wider uptake of biogas systems in Tuvalu?
a.	Are additional initiatives and efforts needed to address barriers presented by high establishment costs of systems and accessing credit/finance for this purpose (e.g. similar to the Fiji Department of Energy and Development Bank Biogas Loan Scheme)?
12.	Should biogas be included as a priority technology in the Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu 2012-2020, when it is next updated in Q3 of 2018? If so, what are the key recommendations to achieve sustainable and efficient production of energy from biogas systems into the foreseeable future?

TIMING

The evaluation will be carried out over a two-month period between [when] to [when] during the last quarter of the project.

MANAGEMENT AND GOVERNANCE

The evaluation will be managed by [insert]. [Insert relevant title or role] will be responsible for contracting the evaluation team and monitoring the evaluation process against the TOR deliverables. An Advisory Committee comprised of a Senior GoT official from the implementing team, representatives of [SPC and GIZ] and [EU], and a Peer Evaluation Adviser designated by GIZ. The Advisory Committee will be responsible for reviewing and approving the Terminal Evaluation TOR, the Inception report, and the draft Evaluation reports.

METHODOLOGY

Effective methodologies engender stakeholder ownership, build evaluation capacity, support accountability, foster independence, and ensure the transparency and reliability of findings. These are the principles that GoT expect to be upheld over the course of this evaluation:

Partnership: Work in partnership with development partners and other stakeholders to design and implement the evaluation.

Transparency and independence: Ensure the evaluation process is transparent (open and understood by all partners), and independent (carried out in a way that avoids adverse effects of political or organisational influence).

Participation: Ensure that stakeholders are appropriately involved at all stages of the review or evaluation

Capacity building: Design the evaluation so that GoT capacity to participate in evaluations is enhanced through involvement in the process.

After identification of the team leader and member, the Terminal Evaluation will be conducted in five stages described below. Drawing on the Monitoring and Evaluation Framework, the Evaluation Questions, analysis of relevant document, and inception meetings, the team leader will prepare the evaluation design and schedule.

The time requirements after the inception phase will be determined by the team leader as part of the evaluation plan.

32 In particular:
- Was the 'business case' for adopting biogas systems clear and convincing to households?
- Were the criteria developed to select households to participate (i.e. receive a biogas system) in project appropriate? Were the criteria followed?
- Is information included in the biogas toolkit adequate and communicated in clear and understandable terms suitable for household audiences? Was this information adequately disseminated?
- Was content covered in TVET training courses adequate and communicated in clear and understandable terms suitable for households? Were these courses available to households when they were required? To what extent has formal certification of technical training courses contributed to proper operation and use of biogas systems?

33 In particular:
- Was the 'business case' for participating in the project clear and convincing to Falekaupule and Kaupule?
- Were the criteria developed to select households to participate (i.e. receive a biogas system) in project appropriate? Were the criteria followed?
- Is information included in the biogas toolkit adequate and communicated in clear and understandable terms suitable for Falekaupule and Kaupule? Was this information adequately disseminated?
- Was content covered in TVET training courses adequate and communicated in clear and understandable terms suitable for the Falekaupule and Kaupule? Were these courses available to Falekaupule and Kaupule when they were required? To what extent has formal certification of technical training courses contributed to proper management of biogas systems?

PHASE	PROCESSES	DELIVERABLES
Inception (Team Leader Only)	Contextual Analysis: Reading/analysis of relevant documents	Inception Report
	Inception meetings in Tuvalu with steering group and with key GoT, SPC, and GIZ staff including stakeholder analysis, identification of key informants, potential case studies, use and dissemination of findings and recommendations	
	Preparation of Inception Report and Evaluation Plan including interview guides, surveys, and participatory tools as required	
	Revision of Evaluation Design and Schedule based on feedback	Evaluation Design and Schedule
Field Work (Full evaluation team)	Orientation of team member	
	Engagement with implementers, contractors, consultants, island governments, communities, and private sector actors: Carry out interviews, meetings, field trips, case studies, surveys, etc. as per evaluation plan with emphasis on the evaluation questions related to effectiveness, impact and sustainability	
	Processing and preliminary analysis of data from field work and review of stakeholder surveys/feedback	
	Carry out remote interviews (Skype/phone) as required. Further field work to fill information gaps, check hypotheses	
Briefing	Workshop with the GoT implementing team, SPC and GIZ to review the programme model in light of the findings and identify key strategic changes	
	Preparation of briefing to Steering Group	
	Briefing of Steering Group	Briefing: Preliminary Findings
Analysis and Writing	Processing and analysis of data	
	Draft Report preparation	Draft Report
	Preparation of Advanced Draft Report	Advanced Draft Report
Validation (Team leader only)	Preparation of validation workshop	
	Validation workshop in Kosrae Briefing for Governor	
	Preparation of Final Report	Final Report
Total Days		

EVALUATION TEAM

The evaluation team will consist of two members with the following profiles:

Team Leader (TL): A specialist evaluator with a minimum of 7 years of experience in designing and managing programme theory-based evaluations, plus experience of conducting evaluations of community based energy programmes (or similar programmes). Experience with designing evaluations for energy infrastructure and/or climate change adaptation programmes is highly desirable.

Community Specialist (CS): A community specialist with a minimum of 10–15 years of experience including experience with energy and agriculture projects. Experience in evaluating community energy/agriculture projects is highly desirable. Tuvalu experience is essential.

DELIVERABLES

See above

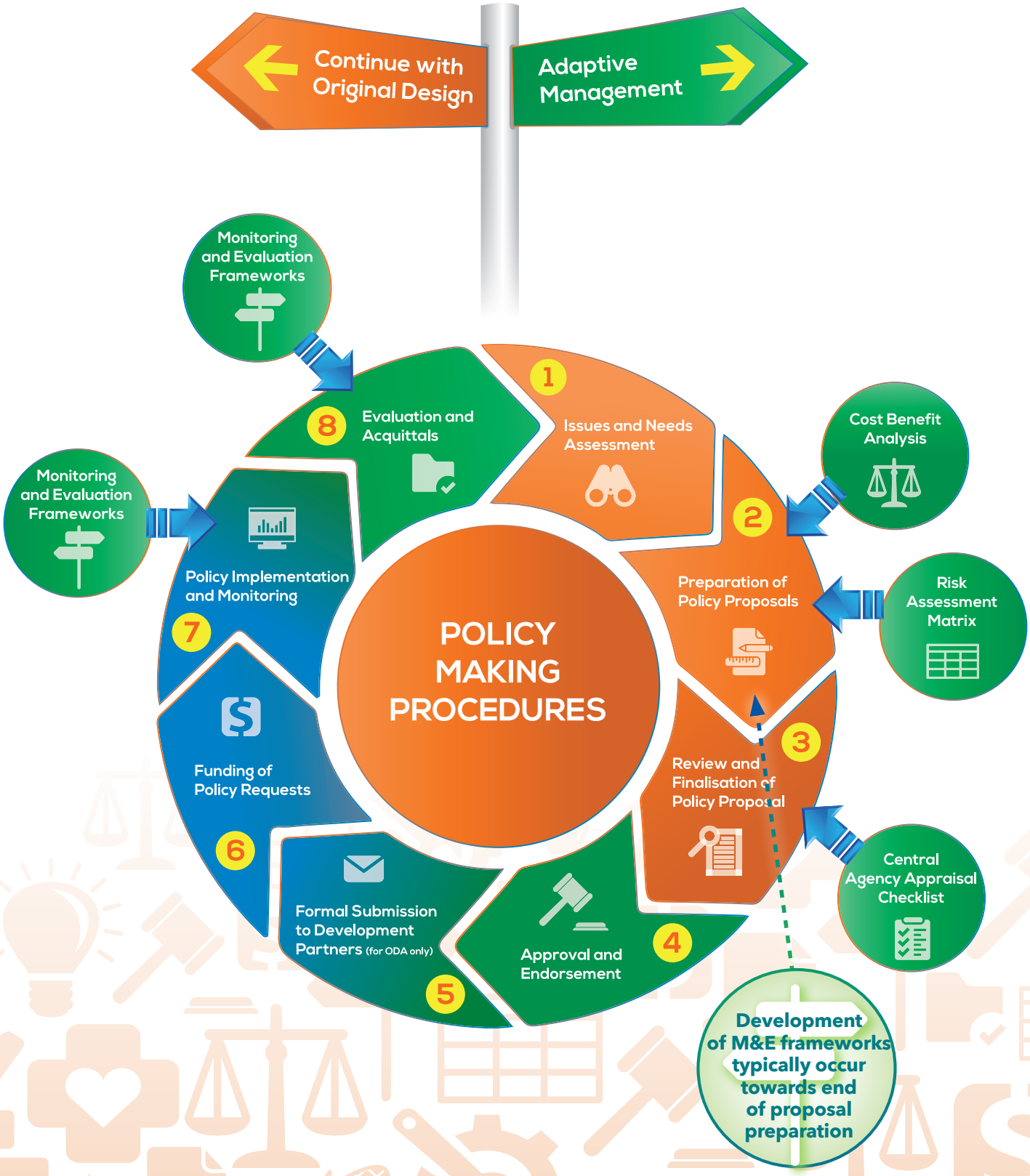
INDICATIVE BUDGET

TASKS	DAYS, TL	DAYS, CS	TOTAL DAYS	COST @ 550 USD/DAY
Planning and preparation	6	1	7	
Field work	10	10	20	
Preliminary analysis & Briefing	2	2	4	
Analysis	5	4	9	
Reporting	5	4	9	
Validation	0	0	0	
SUBTOTAL	28	21	49	26,950
Travel				
Tuvalu @ USD 2500/trip	1	0	1	2,500
Boat travel @ USD 50/day	10	10	20	1,000
Per diem days @ USD 135/day	10	10	30	2,700
SUBTOTAL				6,200
TOTAL				33,150

KEY DOCUMENTS

- Tuvalu Community Biogas project design document
- Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu
- Biogas Cost Benefit Analysis study
- Tuvalu Community Biogas Project Progress Reports

Appendix 1. Monitoring and Evaluation Framework



Appendix 2. Data collection formats

The two key monitoring activities will be:

i. a daily diary to be kept by participating households, and

ii. quarterly site visits.

Data collection formats/templates that will be used for these activities are provided below.

In addition, a before/after survey will be undertaken to help answer evaluation Question 6: To what extent has the project reduced pig waste-related environmental problems experienced in the outer islands? What factors contributed to, or prevented, achievement of this change? A copy of this survey is provided below.

Appendix 3. Full Risk Table

NATURE OF RISK		MAGNITUDE OF RISK			RISK TREATMENT STRATEGY
External factor	Component of project design/logic affected by external factor	Likelihood of external factor occurring (almost certain, likely, possible, unlikely, rare)	Consequence of external factor, if it occurs (insignificant, minor, moderate, major, severe)	Overall risk rating (low, medium, high, extreme)	
Drought (defined as rainfall less than 30% of the monthly mean for more than two consecutive months)	Freshwater is an input to the digester. If freshwater is not available, then production of methane will be reduced in that period (i.e. short-term loss of production).	Possible (1 in every 50 years[34])	Moderate	Medium	Prudent to develop contingency plan. This could include actions such as use of greenwaste as temporary substitute for water. Also need to make sure that existing rainwater tank infrastructure is properly maintained and that contingency storage is available when droughts occur. These practices will be incorporated into the 'toolkit' and TVET modules.
Cyclone	Cyclonic winds and associated debris can damage the biogas system infrastructure, requiring repair or replacement. Damage, in turn, will also cause subsequent losses in methane production. If cyclones also bring wave action and saltwater inundation, this may also spoil the digestate in the system as well as pig dung in pens. More info on nature of inundation impacts is outlined in the row below.	Likely (1 in every 15–20 years[35])	Major	High	Fixing digesters into positions where they are partially sunk into the ground. Potentially expel gas from the digester prior to the cyclone to reduce the exposure of the lid to high winds. Avoiding the use of pig dung that may have been contaminated by salt water from a cyclone's storm surge. These practices will be incorporated into the 'toolkit' and TVET modules.
Sea level rise and storm surge	1. Salt water inundation into the actual digester will spoil the digestate in the system, requiring cleaning of the system and also loss of production for about 6 weeks. 2. Salt water inundation into pig pens will spoil pig dung (key input to production) which in turn will cause loss of production.	Almost certain[36], increasing over time	Moderate	High	Locate the digesters and pig pens outside the storm surge zone. When a pig pen is flooded, avoid using the dung until the pig pen has been cleaned out. These practices will be incorporated into the 'toolkit' and TVET modules.
Politics within Kaupule	Politics could influence selection of sites, away from criteria developed. This in turn could mean that sites are in storm surge zone or households are not as interested/committed to participate in trainings and operate, etc.	Possible	Moderate	Medium	Make dedicated awareness activity to explain to Kaupule rationale for criteria and importance for project success
Shipping delays either from Suva to Tuvalu or within Tuvalu	Shipping delays will cause delays to construction of systems.	Possible	Moderate	Medium	Make transport bookings and reservations as soon as project finance is received.
Issues related to ownership of land, access to suitable land, and/or smell impacts on neighbouring land	Such issues could cause delays in construction of system or interruptions to operation of systems.	Unlikely	Moderate	Medium	Monitor as part of quarterly site visit.
Negative social/cultural perceptions regarding the biodigester systems (e.g. social status)	May take substantial time to achieve social/cultural acceptance which in turn causes disruptions to efficient and ongoing use of systems.	Possible for some islands	Moderate	Medium	Increase advocacy in islands identified as high risk sites (as understood from previous projects). This will be incorporated into the materials to advocate and communicate the financial, economic, social, and environmental 'business case' for adopting biogas systems. If needed, allocate relatively higher number of digester systems to lower-risk islands/sites (especially in circumstance where there are delays to construction resulting from this matter).

34 This is based on a simple analysis of historical rainfall data provided by the Tuvalu Met Office. Note also that the project life is maximum 30 years over which time the incidence and duration of drought is not forecasted to worsen (Pacific Climate Futures Version 2).

35 Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation (CSIRO, 2014) Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports 2014

36 Storm surges are currently a problem in some low-lying areas of Tuvalu, and this hazard will incrementally increase over time under climate change.

The **Pilot Program for Climate Resilience: Pacific Regional Track (PPCR-PR)** is a regional program which aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes (i.e. 'climate change and disaster risk mainstreaming').

The PPCR-PR is implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank (ADB) and is funded through the Climate Investment Funds (CIF).

SPREP
Secretariat of the Pacific Regional Environment Programme