Global Environment Facility (GEF)

United Nations Development Programme (UNDP)

Ministry of Natural Resources & Environment (MNRE)

Mid-term Review (MTR) report

Improving the Performance and Reliability of RE Power System in Samoa (IMPRESS)

(GEF Project ID: 9251 – UNDP PIMS ID 5669)

SAMOA
GEF-5; GEF Climate Change Mitigation (CCM) Programme 1 Promote timely development, demonstration and financing of low carbon technologies and mitigation options

Evaluation timeframe: Oct 2016 - present

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Disclaimer

Please note that the analysis and recommendations of this report do not necessarily reflect the views of the United Nations Development Programme, its Executive Board, or the United Nations Member States. This publication reflects the views of its author.

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ABBREVIATIONS AND ACRONYMS

ACSE	Adapting to Climate Change and Sustainable Energy
ADB	Asian Development Bank
APTC	Australia-Pacific Training Centre
AWP	Annual Work Plan
BSP	Bank of South Pacific
CEO	Chief Executive Officer
CO_2-(e)	Carbon dioxide (equivalent)
CER	CEO Endorsement Request
COVID	Corona Virus Disease
CPD	Country Programme Document
CTA	Chief Technical Advisor
DBS	Development Bank of Samoa
DSM	Demand-side management
EE	Energy efficiency *or* energy-efficient
EoP	End of project
EPC	Electric Power Corporation
EU	European Union
GEF	Global Environment Facility
GHG	Greenhouse gas
GWH	gigawatt-hour (billion watt-hours)
IA	Implementing Agency
IP	Implementing Partner
IPP	Independent power producer
ktoe	kilotons of oil equivalent
kW	kilowatt
kWh	kilowatt-hour
LCOE	Levelised cost of energy
LPG	Liquid propane gas
MEPS	Minimum energy performance standard
MESC	Ministry of Education, Sports and Culture
MfR	Ministry of Customs and Revenues
MOF	Ministry of Finance
MNRE	Ministry of Natural Resources and Environment
M&E	Monitoring and evaluation
MW	Megawatt
MWh	megawatt-hour (million watt-hours)
MWCSD	Ministry of Women, Community and Social Development
MWTI	Ministry of Works, Transport, and Infrastructure
MT	Midterm
MTR	Mid-Term Review
NDC	Nationally Determined Contribution
NDP	National Development Bank (of Palau)
NECC	National Energy Coordinating Committee
NUS	National University of Samoa
NGO	Non-governmental organisation
OOTR	Office of The Regulator
PIGGAREP	Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project
PICTs	Pacific Island Countries and Territories

PIR	Project Implementation Review
PCU	Project Coordination Unit
PIMS	UNDP-GEF Project Information Management System
PM	Project Manager
PIR	Project Implementation Review
PPA	Power purchase agreement
PSC	Project Steering Committee
PUE	Productive uses of energy
PV	Photovoltaic
QPR	Quarterly Progress Report
RE	Renewable energy
RET	Renewable energy technology
S&L	Standards and labelling
SAFT	School of Agricultural and Food Technology (SAFT) of USP
SAT	Samoan tala[1]
SBH	Small Business Hub
SCB	Samoa Commercial Bank
SEDREA	Sustainable Economic Development through Renewable Energy Applications
SPREP	Secretariat of the Pacific Regional Environment Programme
SQA	Samoa Qualifications Authority
SROS	Scientific Research Organisation of Samoa
STEC	Samoa Trust Estates Corporation
SUE	Social uses of energy
TAG	Technical Advisory Group
ToR	Terms of reference
TWG	Technical Working Group
UAF	Universal Access Fund
UNDAF	UN Development Assistance Framework
UNDP	United Nations Development Programme
USD	United States dollar
USP	University of South Pacific
WB	World Bank
YWAM	Youth With A Mission

[1] Also referred to as WST, tala

TABLE OF CONTENTS

LIST OF BOXES

EXECUTIVE SUMMARY

Project information table

Project Title:	**Improving the Performance and Reliability of RE Power System in Samoa (IMPRESS)**			
GEF Project ID:	9251		*Committed at endorsement (USD)*	*Realized co-financing / spent GEF budget at mid-term review (USD)*
UNDP Project ID:	5669	GEF financing:	6,075,828	3,722,838
Country:	Samoa	IA own (UNDP):	50,000	
Region:	Pacific	Government:	40,439,200	38,189,200
Focal Area:	Climate Change	Others (private):	6,0000,00	5,188,862
FA Objectives, (OP/SP):	Climate Change programme #1 Promote timely development, demonstration and financing of low carbon technologies and mitigation options	Total co-financing:	46,489,200	43,378,062
Executing Agency:	Ministry of Natural Resources and Environment	Total Project Cost:	52,565,028	47,100,091
Other partners involved	Ministry of Finance (MOF) and Samoa Trust Estates Corporation (STEC) Electricity Power Corporation (EPC)	GEF approval: 19 June 2017		ProDoc signature (date of project start: 02 August 2017)
		(Operational) Closing Date:	01 August 2022	As planned

Background

Samoa committed in its first Nationally Determined Contributions (NDC) to reducing its greenhouse gas (GHG) emissions from the electricity subsector through the adoption of a "100% renewable energy target" for electricity generation through to the year 2025. To reach the '100% RE target; the Government has been adding substantial RE capacity. In 2017-18, about 154 gigawatt-hours of electric energy was produced of which 58% diesel, 28% hydro, and 14% other (solar). Installed capacity was about 52 MW in 2016. This had increased to 65 MW in 2020, of which about 52% diesel, 30% hydro, 15% solar and 3% other (wind, biomass). More renewable energy is planned to be added, about 5 MW hydro and 9.5 MW solar and wind. The increasing share of variable renewable energy, solar and wind, have caused concerns about (future) system instability. As for longer-term solutions, the state-owned Electric Power Corporation (EPC) works on upgrading and stabilization of the power management system and battery storage as a basis for planned on-grid renewable energy capacity expansion. Promoting energy efficiency and demand-side management (DSM) will lower energy consumption and peak demand growth and thus ease the need for future power production expansion in the long run. In 2017, the Government introduced energy-efficient standards and labels regulations for refrigerators, air-conditioners, and lighting products (Energy Efficiency Act).

While installing variable energy sources with energy storage is one way, another option is to increase the share of non-intermittent sources. Under certain conditions, the country's biomass can be such a source of power generation. One option is gasification of biomass in a carbon-neutral way, by clearing invasive species on the plantation lands and planting of short-rotation trees alongside the coconut trees of the plantation. In 2011 a feasibility study was carried on gasification on some sites, including the coconut plantation of the Samoa Trust Estates Corporation (STEC) on Upolu Island. Biomass can be utilised in anaerobic digesters to produce biogas that can be used in enterprises or social institutes in heat applications (cooking, process heat) in the rural communities.

Against the above-sketched background, the IMPRESS project was conceived for improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa by addressing existing systematic and institutional coordination, financial, market, technical and informational barriers that hinder more widespread adoption and investment in sustainable energy.

Description of the project

This project is implemented over five years and is expected to achieve GHG emission reductions through the displacement of diesel-based electricity generation. Direct GHG emission reduction over the lifetime of the installed equipment is estimated in the Project Document to be 16 kilotons of CO_2e. The **objective** of the Project is "Improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa". The objective is planned to be achieved through **five components**:

1. Enhancement of renewable energy policy formulation and implementation;
2. RE-based energy system improvements;
3. Financing of initiatives for electricity saving, productive and social uses of re electricity, and electricity system performance improvement;
4. Productive & social uses of RE
5. Enhancement of awareness on the applications and benefits of renewable energy/energy efficiency (RE/EE)

UNDP is the GEF Implementing Agency and the Ministry of Natural Resources and Environment (MNRE), is the project's lead Implementing Partner with STEC and EPC being responsible parties.

Main findings and ratings

The next table summarizes the **progress towards results** per outcome. The achievement is colour-coded:

- Green: shows achievements,
- Yellow: shows expected completion by EoP (End of Project)
- Red: unlikely to be achieved by EoP
- Blue: unable to assess (U/A)

Box 1 Outcomes and achievements description

Outcomes	Summary of main achievements
Component 1 Enhancement of renewable energy policy formulation and implementation Expenditures (until mid-2020): 27% of budget allocation	
1.1 Enforcement of clear and consistent policies and regulations that are supportive of the development and implementation of RE-based power	• Reviews have been carried out of STEC Act and National GHG Abatement Strategy. • Contract has been awarded recently for an integrated assignment on business models, financials schemes and cost-benefit analysis of renewable energy technologies for power and non-power uses, cost-benefit analysis of RE technologies; PUE and SUE; integration into grid of RE, and EE efficiency technologies and applications • In addition to the regulations on EE (standards and/or labelling for lighting, refrigerators, and air-conditioners) as defined in the EE Act 2017, regulations on land transport, waste-to-energy and expanding standards and labelling to other appliances are under discussion.
Component 2 RE-based energy system improvement Expenditures (until mid-2020): 72% of budget allocation	
2.1 Enhanced operating performance and reliability of RE power systems	• Many activities regarding the expansion of solar and hydro and enhancing the operation operating performance and stability (including battery storage) are being carried out by EPC (with support from ADB

Outcomes	Summary of main achievements
(generation and distribution) in major islands 2.3 Increased application of power system performance and reliability enhancement technologies	mainly)[2]. These activities are to be considered as baseline activities (implemented by EPC), the Project has successfully supported biomass-for-power (see Output 2.2).
2.2 Increased application of biomass-based energy for power and non-power uses	• Realization of the 750 kW gasifier and power generation system on STEC lands at Afolau near the airport. Being the first bioenergy on such a scale, it can be considered as national pride. The construction was finalised in Feb 2020 with the first trial electricity production in April. Power purchase agreement (PPA) discussions between MNRE, STEC, and EPC were recently concluded, in which power will be sold to EPC under a PPA (power purchase agreement) with a 20-year duration. STEC's focus will be STEC's focus now will be on improving the efficiency of the harvesting method, preparation and production of biomass feedstock for the plant. • First assessment and stakeholder discussions have been taken place at five sites for community-institutional biogas systems (on average about 10 m^3 in size) on Upolu and Savaii Islands.
Component 3 Financing of initiatives for electricity saving, productive and social uses of RE electricity, and electricity system performance improvement Expenditures (until mid-2020): 1% of budget allocation	
3.1 Improved availability of, and access to, financing for electricity DSM, RE-based power generation and electricity system performance improvement projects 3.2 Government of Samoa (GoS) and financial sector providing financing for EE, and productive & social uses of RE	• Some discussions have been taken place with banks or small business promotional organizations, but the establishment of a (government-enabled) financing schemes, either new or as part of existing financing delivery, have not been undertaken and will depend on the results of the before-mentioned integral study on business model, RE feasibility, PUE/SUE and energy efficiency (see Output 1.1)
Component 4 Productive & social uses of RE (PURE/SURE) Expenditures (until mid-2020): 1% of budget allocation	
4.1 Increased demand and utilization of RE for productive and social uses	• As baseline activity, it can be reported that EPC has installed individual 1-2 kW solar systems for families living away from the electric grid. • There has been little progress and the start of activities will depend on the before-mentioned study (see Component 1) on business model for sustainable biomass and renewable energy and how these can be linked with PURE and SURE.
Component 5 Enhancement of awareness of the applications Expenditures (until mid-2020): 60% of budget allocation	
5.1 Improved awareness about RE and EE technology	• Discussions are advancing with the National University of Samoa (NUS) and relevant authorities to set up a 'training of trainers' courses (on planning, biogas, solar, and energy efficiency) • Several workshops and meetings have been hosted or organised with IMPRESS support. A study tour was organised to Fiji • IMPRESS has carried out awareness creation activities at schools and disseminated awareness materials at events and through social media • 300 solar street lights have been installed in villages • As baseline activity, it can be mentioned that EPC has installed prepayment and smart electric watt-hour meters resulting in energy conservation. Also, EPC is promoting the introduction of electric vehicles and has set up a small pilot project with 10 electric vehicles

[2] For a more detailed description of recent developments, the reader is referred to section 2.1 of this report

Thus, achievements differ widely per Component. The delays in some of the Components are caused by a combination of factors:

- *Project design.* The IMPRESS project covers, in principle, all RE-energy based generation and use, solar, wind, biomass, to which energy efficiency is added (although the latter is not reflected as such in the title of the project). Unfortunately, the project design document (ProDoc) is not very helpful in providing clarity in this wide range of technologies, target groups and applications. The description of outcomes and outputs remains very general terms and despite the length of over 44 pages often does not get to the point and glosses over the differences in size, type and and application of various RE and EE technologies and in their baseline situation, while not mentioning clearly the needs of various target groups:
  - *Lack of good train of thought concerning issues and options in community-scale renewable (bioenergy) applications in productive uses and energy efficiency*. The community-level demo activities in the ProDoc in principle cover all RE. In Component 2, off-grid energy hint at a focus in practice on biogas for heat applications, so why not mention this more clearly and link with activities in Component 4 (PUE) and financing (PUE) so an integrated package could have been designed for 'community-level productive uses of biogas with financial support'. The need for community-level off-grid activities is not clarified in Samoa's situation of almost 100% electrification. In energy efficiency, EE refrigerators are mentioned as a technology to be supported but not clarifying which target group (households, small business, large commercial) or indicating how these would receive support from a financial mechanism.
  - *Distinction between baseline and incremental activities is not clearly defined.* It would have been helpful if the ProDoc would have makes an unambiguous distinction between GEF-funded incremental activities (e.g. support to Afolau gasifier) and baseline (e.g. battery storage for grid stability). Particularly in Components 1 and 2 this distinction is vague and there is no division of tasks mentioned entities involved in baseline activities (e.g. EPC) and IMPRESS
  - *Lack of focus on technology-application-target group combination.* The ProDoc focusses in principle on the whole range of utility-scale RE, small and distributed RE, and energy efficiency. Even in a small country, such as Samoa, there is only so much that a GEF project this size can do. While some technologies are mentioned (e.g, biomass gasifier activities), the decision on what specific technology-application-target groups focus in the various Components has been postponed until project implementation itself; in fact, will be postponed beyond mid-term after having received the results of an integrated assessment study (discussed in the next point). With technology-application-target group is meant a technology (e.g. biogas for heat applications) linked with energy use (e.g. heat for cooking), target group (e.g. small restaurant or rural shop), and a finance or other support option (grant, loan; incentive, regulation). Thus, activities could have been designed more specifically for certain technology-target group combinations. Thus, barriers and issues could have been more easily been identified per technology-target group cluster rather than having a generic analysis for RE as a whole and options designed according to specific needs identified.

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- *Project implementation*. Given the relative importance of realization of the gasifier facility, the activities related to small-scale biomass (biogas, in Component 2) as well as the community-scale productive and social uses and financing options (Components 3 and 4) were planned to start later in the implementation schedule. In addition, delays have taken place in the procurement of contractors (for the Afolau plant). Only halfway project implementation, the activities on PUE/SUE and financing (Components 3 and 4) have mostly not been started. One reason is the delay in tendering for a number of consulting services (issuing, bidding, re-bidding, postponement). A number of proposed consulting services have been now combined in an integrated study on "business models, financials schemes and cost-benefit analysis of renewable energy technologies, renewable energy management & technology" and the contract was recently awarded. The MTR consultant hopes this will detail the specific barriers and options regarding PUE/SUE and financing schemes of technology-application-target groups combinations. This is missing in the Project Document and/or should have undertaken at the start of project implementation.

- *External factors affecting relevance of some outputs.* Several developments have occurred since the design of the original concept 2015-2017, (PIF):
  - Utility-scale renewables (in particular solar PV and battery storage) have been expanding rapidly since 2015, (when the IMPRESS project was being conceived), which invoked concern about the grid stability in a situation of expanding variable energy capacity (solar and wind). Thus, the issue was incorporated in the project design. With two battery storage systems now in service on Upolu (with diesel generator backup), stability of the grid is now maintained. EPC is now commissioning a new grid stability study of Upolu system (to be supported by JICA) in view of massive additional solar PV capacity planned on Upolu (and also solar PV on Savaii) with large battery storage. Given these advances, the IMPRESS Project has not been involved in these issues. In the MTR consultant's view, most activities regarding grid-connected non-biomass in Component 2, are to be considered as purely baseline, i.e. part of the overall IMPRESS framework, but implemented independently by EPC. Hence, these activities are referred to but usually not reported in the Quarterly Progress Reports.
  - Similarly, IMPRESS would have provided support activities for the formulation of energy efficiency standards and labelling, but when the project started in 2017, the Energy Efficient Act had been passed. Again, this new reality has cast doubt on the need for planned IMPRESS activities. For example, Output 1.3 "Formulated and approved EE implementation regulations to promote EE" was thus already achieved at project at Inception" and re-planning of energy efficiency activities needs to be done.

Box 2 MTR achievements and rating summary table

Main criteria	Rating	Explanation
Progress towards results (objective achievement)	MS	The biomass gasification facility has been commissioned and will start operating 8 hours a day. The MTR estimates a cumulative greenhouse emission reduction of 56 kilotons of CO_2-e, already higher than the targeted CO_2 reduction of 32 ktCO_2 (as mentioned in the ProDoc). With the power plant operating on 24/7 basis and adding the greenhouse gas reduction impact of the 300 installed solar street lights and four biogas installations, the expected lifetime GHG emission reduction at the end of the project (EoP) will be 57.1 kilotons of CO_2 (mid-term review estimate). Based on the above considerations, the 'overall progress towards results' (a combination of achievements regarding the objective and the five outcomes) is rated as *moderately satisfactory*
Progress towards results - Outcome 1 - Outcome 2 - Outcome 3 - Outcome 4 - Outcome 5	 MS HS U U MS	Components 1 and 5 can be considered as on-track (*moderately satisfactory*). Component 2 has advanced the most with the realization of the STEC 750 kW gasifier (*highly satisfactory*), although noting that an assessment of the biogas plants has only just been finalised and no biogas installations has been built. Components 3 and 4 have hardly started and the further definition and work planning depending on the results of a planned study on business model for the sustainable supply of biomass resource (production, harvesting, processing and supply) and non-power productive and social uses of renewable energy (*unsatisfactory*).
Strategy and relevance	R	Samoa has the ambitious goals of achieving 100% renewable energy in the power supply. The exploration of bioenergy as a non-variable source will help broaden the renewable energy mix, supplementing solar, wind, and hydro, as will be activities in the area of energy efficiency. The Project is considered as very '*relevant*'.
Implementation and adaptive management	S	Overall, implementation is rated as '*satisfactory*'. The project's management is well-embedded in the government structure with a small but effective Project Coordination Unit. It has an active group of stakeholders participating in the Project's Technical Advisory Group and the four thematic Technical Working Groups that have been created. Given the progress in Component 2 (of which 72% of the budget allocation has been spent) and the dominant position budget-wise of Component 2, about 61% of the total budget had been spent (up to mid-2020). To remedy the lack of progress in the 'non-gasification' activities, a new CTA was recently appointed which would help (re-)define and (re-)start the activities in Components 1, 3, and 4. This will be partly based on the results of the above-mentioned integrated study on a) business model and financial schemes for the sustainable supply of biomass resources, b) cost-benefit of RE technologies, integration into the existing EPC grid, and role of decentralised RE power

Main criteria	Rating	Explanation
		generation, c) energy efficiency that will be carried out in 2020. The integrated assessment combines several activities that were part of various project outputs in the original design)
Sustainability	MU-L	On sustainability, there is a strong commitment by the Government as evidenced by having the ambitious 100% target of renewables in power generation (in 2025). With recent projects on grid stability completed and a new bid for installation of renewable energy plus battery storage under negotiation (77 MW of solar and 196 MWh of storage), the Government's RE target will be almost met with 90% of demand in 2023. Nonetheless, this is not the full 100% aimed at and demand after 2023 will increase. Thus, there is scope therefore for expansion with other renewables In this respect, biomass offers another non-variable alternative (alongside solar, hydro, and wind) if feedstock can be guaranteed without large daily or seasonal fluctuations to help fill the gap towards full 100% RE. In this sense, sustainability of large-scale RE is *likely.* However, there is no clear bioenergy programme (as part of the overall renewable energy planning) with plans for specific investments (in more biomass-for-power capacity) and how funds can be mobilised other than from the international community for both larger and small-scale RE. There is the Energy Efficiency Act, but no initiatives yet regarding distributed RE (with net-metering). Hence, sustainability is judged as '*moderately likely'*. If IMPRESS project in its second half would focus on post-project sustainability aspects, the rating might change to likely.

Notes:

- "Progress towards results" and "Implementation and adaptive management" are rated on a 6-point scale ranging from Highly satisfactory (HS), Satisfactory (S), Moderately satisfactory (MS), Moderately unsatisfactory (MU), Unsatisfactory (U) and Highly unsatisfactory (HU); Relevance is rated on a 2-point scale: Relevant (R) or Not relevant (NR); Sustainability is rated on a 4-point scale, ranging from Likely (L), Moderately Likely (ML), Moderately Unlikely (MU) and Unlikely (U).

Conclusion

The construction and commissioning of the biomass gasifier at Afolau on STEC lands, approval of STEC as operator, the signing of a power purchase agreement (PPA) between EPC and STEC, and approval of the generation license is a milestone for the IMPRESS Program and Samoa as this will be the largest bioenergy project and an important achievement for commercial bio-energy promotion in the country. The achievements regarding gasification contrast with the activities in the community-scale biogas installations at five sites (also part of Component 2) that have barely started and activities on productive and social uses of energy (PURE/SURE) in rural areas (Component 4) and of financing for RE and EE (Component 3) that have not been initiated yet.

The MTR finds project design issues a contributing factor to the lack of progress in the above-mentioned areas (in particular regarding community-scale RE and outputs of Components 3 and 4). These issues need to be addressed as a condition for achieving the results. These cannot be addressed by changes in implementation and management (only). Furthermore, external factors influenced the relevance of or delay in the execution of some activities. Thus, within the overall GEF-approved framework of outcomes, the list of outputs needs to be re-assessed and a new plan of activities made (suggestions are given in the Recommendations section). In Component 1, some activities must be redesigned, particularly the ones that will address the need for energy efficiency regulations. Approved in 2017, the Energy Efficiency Act brings the introduction of energy standards and labelling (S&L) for some electric appliances (refrigerators, lighting, air-conditioning). This necessitates a re-thinking of what should be done in the area of energy efficiency in appliances and buildings, or even expanding to new sectors (e.g. transport. In Component 2, activities on the issue of integration of variable renewable energy (RE) sources (such as solar and wind) have been and will continue to be addressed by EPC. Most activities on grid stabilization and integration of utility-scale RE should be regarded as baseline activities, implemented in parallel by EPC, without the need for IMPRESS intervention. IMPRESS, instead, may want to focus on other areas, such as distributed power (e.g. in the form of rooftop PV and net-metering). The status of energy in rural areas needs to be re-assessed and interventions such as community-scale biogas should be evaluated in the context of viability of (rural) small business operations.

The Project has recently appointed a Chief Technical Advisor and commissioned on an integral study on a) business model and financial schemes for the sustainable supply of biomass resources (production, harvesting, processing

and supply of biomass for power and non-power uses), b) cost-benefit of RE technologies, integration into the existing EPC grid, and role of decentralised RE power generation, c) energy efficiency. Regarding the Components with "unsatisfactory" rating, the MTR Consultant provides some only general recommendations on re-designing outputs that are presented below in Box 3. How the list of outputs will be revised should depend on the advice of the new CTA, results of the integrated study, and discussions between UNDP CO, UNDP RTA, and project partners.

Lesson learned

The example of Samoa shows that commercial-scale biomass-for-power can play an important role in the energy mix as a non-variable source of renewable energy alongside the variable sources of solar and wind (i.e. if the feedstock supply can be guaranteed on a regular basis). However, the timeframe of subsequent phases of more widespread deployment let alone larger-scale dissemination of the biomass-for-energy technology is much larger than the implementation period of a typical development project. The momentum gained should not be lost and bioenergy projects need to be replicated within the framework of a nationally-endorsed bioenergy sector of an overall renewable energy master plan.

Recommendations

No.	Recommendations	*Timeframe;* Responsible
1	The current framework of outcomes, outputs, and activities needs to be revised with baseline activities clearly separated from GEF-incremental ones and selecting technology-application-target group combinations to focus on within the overall GEF-approved framework. Some outcome progress indicators need to be redefined as well. The MTR Consultant has therefore proposed a revised list outputs and outcome indicators (Box 3) with the project Components on the vertical axis (as in the project's results framework) and major thematic areas on the horizontal axis, namely a) sustainable energy policy, b) utility-scale RE (bio-gasification), c) community-scale RE for PUE/SUE (biogas for on-site heat applications), d) energy efficiency and integration of RE in buildings (and other sectors).	*Medium-term* MNRE, PCU
2	An integrated study is planned on business model and financial schemes, cost-benefit of RE technologies, and energy efficiency. The Chief Technical Advisor has been recently appointed. The CTA will be an external source of advice and support to help (re-)define and implement activities in which the project has been lagging, notably in the area of community-scale biomass and related productive and social uses, and energy efficiency promotion. In this respect, it is suggested that: • The CTA will audit the Project based on the originally planned outcomes/outputs and scheduled activities (as given in ProDoc and according to work plans mentioned in the latest QPRs); • The Project, UNDP CO and UNDP RTA should have a discussion based on 1) the CTA's audit of originally planned outputs/activities, 2) results of a planned integrated study on RE and EE, and 3) the suggestions by the MTR consultant given in the Boxes 3 and 21 for re-drafting the list of 'outputs and outcome indicators'; • For the remaining implementation period with the IMPRESS budget remaining of about USD 2.5 million, the MTR recommends that the re-drafted outputs have activities that are well-described in a budgeted work plan be made for the remaining 2-year period of IMPRESS; • Last, but not least, the CTA could take a lead role not only in revising activities but also in having responsibility for implementation with an agreed timeline.	*Short-term* MNRE, UNDP, PCU
3	When re-drafting the IMPRESS work plan for 2021-2022, the following recommendation can be taken into account: a) Assess critically the role of biogas. The Piu project (installed before IMPRESS started) has not been functioning and reasons should be incorporated in the study together with recommendations on the way forward. One needs to look very critically add the role of community-level electrification and its competitiveness and need for IMPRESS support, in view of the fact that almost 100% of Samoa is supplied with electricity;	*Short to medium-term* MNRE, PCU

	b) Expanding biomass for heat applications (replacing fuels) to villages must be approached too with caution because of the lack of capacity in villages, sustainable supply of feedstock, economy of scale, and competitiveness concerns; c) Study and discuss issues and options in recent IPP developments (apart from Afolau, the solar IPPs) and lessons learnt for future IPP development. This may serve as guideline for the planned grid-connected solar PV development, as well as RE additions beyond the period 2023-25; d) Initiate studies and stakeholder discussions on efficiency and fuel use in marine and land transportation and needs for financial and technical support; e) The MTR feels that it is premature to consider a financial mechanism (with a bank) for the cluster formed by biogas, rural PUE and SUE. At this stage, energy applications in this area are far from being commercially viable and, given the income levels of beneficiaries, grant support is likely to be more appropriate. It is suggested that the above-mentioned 'integrated study' with CTA guidance explores other 'energy and financing' options, such as a financial mechanism for EE and RE integration in buildings and (commercial) productive uses in combination with the introduction of appropriate government regulations (e.g. on net-metering or fiscal incentives for 'green' investments as an expansion of regulation un EE Act or Energy Bill). The experience with sustainable energy financing schemes in other parts of the Pacific should be reviewed. Also, the possible of UNDP's 'performance-based payments' (PBP) should be explored as an option for supporting such a sustainable energy scheme in Samoa	
4	It is difficult to find a good summary of results of IMPRESS. It is suggested that the drafting of the next PIR (for UNDP/GEF reporting) is accompanied with an 'annual progress report' for *internal readers* which separates implementation description from results reporting with a) concise narrative of key results in the particular year and summary on progress per component in general, b) overview of planned actions and priorities for the coming year(s). For *external readers* a good summary with success stories and highlights as well as issues and lessons learnt is recommended.	*Short-term* PCU
5	The Project has indicated the need for a project vehicle. Having this type of mobility will be more important now the project will shift to small interventions at various sites (e.g., the biogas sites) and to do M&E.	*Short-term* UNDP
6	Towards the end of IMPRESS, have a consultancy assignment (guided by the CTA and project management) to formulate a "renewable energy master plan, with a separate section on bioenergy". The RE master plan would build on the results of the before-mentioned integrated study (see point 4) and the latest expansion plans that would boost electric energy production from RE to about 90%. The bioenergy section should cover opportunities at least in the two main areas, a) larger-scale power generation by IPPs for the grids on Upolu and Savaii (gasification or larger-scale biogas for power generation), and b) small-scale biomass for heat applications in agrobusiness, tourism facilities and social services (biogas, other). The national bioenergy action plan should cover short, and medium-term with targets aligned with the current SESP 2017-2022, EPC's Power Plans, and Samoa's longer-term development goals and come with an operational plan indicating institutional responsibilities and budget. The Plan should provide suggestions for pilot project activities (e.g. second gasifier facility and biogas for PUE) as well as guidance to prospective IPPs on incentive schemes (feed-in tariffs, fiscal measures) and incentives for small-scale schemes (if viable) with special attention for rural communities, youth employment, and gender.	*Medium-term* MNRE, PCU

Note: Short-term: < 0.5 year; medium-term: between 0.5 and 1.5 year; long-term: > 1.5 year

Box 3 Matrix of proposed adjustments in the list of outputs and outcome indicators

Objective	Indicators
Improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa	A1. Cumulative (direct) electricity generation using RE resources (*from RE-based energy systems that are assisted with GEF resources during the IMPRESS Project implementation period*) Baseline value (BL): 0, Midterm target (MT): 28 GWh; End-of-Project (EoP): 86 GWh[3] A2. Cumulative (direct) GHG emission reduction (as a result of energy savings/substitution) (BL: 0; MT: 19 $ktCO_2$; EoP: 57 $ktCO_2$) B. Number of direct beneficiaries) of project interventions (newly added indicator) Baseline: 0 At MT: 1370 households (solar street lighting); At EoP: 1370 households (street lighting) and 1050 households (gasifier)[4]

Baseline and parallel activities	Sustainable energy policy and planning	Utility-scale RE power generation	Social uses and small productive uses	Sustainable energy in buildings and productive sector (EE appliances / decentralised RE)
	Outcome 1: Samoa Energy Sector Plan 2017-2022 (SESP); Strategy for the Development of Samoa (SDS) Energy Bill is being planned by the Government (supported by ACSE – EU/GIZ project). The Bill will outline a legal framework for Energy Sector operations and	Outcome 2: Installed capacity was about 65 MW in 2020, of which about 52% diesel, 30% hydro, 15% solar and 3% other (wind, biomass). ADB has supported a number of projects on hydropower (as a non-variable source), smart grid technology and battery energy storage[5] . If planned expansion is achieved, RE could provide about 90% of electric energy in 2025.	Outcome 4: Some pilot biogas demonstration supported by YWAM and SIDS-DOCK/PIGGAREP+ programmes Outcome 3: Lending for small businesses but not particularly for RE, EE or green investments	Outcome 1: Standards and labelling for refrigerators, air-conditioning and lighting products (EE Act, 2017). The test standards, MEPS and energy labelling rules are set out in the Regulations. Some tax incentives for importation of RE equipment.

[3] See also **Box 12**. Mid-term: installation of 750 kW gasifier (operating 1/3 of time at 80% of capacity) and 300 solar street lights, avoiding/substituting 56 gigawatt-hours (GWh) over the equipment's lifetime with lifetime GHG emission reduction of 39 kilotons of CO_2; EoP: 750 kW installed gasification capacity, 300 street lights and five installed community/institutional biogas projects, avoiding 80 GWh over the equipment's lifetime with lifetime GHG emission reduction of 51 ktCO2;

[4] Since the gasifier produces to the grid, one cannot say which households get RE and other energy. One can say that the gasifier will produce 3942 MWh per year which is about 2.57% of Samoa's electricity production in 2017/18. So, we assume that, comparatively, the gasifier benefits 2.57% of EPC's 40,000, which is about 1,050 households (clients).

[5] Renewable Energy Development and Power Sector Rehabilitation Project (2018-present) and the Power Sector Expansion Project (2008-2017)

Baseline and parallel activities	Sustainable energy policy and planning	Utility-scale RE power generation	Social uses and small productive uses	Sustainable energy in buildings and productive sector (EE appliances / decentralised RE)
	should provide greater clarity to investors in the Energy Sector			

IMPRESS (GEF incremental) Components (results framework)	Sustainable energy policy and planning	Utility-scale RE for power (biomass gasification)	Community-based biogas and PURE/SURE	Energy efficiency and RE integration in buildings
1. Enhancement of renewable energy policy formulation and implementation *Indicators:* C. Number of approved and enforced policies that support and incentivize investments in RE (and EE) development and utilization (BL: 0; MT: 0; EoP: 1) D. Number of approved and enforced regulations that support EE (and EE) implementation in Samoa under the Energy Bill (BL: 0, MT: 1; EoP: 3)	Output 1.1 Within SESP, and as part of the Energy Bill, established planning and legal-regulatory framework for renewable energy (power and non-power)		Output 1.4 Formulated policy measures to incentivize communities and the private sector (for rural and small RE technologies)	Output 1.5 Expanded legal-regulatory framework for EE and distributed RE (incl. incentives)
	Output 1.2 Consultancy assignment on (i) Development of business models, financials schemes and cost-benefit analysis of renewable energy technologies for power and non-power uses, in particular, business models for the sustainable supply of biomass resources (production, harvesting, processing, supply); (ii) renewable energy management & technology (incl. cost-benefit analysis RE technologies; PUE and SUE; integration into grid of RE, and (iii) decentralised RE and EE efficiency technologies and applications			
	Output 1.3 Renewable energy (and bioenergy) master plan for increased performance and stability in view of the RET target (incorporating results of Output 1.2)			Output 1.6 Assessment of issues and options on efficiency and fuel use in marine and land transportation and needs for financial and technical support
2. RE-based energy system improvement • Outcome 2a: Increased application of biomass-based energy for power and non-power uses • Outcome 2b: Increased grid performance and reliability *Indicators:*	Output 2.1 Completed assessment of available biomass resources	Output 2.2 Installed and operational biomass-based power generation (gasification)	Output 2.3 Installed and operational biomass-based technologies for non-power applications in selected communities	Output 2.4 Installation of solar street lighting

IMPRESS (GEF incremental) Components (results framework)	Sustainable energy policy and planning	Utility-scale RE for power (biomass gasification)	Community-based biogas and PURE/SURE	Energy efficiency and RE integration in buildings
E. Number of biomass-based power generation units integrated into the EPC grid system and installed capacity (BL/MT: 0; EoP: one unit operational at 750 kW) F. Number of operational off-grid community biomass-based energy projects installed (Planned: BL: 0; MT: 0; EoP: 4)				
3. Financing of Initiatives for electricity savings, PURE and SURE • Outcome 3a: Improved financing and access to financing for RE and DSM/EE *Indicators:* G. Number of banks/ financial institutions that involved in sustainable lending (new schemes or existing schemes with 'green' component added) (BL/MT: 0, EoP: at least 1)			Output 3.1 Assessed need and modality of a financial support scheme for bioenergy for (rural) productive and social uses (building on Output 1.2 and linked with Output 4.1)	Output 3.2 Assessed need and modality of a public-private financing scheme (and incentives) for EE and RE in buildings (incorporating results of Output 1.2)
			Output 3.3 Workshop and consultations with government (MOF, MNRE), financial and business support organizations (e.g. SBH, SCB, DBS, others) on 'greening' existing lending and the need for new schemes	
4. Productive and social uses • Outcome 3a Increased demand for PURE/SURE *Indicators:* H. Number of businesses utilizing biomass-based energy for PUE and SUE (BL: 0; MT: 0; EoP; 3)			Output 4.1 Plans for replication of (community-scale) biogas for PURE and SURE applications	Output 4.2 Update of consumer/user survey on RE and EE awareness

IMPRESS (GEF incremental) Components (results framework)	Sustainable energy policy and planning	Utility-scale RE for power (biomass gasification)	Community-based biogas and PURE/SURE	Energy efficiency and RE integration in buildings
5. Enhancement of awareness on sustainable energy *Indicators:* I. Number of trained local authorities (and bank and NGO/private-sector officials) that are capable of developing, planning, and implementing RE, DSM/EE and PURE/SURE (BL: N/A; MT: at least 15, at least 30) and share of women participation J. Number of schools, local community groups and Government departments that took part in RE and EE awareness campaign (BL:0; MT: 5; EoP: 10)	Output 5.1 Completed capacity development on RET for schools and universities Output 5.2 Established networking and info sharing on RE and E		Output 5.3 Capacity building for beneficiaries (end-users), financing institutions, and project developers	Output 5.4 Completed promotional and information dissemination activities

The text in red gives changes in outcome indicators or values thereof, as suggested by the MTR Consultant

1. INTRODUCTION

1.1 Purpose of the mid-term review (MTR) and objectives

1.1.1 Background

Although Samoa is only responsible for an insignificant amount of global greenhouse gas emissions, Samoa is committed to combating and addressing issues associated with climate change including adaptation and mitigation measures to demonstrate to the world that all nations can take responsibility for a low-carbon future. Regarding renewable energy, energy, the Government focuses on how to successfully reduce the dependency on fossil fuel and promote the use of renewable energy technologies. In the electricity sector, the Government has adopted a "100% renewable energy target" for electricity generation. In order to reach the '100% RE target; the Government has added substantial renewable energy capacity in recent years. By 2016, renewable energy (solar, wind, hydro, biomass) contributed about 42% of electric energy generated. However, the large share of variables renewables such as solar and wind has raised concerns about the reliability and stability of the electricity grids on the two main islands. For this reason, technical 'smart grid' solutions are pursued as well as electricity storage options (batteries, pumped storage). Another way is to diversify the renewable energy mix by developing Samoa's plentiful biomass resources, including agricultural residues, forestry residues, sawmill waste, coconut, and municipal and other solid waste for power generation or heat applications. A third sustainable energy way is formed by the rational use of energy in the various energy-consuming sectors.

The project is titled "Improving the Performance and Reliability of RE Power Systems in Samoa", which is referred to shortly as "IMPRESS" project and is an initiative funded by the Global Environment Facility (GEF, USD 6.075 million) and the United Nations Development Programme (USD 0.05 million) and nationally implemented by the Ministry of Natural Resources and Environment (MNRE). It will do so by mobilising about USD 46.44 million in government and private sector financing over the project implementation period.

The objective of the project is to "improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa". The project concept was approved by the GEF in October 2015. The fully-fledged project documentation was developed thereafter and GEF endorsed the project in June 2017. IMPRESS started on 2 August 2017 and the project's Inception workshop was held on 31 October 2017. IMPRESS is scheduled to be operationally closed by 1 August 2022.

1.1.2 Purpose of the MTR

With implementation well underway, a Mid-Term Review (MTR) needs to be undertaken of the project in accordance with the UNDP and GEF Monitoring and Evaluation (M&E) policies and procedures. The MTR has to be carried out by an independent consultant, i.e. not previously involved in project design or implementation. In a competitive process, Mr. Johannes (Jan) van den Akker (Netherlands) was selected as the 'MTR Consultant'.

The **objective** of the MTR is to "*assess progress towards the achievement of the project objectives and outcomes as specified in the Project Document and assess early signs of project success or failure with the goal of identifying the necessary changes to be made in order to set the project on track to achieve its intended results. The MTR will also review the project's strategy and its risks to sustainability*."

1.2 Scope and methodology

The MTR has been utilising the following *sources of information*:

- Desk review of progress reports and project documents (listed in Annex C),
  - CEO Endorsement Request (CEO ER) and annexes; annual progress reports (PIRs, project implementation review 2019), and quarterly progress reports (QPRs)
  - Overview of budget expenditures and realized co-financing; annual work plans (AWPs)
  - Project outputs (including reports and activity summaries); project or counterparts' websites
  - National policy documents on sustainable energy, climate change mitigation; as well as other relevant reports, PowerPoint presentations, and documents from counterpart organizations and development partners.
- A mission to Samoa was planned to be undertaken in July 2020. However, due to the (international) travel and national restrictions posed by the COVID-19 pandemic, the mission had to be cancelled. Instead, a series of remote interviews were undertaken online (using Zoom).
- A list of project partners and stakeholders met is provided in Box 7. The meetings and interviews helped the reviewers to obtain in-depth information on impressions and experiences and to explore opinions about the Project and their understanding and identify opportunities

Regarding *data analysis and methods for analysis*, relevant reports and documents were collected. The review of project and background documents (listed in Annex C) provided the basic facts and information for developing the mid-term review report, while the remote interviews served to verify these basic facts, get missing data and learn the opinions of respondents to help interpret the facts. Concerning the latter, the interviews with individuals (representatives from project partners and stakeholders) were based on open discussion to allow respondents express what they feel as main issues, followed by more specific questions on the issues raised (guided by the list of interview questions, presented in Annex E). Where needed, such interviews were followed up by e-mail exchange with the individuals interviewed.

Triangulation has allowed validation of information through cross verification from two or more sources, basically the interviews and document analysis. The inability to visit Samoa may have posed some limitations on the MTR. For example, the MTR Consultant was not able to visit project sites (the Afolau gasification plant and selected communities with planned biogas facilities) and meet the local beneficiaries (and learn by observation more about the socio-economic conditions) and to have more informal discussions (e.g. with the project team and project partners during travel to meetings and to the islands). On the other hand, online discussions were organised with the Project team regularly.

The rating has taken place according to the evaluation criteria and the rating scales identified in the UNDP *Guidance for Conducting Midterm Reviews of UNDP-supported, GEF-financed Projects* (2014)[6]. The ratings in this report have been determined based on the project progress reporting and the analysis the Reviewers carried out of the available information and comparing these with observations from the mission (interviews with stakeholders and site visits) and checking with the information presented in project technical reports and policy and background documents.

[6] Other guidelines consulted are those presented in the UNDP *Handbook on Planning, Monitoring and Evaluating for Development Results*, *Updated Guidance on Evaluation* (2012), the UNDP Discussion Paper: *Innovations in Monitoring & Evaluating Results* (2013) and the GEF *Review of Outcomes to Impacts (ROTI) Handbook* (2009). Regarding gender aspects, the evaluation refers to the *Guide to Gender Mainstreaming in UNDP Supported GEF Financed Projects* (2016).

1.3 Structure of the MTR report

This report contains the main body, executive summary, and annexes. The body of this report is structured around the following chapters; it starts with an introduction to the objectives, scope, and methodology of the mid-term review (Chapter One), description of the project context and a summary of project facts (such as start date, duration, the context in which the project started), its objectives and stakeholders (Chapter Two).

The assessment of the "review findings" has been guided by the questions on the "review evaluative matrix", of which a final draft was formulated at the inception stage of the assignment (see Annex E)[7]. The report follows the outline for midterm reviews of UNDP/GEF projects[8] but has split the suggested chapter on "Findings" in three parts for practical reasons due to the chapter size and to permit a more reader-friendly presentation of the information. Findings on relevance, design, and results framework formulation are in Chapter Three. An overview of progress regarding the achievement of outcomes and outputs is given in Chapter Four, while the findings on project implementation and monitoring are presented in Chapter Five. Finally, Chapter 6 discusses the findings on the replication effects and sustainability. Chapter Seven presents the conclusions, recommendations, and lessons learned from the project. These include actions that might be taken (by the Government) to help ensure the sustainability and continuity of project achievements. The MTR Team also gives some suggestions for UNDP (and GEF) to help improve the design and implementation of future projects.

In development projects, 'results' are the describable or measurable development change resulting from a cause-and-effect relationship. These results include project outputs, short to medium-term outcomes, long-term impacts, including global environmental and development benefits.

The achievement of the results and the longer-term sustainability thereof is influenced by the:

- Way the project was formulated and designed (discussed in Chapter 3);
- Way the project was implemented by the various project partners (discussed in Chapter 5);
- Occurrence and impact of internal and external risks (discussed in Chapter 6).

Annexes at the end of the report include the Terms of Reference (Annex A), mission details and list of organisations and people interviewed (Annex B), documents collected and bibliography (Annex C), explanations on adjustments proposed in the results framework (Annex D), and evaluation questions and methodology (Annex E).

[7] See the *Inception Report* of the *Mid-term Review* (J. Van den Akker; July 2020)

[8] See Annex F, 'Evaluation Report Outline' in the UNDP *Guidance for Conducting Terminal Evaluations* (2012)

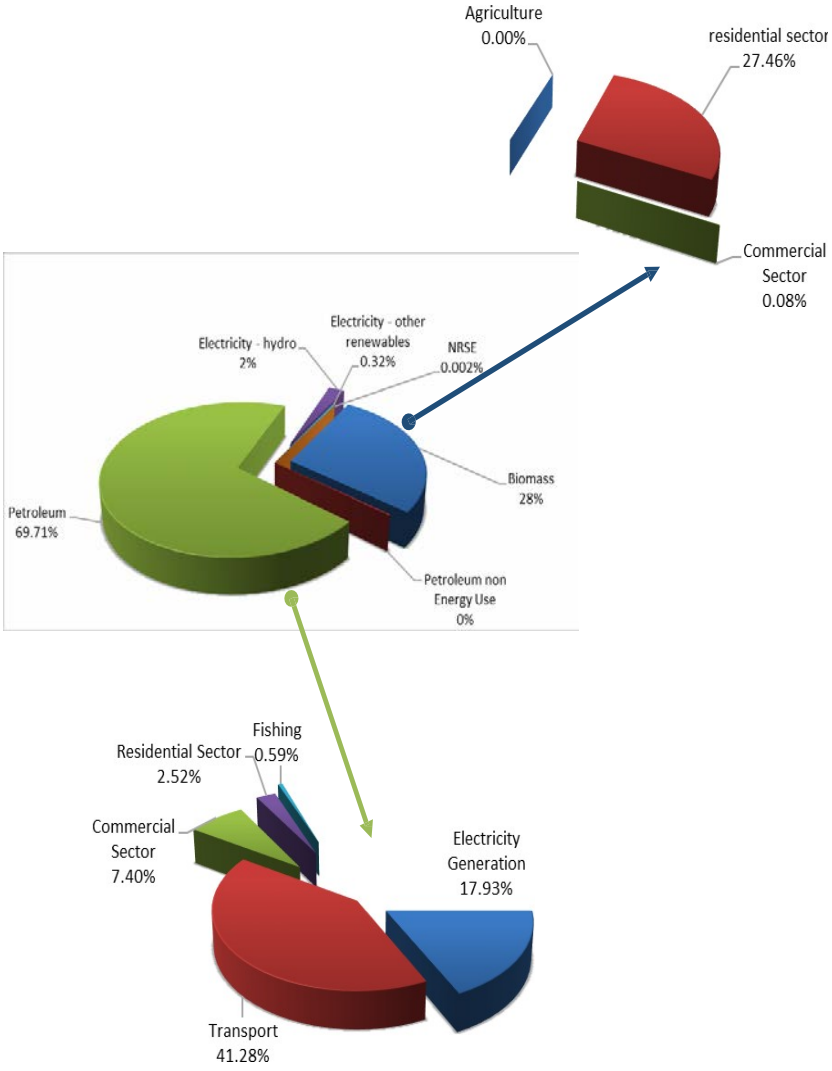
2. PROJECT DESCRIPTION AND BACKGROUND

2.1 Context and problems that the project sought to address

Energy sector overview

Of the energy supply in 2016 of 129.4 kilotons of oil-equivalent (ktoe), it was estimated that 28% was met by biomass, 69% by petroleum products while the remaining 3% was met by hydropower, solar, wind and other renewables. Of the total primary energy supplied, 18% was used for electricity generation to give a net electricity supply of 113.8 ktoe. An overview is given in Box 1. Biomass is mainly used by the residential sector for cooking. In

Box 4 Energy supply and greenhouse gas emissions in Samoa



Energy supply was 129.4 kilotons of oil-equivalent (ktoe) in 2016. Renewable energy is indigenously available (biomass 35.3 ktoe, hydro 2.8 ktoe and solar & wind, 1.4 ktoe), forming about 31% of energy supply in 2016, while all petroleum products are imported.

Final energy consumption was 113.8 ktoe in 2016 with as main consumers the residential sector (42.1 ktoe), road transport (45.3 ktoe), commercial & industrial (14.2 ktoe), sea transport (7.7 ktoe), agriculture, forestry and fisheries (0.8 koe) and government & social services (3.4 ktoe).

Source: Samoa Energy Review 2016; Samoa Energy Sector Plan 2017-2022

The Second National Communication (2009) to UNFCCC mentions that the energy sector is responsible for 50% of the country's greenhouse gas (GHG) emissions (174.4 kilotons of CO_2-eq of the total of 352.0 ktCO_2-eq) from road transport (27%), electricity generation (13%) and other energy consuming activities (10%). The other main emitting sector is AFOLU (agriculture, forestry and other land use) with 38% and industrial process and waste (12%). The AFOLU sector was also responsible for CO_2 removal of 785.1 tCO_2-eq).

2016, 59% of imported petroleum in Samoa was utilized for transportation and about 26% for power generation. This has been driven primarily by the increasing demand for road vehicles and electrical appliances, along with the added steady growth in local industries such as manufacturing and tourism[1].

Electricity sector

The Electric Power Corporation (EPC) is wholly government-owned and has the authority for generation, transmission, and distribution of electricity throughout Samoa[9]. Several independent power producers (IPPs) generate power from solar, hydro, and wind. The national electrification rate is almost 100% with a total of 98% households being grid-connected and the remainder having small diesel generators or solar PV.

Total electricity generation amounted to 153.5 GWh in 2017/18, of which 58% diesel, 28% hydro, and 14% solar (and wind). Installed capacity was about 52 MW in 2016 with an energy generation of 122.8 GWh (in 2016). Most of the electricity in Samoa, particularly for the main grids on the two main islands, Upolu and Savaii, is produced through diesel and hydropower generation. Apolima Island continues to enjoy 100% clean electricity from a solar mini-grid. of which about 58% diesel, 15% hydro, and 26% solar and 1% wind. During 2017-2020, substantial renewable capacity was added. Installed capacity increased to 65 MW in 2020, of which about 52% diesel, 30% hydro, 15% solar and 3% other (wind, biomass) [10].

Box 5 Electricity production in Samoa, FY 2017-18

Island/source	MWh
Upolu Island	**138,676**
- diesel	74,937
- hydro	42,814
- solar (EPC)	2,972
- solar (IPPs)	17,818
- wind	134
Apolima Island (solar)	10
Savaii Island	**14,822**
- diesel	14,526
- solar (PC)	292
- solar (IPP)	4
Total	**153,508**

Source:
EPC Annual Report 2017-2018

The share of renewables in electricity supply has been steadily increasing. This reflects an increase in hydropower due to rehabilitation efforts undertaken by EPC (after the damage inflicted by cyclone Evans in 2012), construction of new hydro as well as an increase in solar photovoltaics (solar PV)[11]. The increasing share of variable renewable energy, such as solar and wind, raised concerns about system. The immediate measures undertaken by EPC were running diesel generators in light load conditions to minimize system instability during variation of PV and wind power outputs, and also, temporarily disconnecting the oversupplied solar PV plants from the grid. It is envisioned that the current grid stability problems will be amplified unless substantial electricity storage such as batteries or pumped hydropower reservoirs become available. As a longer-term solution to counter grid stability, higher proportions of intermittent renewable generation should come with energy storage accompanied with detailed modelling of the electricity system and installation of 'smart grid' technologies for grid stability.

Thus, EPC installed recently two battery energy storage systems (at Fiaga power station and Faleolo International Airport), while contemplating pumped storage. EPC did a computer-based system that automatically controls and regulates the operation of not only the two new battery systems but also all the EPC power plants and IPP solar farms. The two battery storage systems and micro-grid controller are reportedly functioning well as designed and EPC has not experienced any more blackouts as a result of grid instability of the entire system. EPC is currently carrying out two studies. One is on improving the protection of Fiaga power station (including its large battery system) against lightning strikes (given its elevated location). A second study reviews system protection to improve system reliability and minimization of the impacts of power distribution and transmission faults on areas.

Regarding the status of solar, wind and hydropower facilities:

9 EPC reports to the Minister of Works, Transport and Infrastructure (MWTI)
10 Source: IMRESS Chief Technical Advisor
11 EPC Annual Reports (2017-18 and 2016-2017); SESP 2017-2022

- Five old hydro plants (Taelefaga, Lalomauga, Samasoni, Fale ole Fee and Alaoa) have been rehabilitated and three new hydropower plants (Tafitoala-Fausaga, and Fuliuasou in Upolu, and Vailoa in Savaii) were added[12];
- Of the twelve solar PV systems (with a total capacity of 13 MW), all are reportedly in operation[13] ;

As part of the Master Plan to achieve 100% RE in 2025, a bid was issued for IPPs to finance, develop and operate additional renewable energy (e.g. solar, wind, biomass, waste to energy, and battery storage). A tender closed in August 2020 and negotiation is now in progress with the top-ranked bidder who is proposing to build 72 MW of solar power with 196 MWh of battery storage. This would produce about 77 GWh per year thus bringing total renewable energy penetration to about 90% of the country's total electricity demand in 2023 (enabling running the grid system with diesel generators only as backup). Progress of this major development will be closely monitored by the Project.

Energy policy and institutional setup

The Energy Policy and Coordination Division of the Ministry of Finance (MOF) is responsible for energy planning and policy, development of the Samoa Energy Sector Plan (energy roadmap), and a programme of activities to implement these policies. The Division also covers overall monitoring and evaluation of the energy sector, including coordinating national and regional level energy projects and publishing annual energy reviews. The Ministry of Natural Resources and Environment (MNRE) is responsible for environmental aspects of energy use including greenhouse gas emissions and climate change matters. Apart from these Ministries, the Scientific Research Organisation of Samoa (SROS) and EPC, as well as NGOs and the private sector, play a role in the implementation of the energy and climate change plans.

Several Acts deal with the energy sector. The EPC Act (1980, amended in 2010) governs the activities of the electric power utility. The PUMA Act (2004) regulates the development, regulation, sustainable use, and management of land, requiring environmental impact assessments and management plans for a range of activities. The Electricity Act (2010) created an independent regulator (OOTR, Office of the Regulator) to oversee the electricity sector.

The latest Samoa Energy Sector Plan (2017-2022) mentions five 'end of sector plan' outcomes:

1) Renewable Energy Increased. The Renewable Energy subsector focuses on how to successfully reduce the dependency on fossil fuel and promote the use of renewable energy;
2) Electricity Services Improved. The Electricity subsector will focus on the supply of electricity from fossil fuel and alternative renewable energy sources that have been proven feasible. This will include the generation and distribution of electricity.
3) Energy Efficient Transport Sector. The Transport subsector focus on ensuring that the transport sector adheres to legislations and acts that are governing the sector. Promoting energy efficiency and considering other alternative fuels to power transportation and to ensure it is environmentally friendly.
4) Management of Petroleum Products improved. The Petroleum subsector will look into the effective and efficient monitoring of the petroleum products, and to ensure that the distribution, storage, and disposal of petroleum products adhere to legislations and required standards.
5) Coordination of Energy Sector Improved. This section on the Institutional setting and governance framework focuses on good governance, leadership, and coordination across the whole energy sector.

[12] An additional 2MW generator is installed at Taelefaga hydro plant increasing capacity from 4 to 6 MW and increasing generation with 5 GWh annually. Except for Lalomauga hydro is scheduled to be back in service in Oct 2020, the other seven hydro facilities are operating efficiently. On grid integration, the Lalomauga hydro electromechanical control system was changed to PLC control (so that the two generators in the plant can be remotely monitored and controlled from the National Control Center). In addition, a bid has been advertised for a new 700 kW hydropower plants (which would produce 4 GWh annually) in Tiapapata, scheduled to be completed on Q4-2022. Source: IMPRESS CTA (Chief Technical Advisor

[13] Five are owned by IPP companies and seven systems owned by EPC. Source: IMPRESS CTA

In this light, Samoa committed in its first Nationally Determined Contributions (NDC) to reducing its greenhouse gas (GHG) emissions from the electricity subsector through the adoption of a "100% renewable energy target" for electricity generation through to the year 2025. In order to reach the '100% RE target; the Government has added substantial RE capacity (mainly hydropower and solar PV facilities).

Role of biomass for energy

Biomass (firewood, coconut shells, coconut husks, plant waste residues, etc) is available for direct combustion or can be converted fort energy use in liquid biofuels (coconut oil biofuels, biodiesel, and ethanol) and biogas or wood gas. Wood biomass and coconut shells and husks are available in sufficiently large quantities. The Samoa Trust Estates Corporation (STEC) plantation also has a large concentration of coconut shells and husks and plans to use invasive wood species for electricity production.

The share of renewables in energy consumption has lowered from about 58 ktoe in 2000 to the 39 ktoe in 2016 due to a drop in biomass consumption from about 52 ktoe in 2002 to 32 ktoe in 2011 (and slightly up again at 35 ktoe in 2016). This is mainly attributed to the reduction in contribution from the agriculture sector (copra and cocoa industry) and forestry sector[14]. Two decades ago, Samoa used biomass for copra drying (about 38 kilotons of coconut residue), for producing steam for coconut oil production (11 kton), for electricity production from wood product manufacturing waste (1 kton) along with steam production for timber drying (11 kton) at Asau, and for soap and coconut cream manufacture (0.5 kton). However, Samoa no longer has a significant coconut export market and the natural timber resource is now mostly gone or protected against logging[15].

Samoa's forests are mainly humid tropical rainforests and 75% are on Savai'i. Estimates of coverage range from about 35% to 45% but data collection has been poor and recent work suggests that the lower estimates may be more accurate. More than 80% of forests are not commercially exploitable and most of the remainder has already been cleared for timber or agriculture or damaged by cyclones. The Samoa Trust Estates Corporation (STEC) plantation also has a large concentration of coconut shells and husk. Interestingly, the woody overgrowth biomass resource within the STEC plantation is made up primarily of invasive plant species which could provide feedstock for gasifiers[16], an idea followed up with IMPRESS support leading to the realization of the 750 kW bio-gasifier in 2020. Invasive species are those that proliferate and become destructive following environmental changes caused by human activities or natural events. The Samoa National Invasive Species Strategy and Action Plan (NISSAP 2019-2024 mentions that alongside the 540 native flowering plant species there is a roughly equal amount of introduced species. For example, the Merremia vine has become particularly aggressive dominating half of Samoa's lowland forest).

There also has been a significant drop in the biomass usage by households (that instead prefer utilizing multiple cooking sources such as LPG and electricity) although remaining a source of cooking fuel for households. Overall energy consumed in the households, commercial and social sector was 41 ktoe, of which 86% biomass (64% fuelwood and wood waste; 22% coconut residues), 6% electricity, 2% kerosene and 6% LPG. About 60% of households use biomass, and 40% use modern fuels. Since biomass is no longer used for power generation or in agricultural processing, the share of residential biomass in bioenergy has relatively increased from 66% in 2000 to almost 100% in 2016.

Apart from using biomass resources for electricity use, there is a potential for the production of biodiesel from coconut oil, and for blending coconut oil with diesel for direct injection into diesel engines and gasifiers. EPC experimented during 2009-2010 with blends of coconut oil and diesel fuel for power generation on both Savai'i and

[14] Due to the closure of sawmills including the only mill that used biomass to produce its own electricity, and discontinuation of copra production in 2006. Source: Project Document

[15] IRENA *Renewable energy opportunities and challenges in the Pacific Islands region* (2013)

[16] Source: *Feasibility Study for a Gasification Power Plant in Samoa* (2011) by SME Cambodia for MNRE

Upolu, but ceased using biofuel when the coconut supplier went out of business. The Scientific Research Organisation of Samoa (SROS) has carried trials on developing biodiesel technology using coconut oil as the primary feedstock. Instead of using straight coconut oil to blend with diesel to run vehicles, SROS has successfully converted coconut oil into biodiesel using the transesterification process. It continues looking into another suitable feedstock, such as Jatropha, Funtumia and Castilla[17].

A few biogas plants using piggery waste were built in the 1980s but none of them sustained operations. In 2005–2006 there were attempts at large-scale biogas production with equipment installed at the Tafai'gata landfill on Upolu. FAO-commissioned feasibility studies looked at the production of biogas and fertilizer (small community based and larger facilities at resorts or in agriculture and associated businesses) or combined with wastewater treatment. In recent years, a demonstration project in Piu Village using the invasive Merremia resource alongside organic waste and other feedstock to produce biogas for village households[18]. Some 4 to 6 household-level biogas digesters were installed in Poutasi village (on Upolu). The results have been mixed with many systems being abandoned after a couple of years.

Productive uses of energy

The Project Document mentions that "Samoa does not have a long-term strategy for the Productive Use of RE (PURE) and Social Use of RE (SURE) to support the economic development of the country". The latest Energy Sector Plan (2017-2022) addresses key energy sources for end-users in the residential, commercial, industry, and transportation sectors and discusses gender issues and the cost of energy for rural and vulnerable groups. However, the plan provides no details specifically on PURE and SURE. Several organisations, such as the Small Business Hub (SHB), provide financial and capacity-building support for local entrepreneurs to start-up businesses, but sustainable energy as such has not been mainstreamed in these lending and support efforts.

Energy efficiency

The Samoa Energy Efficiency Act 2017, which commenced on 21 December 2017, means that all products covered by the Act and the Regulations must now meet Minimum Energy Performance Standards (MEPS), and some also have to carry a standard energy label when they are offered for sale. The Regulations take effect at different times for different products. The test standards, MEPS and energy labelling rules are set out in the Regulations. Household refrigerators and freezers imported into or traded in Samoa must meet MEPS and carry standard energy labels since March 2018. Air conditioners imported into or traded in Samoa must meet MEPS and carry standard energy labels since September 2018. Lighting products (incandescent lamps, fluorescent lamps, and ballasts) imported into or traded in Samoa must meet MEPS from 5 March 2019.

2.2 Project description and strategy

2.2.1 Objectives of the project; expected results and established indicators

Against the above-sketched background, the IMPRESS project was conceived the improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa by addressing existing systematic and institutional coordination, financial, market, technical and informational barriers that hinder more widespread adoption and investment in sustainable energy.

[17] IRENA; SESP 2017-2022

[18] https://sustainabledevelopment.un.org/partnership/?p=7630; https://www.ws.undp.org/content/samoa/en/home/presscenter/articles/2014/03/13/samoa-where-garden-weeds-become-renewable-energy.html

A summary of the project framework with **objective, outcomes, outputs, and indicators** is provided in Box 6 below (as given in the Project Document and amended in the Inception Report. Note that changes at project inception are indicated in the table in italics, while text removed at inception is indicated by strikethrough).

Box 6 Summary of the project objective, outcomes, and outputs

Objective	Indicator and target
Improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa	• Cumulative electricity generation using RE resources (from RE-based energy systems that are assisted with GEF resources during the IMPRESS Project implementation period) Baseline value (BL): 82 GWh, Midterm target (MT): 259; End-of-Project (EoP): 438 GWh) • Cumulative GHG emission reduction (BL: 7,832; MT: 12,944; EoP: 16,251 tCO_2) • Cumulative number of households benefitting from RE-based electricity generation and EE technology applications. (BL: 0; MT: 1370 HH (RE) and 6840 HH (EE); EoP: 2740 HH (RE) and 13,700 (EE)[19]

Outcome	Output
Component 1 Enhancement of renewable energy policy formulation and implementation	
1. Enforcement of clear and consistent policies and regulations that are supportive of the development and implementation of RE-based power *Progress indicators:* • Number of approved and enforced policies that support and incentivize investments in RE *(and EE)* development and utilization (BL: 0; MT: 0; EoP: 1) • Number of approved and enforced regulations that support EE *(and RE)* implementation in Samoa under the Energy Bill (BL: 0, MT: 1; EoP: 3) • *Note: italics:* changes at Inception	1.1 Established and enforced clear and consistent RE policy and legal frameworks for RE (power and non-power) development and implementation; 1.2 Comprehensive energy integrated development plans formulated by skilled government planners; 1.3 Formulated and approved EE implementation regulations to promote EE 1.4 Formulated and approved policy measures to incentivize communities and private sector for RE production

GEF budget: USD 329,000. Co-financing: USD 812,250 (TA)

Outcome	Output
Component 2 RE-based energy system improvement	
2.1 Enhanced operating performance and reliability of RE power systems (generation and distribution) in major islands *Progress indicators:* • SAIDI (System Average Interruption Duration Index): (BL: 2,586; MT/EoP: 2,439 occurrences) • SAIDI (BL: 36, MT/EoP: 34 minutes (baseline and target indicators estimated based on 5% and 10%	2.1.1 Completed power system profile and analysis of grid performance and power quality; 2.1.2 Completed assessment of the various available biomass energy resources in Samoa, including biomass energy resource production business model; 2.1.3 Applicable cost-effective RE-based power generation technologies that are feasible in Samoa, including technologies for enhancing the electricity system performance and reliability identified;

[19] Proposed change at Inception: use 'percentage' instead of 'number' MT/EoP: 5%, 10% of HH, RE; 10%, 20% of HH: EE.

Outcome	Output
improvement of 2016 target of Upolu: SAIDI-1300mins; Savaii: SAIDI –1400mins.	2.1.4 Completed designs and implementation plans for the application of technologies for enhancing electricity system stability and energy performance; 2.1.5 Published information on performance and impact on each implemented RE technology application and demonstration
2.3 Increased application of power system performance and reliability enhancement technologies *Indicators:* • Number of grid systems with increased reliability due to the effective application of system reliability enhancement technologies (BL/MT: 0; EoP: 1)	2.3.1 Detailed designs and specifications for demonstrations for power system performance and grid system reliability enhancement 2.3.2 Operational demonstrations of power system stabilization technologies in the EPC power grid system 2.3.3 Documented operating and energy performances of demonstrations 2.3.4 Approved plans for the replication and/or scale up of the demos on minimizing/abating potential system instability in the EPC power grid system
2.2 Increased application of biomass-based energy for power and non-power uses *Progress indicators:* • Number of biomass-based power generation units integrated into the EPC grid system (BL/MT: 0; EoP: at least 2) • Number of operational off-grid community biomass-based energy projects (BL: 0; MT: 2; EoP: 4)	2.2.1 Completed preliminary engineering designs and implementation plans for biomass-based energy for power and non-power uses demonstrations; 2.2.2 Operational biomass production facility for biomass-based power generation; 2.2.3 Operational biomass-based power generation demonstrations 2.2.4 Operational biomass energy technology demonstrations for non-power applications in selected communities 2.2.5 Documented operating and energy performances of demonstrations 2.2.6 Technically capable and qualified personnel for managing, operating and maintaining the demo units/facilities

GEF budget: USD 772,450. Co-financing: USD 2,427,250 (TA)
GEF budget: USD 3,836,700. Co-financing: USD 40,496,450 (INV)

Outcome	Output
Component 3 Financing of initiatives for electricity saving, productive and social uses of RE electricity, and electricity system performance improvement	
3.1 Improved availability of, and access to, financing for electricity DSM, RE-based power generation and electricity system performance improvement projects *Progress indicators:* 1) Number of banks/ financial institutions that implemented and funded the designed and endorsed financing models and schemes (BL: 0; MT/EoP: 2) *Proposed change at Inception: at least 1*	3.1.1 Feasible financing models and schemes designed and developed to serve as incentives for RE and Demand Side Management (DSM)/EE projects 3.1.2 Completed capacity buildings for the local banks and financial institutions (FIs) on financing RE and DSM/EE projects (incl. on PURE and SURE projects) 3.1.3 Actual RE and DSM/EE investments by end-users, project developers and investors
3.2 Government of Samoa (GoS) and financial sector providing financing for EE, and productive & social uses of RE *Progress indicators:* • ~~*Total investments mobilized through the implemented financing schemes*~~	3.2.1 Established and operationalized government financing scheme(s) for feasible RE and DSM/EE technologies projects

Outcome	Output
~~*(BL: 0; MT: USD 355,000; EoP: USD 710,000)*~~ • Cumulative number of RE/EE projects supported by the implemented financing models (BL: 0; MT: 25 RE and 165 EE fridges; EoP: 164 RE and 330 refrigeration projects)	

GEF budget: USD 337,700. Co-financing: USD 817,000

Outcome	Output
Component 4: Productive & social uses of RE	
4.1 Increased demand and utilization of RE for productive and social uses *Progress indicators:* • Number of businesses utilizing biomass-based energy for productive and social uses (BL: 0; MT/EoP: 3). • *Suggested change at Inception: MT/EoP: at least 3* 2) Percentage of household expenses on fuel in pilot communities (BL/MT: 5%; EoP: 4%). Average value from Household Income and Expenditure Survey 2013 / 2014, Samoa Bureau of Statistics	4.1 Completed feasibility studies of new business ideas for productive and social uses of RE 4.2 Established appropriate business models for RE power and non-power applications for productive and social uses 4.3 Established and operationalized business(es) involving productive and social uses of RE

GEF budget: USD 337,700. Co-financing: USD 817,000

Outcome	Output
Component 5: Enhancement of awareness of the applications	
5.1 Improved awareness about RE and EE technology *Progress indicators:* • Cumulative % of households utilizing low carbon (EE & RE) technologies (MT: 5% RE, 25% EE; EoP: 10% RE and 50% EE) • Number of trained local authorities, i.e., local government officials) that are capable of developing, planning and implementing RE, DSM/EE and PURE/SURE projects (BL: N/A; MT: 10; EoP: 20). *Suggested at Inception: at least 10, at least 20* *Status*: - Data collected from MOF EE database. TA in Q1/Q2 2020 to carry out survey	5.1 Completed capacity development on RET (design, engineering, financing, construction, operation & maintenance) for schools and universities 5.2 Established operational information network for the promotion, dissemination and information sharing of RE and DSM/EE technology, policy measures, incentives and financial schemes 5.3 Completed promotional activities of communities, entrepreneurs, institutions and local government authorities on RE and DSM/EE technologies, applications and policy planning

GEF budget: USD 337,703. Co-financing: USD 1,078,440

Together with the Project management cost (PMC) of USD 289,325 (with co-financing of USD 302,250), the total GEF budget is USD 6,075,828 (and co-financing of USD 46,489,200).

The planned co-financing, as given in the CER (CEO Endorsement Request) is as follows:

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Amount USD
National Government	Ministry of Finance (MOF) and Ministry of Natural Resources and Environment (MNRE)	Grant	38,189,200
		In-kind	2,250,000
Private Sector	Samoa Trust Estates Corporation (STEC)	In kind	6,000,000
GEF Agency	United Nations Development Programme (UNDP)	Grant	50,000
Total Co-financing			**46,489,200**

2.2.2 *Project start and duration; main project partners and stakeholders*

The project concept was approved by the GEF in October 2015. The fully-fledged project documentation was developed thereafter and GEF endorsed the project in June 2017. Starting with the project document signature on 2 August 2017, the project's Inception workshop was held on 31 October 2017. The Project is implemented by UNDP as GEF Implementing Agency (IA) and the Ministry of Natural Resources and Environment (MNRE) as the Implementing Partner (IP). IMPRESS is scheduled to be operationally closed by 1 August 2022.

Box 7 List of project partners and main stakeholders

Ministries	**Role in IMPRESS**
Ministry of Natural Resources and Environment (MNRE)	• Responsible for communication and coordination with the GEF OFP (Mr. Ulu Bismarck Crawley, CEO, MNRE) and UNDP on project management, implementation, and monitoring; liaison with relevant national government agencies, authorities in local communities; in charge of project management and implementation: o Renewable Energy Division (RED) – Provision of data/information on relevant RE resource research and feasibility studies, national energy plans, national energy balance, policies, regulations, and energy targets, including ongoing and planned energy projects; o Forestry Division – Provision of support in the assessment of biomass potential in Samoa
Ministry of Finance (MOF)	• Provision of data/information concerning relevant financial/fiscal policies and plans in the area of energy; o Energy Policy Coordination and Management Division (EPCMD) – Provision of information on the formulation and implementation of the Energy Sector Plan, including relevant policies and programs, including that relevant to the Petroleum Act; o Economic Policy and Planning Division (EPPD) – Provision of assistance to all sectors for the integration of the Energy Sector Plan and ensuring alignment with the Strategy for the Development of Samoa (SDS); o Aid Coordination and Debt Management Division – Coordination with all other aids to ensure an integrated approach toward meeting the objectives of the IMPRESS project and the national development.
Ministry of Women, Community and Social Development (MWCSD)	• Provision of information and advice on the productive and social applications that can be supported by RE (e.g. biogas for heating, lighting and electricity generation); Provision of advice on the design of RE market sustainability interventions; Provision of assistance in the promotion of the proposed project activities that will focus on communities; Provision of advice in the formulation of RE policies that are supportive of sustainable economic development initiatives for communities
Ministry of Commerce, Industry and Labour	• Provision of support and technical advice for local entrepreneurs in the design and establishment of businesses making use of RE; Provision of advice on the development of financing models and schemes to finance electricity-saving initiatives, productive and social uses of RE; Provision of support and assistance in the implementation of awareness on sustainable RET investments
Ministry of Customs and Revenues	• Potential involvement in the design and expansion of incentives for RE systems
Other, government	• Other ministries with some involvement in IMPRESS are the Ministry of Agriculture and Fisheries, Ministry of Education, Sports and Culture (MESC) and the Ministry of Works, Transport and Infrastructure (MWTI)
State-owned entities	• **Role in IMPRESS**
Electric Power Corporation (EPC)	• Provision of pertinent data/information about its electric system expansion program and power plants necessary for the detailed design of the reliability enhancement project; Coordination with MNRE and STEC on the design, planning, engineering, and commercial operation of the various RE-based power generation projects that will be subsumed into the project, including those on improved electricity system performance and reliability; Provision of coordination

Samoa Trust Estates Corporation (STEC)	• Provision of pertinent data/information on biomass resources and management for the final design of the biomass-gasification demonstration project; Ensuring sufficient feedstock of biomass for sustainable operation of the biomass-gasification demonstration project; Coordination with MNRE and EPC on the design, planning, engineering, financing, and commercial operation of the biomass-gasification demonstration projects.
Scientific Research Organisation of Samoa (SROS)	• Provision of data/information and technical advice on biomass properties for the detailed design of biomass gasification demonstration projects, and productive and social uses of RE.
Authorities	• The role of the *Office of the Regulator (OOTR*) is to provide advice on the work in regards to the setting and review of electricity tariffs, electricity service quality standards, issuance of licenses, and advice on consumer protection; • The *Samoa Qualifications Authority* (SQA) role is to regulate, quality assure, and coordinate Post School Education
Others	• **Role in IMPRESS**
Banks	• Banks that may potentially be involved in the provision of financial services and awareness activities that would enable investments in RE for power and non-power applications and productive and social uses in Samoa. include: Development Bank of Samoa (DBS), Samoa Commercial Bank (SCB), Bank of the South Pacific (BSP), ANZ Bank
Universities	• Involved in Component 5 in the collaboration in RE knowledge management and capacity building activities through the development and possible integration of project experience in RE/EE-related curricular, and training programs are the National University of Samoa (NUS), and the University of the South Pacific (USP) – SAFT (School of Agric and Food Technology), APTC (Australia-Pacific Training Centre)
NGOs	• *Youth with a Mission (YWAM*) is involved in IMPRESS as follows: provision of support in identification, development, and implementation of biomass energy technology demonstrations for non-power applications in selected communities. Collaboration for capacity building and awareness activities in promoting sustainable RET applications in support of national economic development • *Small Business Hub (SBH*), formerly known as SBEC (Small Business Enterprise Centre) potential involvement is in the provision of guarantee schemes and training that would enable investments in RE for power and non-power applications
Development partners	• The European Union and the German GIZ are assisting fifteen Pacific ACP Island countries (including Samoa) through the regional Programme*: Adapting to Climate Change and Sustainable Energy (ACSE).* The objectives of the ACSE Programme are to enhance sustainable livelihoods in Pacific Island Countries, strengthen countries' capacities to adapt to the adverse effects of climate change and enhance their energy security at the national, provincial, and local/community levels. The project will enable the Samoan Trust Estate Corporation (STEC) to convert waste biomass that has overgrown once productive coconut plantations into a renewable fuel that will replace imported diesel and reduce Samoa's dependence on imported fuels. • The Asian Development Bank has implemented (is implementing) some projects with relevance for energy and productive use (see Box 8)

2.2.3 Project implementation arrangements

The project is nationally implemented (NIM) by the Ministry of Natural Resources and Environment (MNRE), in line with applicable agreements between the Government and UNDP. The UNDP Country Office oversees the management of the overall project budget and is responsible for monitoring project implementation, timely reporting of the progress to the UNDP Regional Hub (based in Bangkok), as well as organising mandatory and possible complementary reviews, financial audits, and evaluations on an as-needed basis.

Samoa's NECC[20] has the key responsibility of overseeing the development of the Energy Sector in Samoa. The PSC/NECC is chaired by the Minister of Finance and its members include CEOs of MOF, MNRE, MWTI, MWCSD, MAF, EPC, LTA, SROS, MFR, MCIL, STEC, and the Office of the Attorney General (OAG). The PSC is the strategic decision-making body of the project, providing overall guidance and direction to the Project Manager.

A Technical Advisory Group (TAG) is the strategic decision-making body of the project, providing overall guidance and direction to the Project Manager and approves all major revisions in project strategy and implementation approach, Annual Work Plans (AWPs), and any essential deviation from the original plan, and M&E reports. It also ensures that required resources are committed, and mediates any project conflicts and/or negotiate solutions for project problems with external bodies. The CEO of MNRE is the project's National Project Director (NPD)[21]. The NPD is assisted by a small Programme Coordination Unit (PCU) that is headed by the Assistant CEO of MNRE's Renewable Energy as Project Manager (PM) [22], assisted by a Project Coordinator[23]. Reporting to the NPD, the PCU's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specific constraints of time and cost. The PCU monitors work progress and ensure timely delivery of outputs as per Annual Work Plans and the Project Results Framework.

[20] Chaired by the Minister of Finance, its members include head of departments (CEOs) from MOF, MNRE, MWTI, MWCSD, MAF, EPC, LTA (land Transport Authority), SROS, MFR, MCIL, STEC and the Office of the Attorney General (OAG)

[21] Mr. Ulu Bismarck Crawley.

[22] Ms. Vanda Faasoa Chan Ting

[23] Ms. Toiata Uili

3. FINDINGS: PROJECT DESIGN AND STRATEGY

This part of the report presents an overview of the mid-term review findings. Due to the size of the main text it has been divided into four chapters that cover a) project design & formulation, b) project results, c) project implementation, and d) sustainability. The findings are formulated around several evaluative criteria and questions so that the reader can make a link with what was asked and what was found. The orange-coloured boxes in this and the other Chapters have guiding questions from the Evaluative matrix (Annex E) that correspond to a particular section in this report.

Chapter 3 looks first at the project relevance and country drivenness (at project design), and links with national development. Second, it looks at the design logic (in the framework of outcomes and outputs to reach the objective) and how the design framework was formulated, including the definition of indicators and target values for outcomes and outputs.

3.1 Relevance and design

- Consistency with the GEF focal areas in Climate Change/operational program strategies of the GEF CC and with the UN and UNDP country programming?
- Does the project adequately take into account the national realities, both in terms of institutional and policy frameworks in its design? Are project outcomes contributing to national development priorities and plans in accordance with the national local policy legal and regulatory frameworks (country priorities)?
- Is the Project addressing the needs of the target beneficiaries? Relevance of the project's objectives, outcomes and outputs to the different target groups of the interventions. Review decision-making processes: were perspectives of those who would be affected by project decisions, those who could affect the outcomes, and those who could contribute information or other resources to the process, taken into account during project design processes?

Consistency with global environmental priorities and country programming

The project, which aims at mitigating the impacts of climate change through the promotion of off-grid renewable energy in developing countries, is an element of the GEF-6 Resource Allocation Framework. The project idea fits in its climate change mitigation Objective #1 to "Promote timely development, demonstration and financing of low carbon technologies and mitigation options".

The UN Development Assistance Framework (UNDAF) for the Pacific Region (2013-2017) has served as a guideline for the programming of activities of UNDP with the Government of Samoa at the time of the formulation of the Project. The UNDAF mentions several programme outcomes of which the first is most relevant to the IMPRESS Project, namely "Improved resilience of PICT[24]s, with particular focus on communities, through integrated implementation of sustainable environmental management, climate change adaptation/mitigation, and disaster risk management". The Sub-regional Project Document for the PICTs (2013-2017) mentions several programme outputs that fit under Outcome 1 of the UNDAF, namely (a) Enhanced policy and regulatory frameworks that facilitate a transition to green, low-carbon climate-resilient paths of development and increased access to renewable energy are put in place; (b) Capacities of local government departments are strengthened for effective

[24] PICTs: Pacific Island Countries and Territories

participatory environmental governance. It should be noted that energy and climate change continue to be referred to in the new Pacific UNDAF and Multi-Country Programme Document (2018-2022). The UNDAF Outcome 1 is "By 2022, people and ecosystems in the Pacific are more resilient to the impacts of climate change, climate variability, and disasters; and environmental protection is strengthened" and its Output 1.1 "Scaled-up action on climate change adaptation and mitigation across sectors which is funded and implemented" with the relevant progress indicator "Dollar amount mobilized with support from UNDP for climate change adaptation and mitigation (including energy efficiency, renewable energy, energy access)".

The IMPRESS contributes directly to the following Sustainable Development Goals:

7. Affordable and Clean Energy – Ensure access to affordable, reliable, sustainable, and modern energy for all.
13. Climate Action – Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.

Government policy and strategies

The IMPRESS Project is well-embedded in Samoa's national policies on sustainable energy and climate change. The correspondence with the Project's expected results with those of Samoa's Energy Sector Plan (2017-2022) is summarised in Box 5. Although Samoa is only responsible for an insignificant amount of global greenhouse gas emissions, the country is committed to combating and addressing issues associated with climate change including adaptation and mitigation measures to demonstrate to the world that all nations can take responsibility for a low-carbon future. The project is fully in line with Samoa's Nationally Determined Contribution (NDC) with its ambitious target of a "100% Renewable energy target for electricity generation through to the year 2025". The NDC indicates that achieving such a target will be dependent on receiving additional (international) assistance, for example, by projects such as IMPRESS.

Gender

- Are relevant gender issues raised in the project design? Are broader development and gender aspects of the project being monitored effectively (do SMART 'development' indicators, include sex-disaggregated indicators and address future catalyse beneficial development effects (i.e. income generation, gender equality and women's empowerment) that should be included in the project results framework and monitored on an annual basis

Gender as such is not reflected very specifically in the results framework, because at the time of project conceptualisation (2013/14) there were no clear guidelines on including gender-relevant indicators in the results framework. Also, there was no requirement to include a specific gender action plan in the project documentation. The Project Document mentions on mainstreaming gender it aims to "contribute to the strengthening and enhancement of the involvement of women in multiple areas, including design and development policy and regulatory frameworks, operation of biomass production and gasification facilities, income generation through PURE and SURE, development and implementation of capacity building and awareness programs". However, there are no specific activities addressing gender equality issues implementation of IMPRESS activities, except stating that IMPRESS is to "equally engage men and women in the decision-making process during project implementation".

Most of the gasification plant activities (e.g. clearing of bush and chopping down trees; technical operation of the plant) are traditionally done by men. However, it will be interesting to see how the studies planned on biomass production and utilization as well as the productive use of energy and income generation will address gender aspects. Regarding capacity building and awareness programs, project indicators may be detailed more to address gender aspects, e.g. "% of PUE business that are women-led".

3.2 Conceptualization and results framework

- Are lessons from other relevant projects properly incorporated in the project design?
- Are the project's objectives and outcomes or components clear, practical, and feasible within its time frame? Is the project internally coherent in its design? Are there any incorrect assumptions or changes to the context of achieving the project results or are any amendments to the theory of change/logframe been made or planned during the Project's implementation?
- Undertake a critical analysis of the project's logframe indicators and targets, assess how "SMART" (Specific, Measurable, Attainable, Relevant, Time-bound) the midterm and end-of-project targets are, and suggest specific amendments/revisions to the targets and indicators as necessary.
- Review the extent to which relevant gender issues were raised in the project design. Ensure broader development and gender aspects of the project are being monitored effectively. Develop and recommend SMART 'development' indicators, including sex-disaggregated indicators and indicators that capture development benefits.
- M&E design. Does the project have an effective M&E plan to monitor results and track progress towards achieving project objectives (see also Section 4 on Implementation).

Project's analysis of barriers and gaps and design of outcomes and outputs to address these

The Project Documents provides a detailed list of policy-regulatory, technical, awareness, and capacity as well as financial barriers (about 3 pages) that follow from a broader analysis of the situation around 2014-2016. Thereafter follows an impressive list of outcomes, outputs, and activities designed to remedy the barriers and issues. The large size of 44 pages provides a lot of details but also makes it difficult to digest for the occasional reader. A summary of the ProDoc's outcomes, outputs, and activities for a quick reference is given in Box 3.

Despite the lengthy description of outputs and activities, the ProDoc does not always get to the point. For example, ProDoc's Chapter 4 dedicates 6-7 pages to Component 4 (PUE for non-power and power applications). It leaves the reader puzzled about what technologies are we talking about and which beneficiary groups these serve in which type of energy end-use. After several reading rounds, the MTR Consultant found that Component 4 focusses on biogas (and biomass) for household cooking and food processing (e.g. roasted banana or taro chips) for local sale or crop processing or heat for small workshops. In a few places reference is made to solar applications (e.g. cold storage) and efficient cookstoves. Since the technology-target group combinations are not clearly identified it is not made clear why using a particular RE would be a good strategy or why a particular form of financing support (Chapter 3) is needed. In addition, it is not clear from the ProDoc what case can be made for off-grid electrification in a country with almost 100% electrification, while the area of distributed production (e.g. rooftop PV with net-metering) is not mentioned as such.

In Chapter 2, the focus is supposedly on biomass for electricity generation in the scale of 250-1000 kW for sale to EPC, as well as stability measures for EPC's grid. In this respect, Output 2.2.4 (biomass for non-power) is a bit oddly placed here. The description is vague but reading the text in detail reveals it is about small-scale biogas digesters for communities. As an activity, it should have been better placed in Component 4 (and with corresponding parts of Component 3 on financing) so that the link with productive uses could have been stressed and the combination 'biogas-PUE' could be approached in one Component in a holistic approach combining technology, finance, awareness and training with productive use development, rather than having biogas-related activities spread over various Components. Thus, barrier analysis and subsequent organisation of outcomes could have been better focussed on particular 'technology-application-target group' combinations, such as a) biomass-for-power (gasification), b) local small-scale applications (biogas in heat applications for PUE/SUE), c) RE and EE applications in

buildings, d) efficiency and fuels in other sectors, and then design the planning, financial support, awareness building and capacity strengthening in a more focussed way according to the needs of each combination.

Box 8 Relation of barriers to RE and EE Samoa with IMPRESS interventions

Barriers at the time of project formulation	Output
Component 1 Enhancement of renewable energy policy formulation and implementation **Outcome 1.1:** **Enforcement of clear and consistent policies and regulations that are supportive of the development and implementation of RE-based power**	
The current policies and regulatory frameworks related to RE development and implementation, (e.g. the EPC Act, 1980, and Electricity Act (2010), specify different sets of targets, overlapping roles and responsibilities among authorities involved in the electricity sub-sector in Samoa. The current application process for IPP in Samoa involves multiple agencies and authorities. There are multiple guidelines available for IPPs/ RE developers that is available at OOTR, MCIL and MfR for RE developments, but what is needed is to	1.1 Established and enforced clear and consistent RE policy and legal frameworks for RE (power and non-power) development and implementation 1.2 Comprehensive energy integrated development plans formulated by skilled
Comment by MTR Consultant: A review of EPC Act 1980 and Electricity Act 2010 has been done by EPC during 2016-17, so there was no need for review. There are guidelines for IPPs (as evidenced by the various IPPs that have developed solar and wind), but the ProDoc mentions that 'a more consistent regulatory framework on development and implementation of RE-based power generation' is needed. This should also look at distributed (small-scale) power generation for grid connection (such as rooftop PV with net-metering). The STEC Act is important concerning the Afolau gasifier, as it allows STEC as a state-owned trading agency to diversify its business outside agriculture/forestry, such as the operation of the biomass power plant and sell electricity to EPC under a 20-year PPA	
Preparation of regulatory frameworks to support the implementation of minimum energy performance standards (MEPS) and energy labeling requirements for lighting products, refrigerating appliances (refrigerators and freezers) and air-conditioners in Samoa have been delayed for many years, and the regulations to support the implementation of MEPS and labeling are pending.	1.3 Formulated and approved EE implementation regulations to promote EE
Comment by MTR Consultant: The baseline has changed since the conception of IMPRESS. The EE Act 2017 stipulates that some appliances must now meet Minimum Energy Performance Standards (MEPS) and labelling (refrigerators & freezers, air-conditioners) and MEPS (incandescent lamps, fluorescent lamps and ballasts). The test standards and MEPS rules are set out in the Regulations (2018). The related ProDoc activities were kept at project inception (Oct 2017) as at that time the EE Bill was still in draft form.	
There are also limited incentives for the implementation of projects on the application of EE and/or RE technologies. There has been an amendment to the "manufacturing" duty tax exemption regulation whereby all equipment imported for RE projects are considered as "raw materials" for producing energy thereby making them all exempted from duty tax in Samoa.	1.4 Formulated and approved policy measures to incentivize communities and private sector for RE production
Comment by MTR Consultant: Some incentives for renewable energy exist (e.g. tax exemption for RE) but need to be enhanced. For example, the subsequent Samoa Energy Sector Plans address key energy sources for end-users in the residential, commercial, industry and transportation sectors. However, there are no specific policy measures yet that have been designed to incentivize development and implementation of RE and EE in Samoa targeting specific sectors or target groups.	

Component 2 Enhancement of renewable energy policy formulation and implementation **Outcome 2.1:** **Enhanced operating performance and reliability of RE power systems (generation and distribution) in major islands**	
The Government of Samoa has set the target of 100% of RE first by 2017, later by 2025. Higher proportions of intermittent renewable generation (such as solar and wind) necessitate energy storage and implementation of 'smart grid' technologies for grid stability. There is limited RE resource assessment data to support the establishment of the national RE targets, and some RE resources, i.e. waste-to-energy, are not included in the target and plan. Without a realistic target, it is difficult to design policies and programs effectively.	2.1.1 Completed power system profile and analysis of grid performance and power quality; 2.1.2 Completed assessment of the various available biomass energy resources in Samoa, including biomass energy resource production business model; 2.1.3 Applicable cost-effective RE-based power generation technologies that are feasible in Samoa, including technologies for enhancing the electricity system performance and reliability identified; 2.1.4 Completed designs and implementation plans for the application of technologies for enhancing electricity system stability and energy performance; 2.1.5 Published information on performance and impact on each implemented RE technology application and demonstration
Outcome 2.3: **Increased application of power system performance and reliability enhancement technologies**	
The increasing share of variable renewable energy, such as solar and wind, have caused system instability, specifically when the system load is low over the weekend. The immediate measures undertaken by EPC included running diesel generators in light load conditions to minimize system instability during variation of PV and wind power output. To address current grid stability problems, a computerised system data and control system is planned. Also, EPC is planning to install substantial battery energy storage is planned), while pumped storage is contemplated.	2.3.1 Detailed designs and specifications for demonstrations for power system performance and grid system reliability enhancement; 2.3.2 Operational demonstrations of power system stabilization technologies in the EPC power grid system; 2.3.3 Documented operating and energy performances of demonstrations; 2.3.4 Approved plans for the replication and/or scale up of the demos on minimizing/abating potential system instability in the EPC power grid system

Comment by MTR Consultant:

RE has reached about 42% in the generation capacity and may reach 55% by 2021 (see Section 2.1). There have been concerns on how the 100% target could be met, due to stability and grid reliability concerns with the integration of intermittent or variable renewables (solar, wind). A couple of ADB-supported projects have support hydropower (as a non-variable source) and grid system stabilization.

- Renewable Energy Development and Power Sector Rehabilitation Project (2018-present) has provided support for the rehabilitation of 3 small hydropower plants (of 4.7 MW in total) and adding 0.8 MW of new hydro capacity (including capacity building on operation and maintenance);
- Power Sector Expansion Project (2008-2017) with several activities:
  - Install prepayment and smart metering in Upolu and Savai'i (that also supply more correct and accurate data on the system's peak and baseload behaviour)
  - Installation and operation of a SCADA (system control and data acquisition) system;
    Capacity enhancement for system-wide modelling and planning, including a cost and tariff study
  - Battery energy storage (BESS) in Upolu and Savaii
  - Upgrades in the transmission and distribution system and some diesel and hydropower facilities.

Two battery storage systems and micro-grid controller installed are functioning well as designed and EPC has not experienced any more blackouts (as result of grid instability). As part of Master Plan to achieve 100% RE in 2025, a bid was issued for IPPs to finance, develop and operate additional renewable energy capacity in combination with battery storage, which would bring total renewable energy penetration to 90% of country's total electricity demand in 2023.

Due to these successful baseline activities carried out by EPC, there has not been a real need for IMPRESS to be involved in variable RE (solar and wind). Thus, the Outputs 1.1 and 1.3 are to be considered as IMPRESS baseline, i.e. linked with IMPRESS, but without the need for direct IMPRESS incremental support.

Outcome 2.2: Increased application of biomass-based energy for power and non-power uses

Samoa has experienced a decrease of about 35% in biomass consumption from 54 ktoe in 2000 to about 14 ktoe in 2015. Almost 100% of biomass utilization in Samoa is in the residential sector (99.70%), primarily for domestic cooking, which is being replaced by LPG or electricity. The potential for biomass energy in Samoa includes agricultural residues, forestry residues, sawmill waste, coconut and municipal and other solid waste for power generation of heat application. The application of grid-connected biomass-based power generation could offer a rational solution to the concern about grid instability.	2.2.1 Completed preliminary engineering designs and implementation plans for biomass-based energy for power and non-power uses demonstrations; 2.2.2 Operational biomass production facility for biomass-based power generation; 2.2.3 Operational biomass-based power generation demonstrations; 2.2.4 Operational biomass energy technology demonstrations for non-power applications in selected communities; 2.2.5 Documented operating and energy performances of demonstrations; 2.2.6 Technically capable and qualified personnel for managing, operating and maintaining the demo units/facilities

Comment:

A few studies on biogas, biofuel and biomass gasification were published around 2009 and 2011. It would have been useful in the Project Document to discuss the analysis, barriers, results and recommendations thereof. In the description of outcomes and outputs in the Project Document, various types of technologies and applications mixed up in one basket. It might have been useful to discuss Outcome 2's interventions using a different categorization of outputs and mentioning gasification and biogas more specifically so that barriers specific to a technology, e.g. gasification, biogas or solar PV and could be formulated more precisely and their potential defined more specifically:

- Resource assessment, RET technology analysis (with special attention to biomass), including the impact of RETs in grid performance and stability
- Biomass gasification demonstration project(s) or other biomass-for-power
- Business models for community-level biogas application (linked with financing and PUE and SUE Component 3 and 4).

It is not clear to the MTR Consultant why it is that the large demonstration project, i.e. the biomass gasification plant at STEC (for which a feasibility study was already carried out in 2011), which is a highly visible activity, is not more prominently referred to throughout the Project Document, also given the fact that STEC is a co-financier of IMPRESS.

Component 3 Financing of initiatives for electricity saving, productive and social uses of RE electricity, and electricity system performance improvement

Outcome 3.1

Improved availability of, and access to, financing for electricity DSM, RE-based power generation and electricity system performance improvement projects

The banks and financial institutions in Samoa are generally not aware of and/or not interested in the business potential in RE and EE investments, that are viewed as risky investments (mainly due to high initial costs of RE/EE technologies, and collateral issues). The high prevailing interest rate is one of the key barriers in financing and investments in energy efficiency measures. For the more decentralized PUE/SUE activities, lack of collateral is usually the cause why several loan applicants could not access business loans. Most of the lands in Samoa are customary lands and therefore cannot be sold or mortgaged. Another barrier is the limited availability of government funds to support (community) RE/ EE initiatives and inadequate private sector funds to support RE/ EE initiatives. Although financial and capacity-building support for local	3.1.1 Feasible financing models and schemes designed and developed to serve as incentives for RE and Demand Side Management (DSM)/EE projects; 3.1.2 Completed capacity buildings for the local banks and financial institutions (FIs) on financing RE and DSM/EE projects (incl. on PURE and SURE projects); 3.1.3 Actual RE and DSM/EE investments by end-users, project developers and investors

entrepreneurs to start-up businesses has been implemented (e.g. by Small Business Hub) these do not have a particular RE angle.	
Component 4: Productive & social uses of RE **Outcome 4.1: Increased demand and utilization of RE for productive and social uses**	
Many rural households do farming and fishing that could sustain them on food but they are burden with expenses from modern living such as electricity, fuel, transportation, education, etc. RE utilisation (e.g. biogas or solar dryers in food processing) for productive uses at the community level and in rural areas has not been evidenced. There are few installations of biogas systems in Samoa for heating, lighting and electricity generation but these demonstrations primarily focus on reduction of household expenses rather than productive and social uses of RE	4.1 Completed feasibility studies of new business ideas for productive and social uses of RE; 4.2 Established appropriate business models for RE power and non-power applications for productive and social uses; 4.3 Established and operationalized business(es) involving productive and social uses of RE

Comment by MTR Consultant:

Here again, the Project Document glosses over a lot of issues that get mixed up into one box. The barrier analysis becomes too generic and this has the danger of drawing wrong conclusions. In Component 2, continuously refers to the general 'RE', although often (after second reading) it appears that gasification or biogas is meant. Components 3 and 4 would have benefitted from being joined and be given a focus application with clear target beneficiary groups. The ProDoc mentions the "absence of accessible and affordable financing for electricity DSM and power/non-power RE applications". However, it is not mentioned how this can be remedied and how financial solutions have to be tailored to certain technology applications (such as biogas for productive uses, rooftop or community-scale biogas generation), efficiency improvements and their application in particular target groups (rural and urban households, small businesses). In other words, the barrier analysis does not make clear what the need for (additional) finance is and what are possible financing schemes applicable to different 'technology-application-target group' combinations. A second observation is that in the ProDoc the need for setting up a (new) financial scheme for RE/EE almost seems to be a given fact. The ProDoc does not make clear why existing schemes (if any) cannot provide finance for productive uses (of energy). A good analysis of financing, needs, issues, and options for different target groups (rural, urban households, agro-processing, small businesses, etc.) is basically lacking.

It is mentioned in the Inception Report (on page 19) that "Highlighted that there is need to engage financial institutions and getting them involved in RE and EE projects. *None of the financial institutions or banks would want to use their loan schemes for RE and EE projects*, unless the project subsidies the interest rates". Maybe for good reason, a bank like to gives a commercial loan based on the expected ability to repay from realised of sales of a product or service. In case of RE/EE, the savings often do not come from expanded income but from expected reduced costs. In fact, the initial cost will increase if the investment cost in the RE/EE is high and the payback time from the investment may be too long for the bank to be attractive or for the debtor to pay (high) interest over time. It is mentioned, however, in the Project Document, that "there is keen interest and commitment from the local financial sector in championing this cause and taking a lead in implementing effective financial support for RE and EE in Samoa" (page 118). When interviewing, some banks and SBH made similar statements. So, although not lending for RE/EE yet, the willingness seems there. The ProDoc should have indicated how IMPRESS could have supported banks (and under which conditions) to provide RE/EE loans and for which technology-application-beneficiary grouping.

Some projects funded by development do not deal with energy as a focus area but have a relation with productive uses

- Samoa AgriBusiness Support Project (SABS).
  Since 2017, the SABS project is funded by ADB's grant to create a financial scheme for projects with initial investment cost from ST$ 0.1- 1 million through local commercial banks. The eligible project shall be sustainable agricultural projects using local raw materials and will contribute to export or import replacement. 50% of the project cost will be funded by the banks of which 50% will be guaranteed by ADB;
- Samoa Agriculture Competitiveness Enhancement Project (SACEP)
  The WB-supported SACEP aims to provide capital investments to strengthen the performance of the livestock, and fruit and vegetable sub-sectors in Samoa. The project provides a maximum grant of ST$ 16,000 (US$7,000) to support capital investment for each beneficiary.

The Inception report indicates that existing projects such as the Youth Employment Programme (YEP) and the before-mentioned SACEP have established financial schemes, as have local entities such as Small Business Hub (SHB) and Development Bank of Samoa. Before embarking on new financing schemes in a country the small size of Samoa, it would

have been useful at project conceptualisation to study financial schemes in place to see if they can be revised to integrate RE/EE consideration or how financing for small productive uses could be extended to individual households (that often have no real collateral).

The analysis of financing needs and options will only now be undertaken by the Project. The outcome of the analysis may well be that there is no need to for finance as envisaged in the ProDoc, or that the services demanded cannot be provided by UNDP (whose mandate puts limitations on its involvement in debt financing or revolving funds), or the financing options identified will be established too late in the project implementation period to have visible results (or only show results after IMPRESS ends).

Traditionally, UNDP/GEF projects follow the division in 'policy', 'technology', finance, and capacity/awareness, often for good reason. In the case of IMPRESS, it might have been useful to divide according to 'technology-application' clusters, review barriers according to these clusters, and design outputs accordingly, for example:

- Energy policy and power planning (including RE/biomass resource and RET/bioenergy technology assessment)
- Medium-sized power production for sale to the grid (biomass gasification)
- Heat applications (biogas) and sustainable energy in buildings (e.g. EE appliances, rooftop PV), including financing and business models.

The project concept was formulated during 2015 and after acceptance of the concept (PIF) in 2016, the project was endorsed in August 2017 (with activities starting by the end of 2017). This means that several years passed since the first ideas on IMPRESS were conceived. Thus, *some activities formulated in the document became outdated at project start*. This is most pronounced in Output 1.3 "Formulated and approved EE implementation regulations to promote EE". This includes the formulation of regulations and compliance regimes for the introduction of Minimum Energy Performance Standards (MEPS) and energy labeling for electrical appliances and lighting products. However, by the time the project started already the Energy Efficiency Act (2017) had been passed, followed by Regulations (2018) on MEPS and labelling for several appliances and lighting. The implication for IMPRESS activities of approval of the EE Act should have been flagged at the Inception Workshop and a revision of activities discussed in more detail.

<u>Lessons learnt of other projects in the Pacific region (PIGGAREP project; SEDREA, ADMIRE)</u>

A number of regional projects had been implemented by UNDP on sustainable energy at project conceptualisation and formulation. One was the Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP), implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) during 2006-2016 and in which Samoa was one of the participating countries. The Terminal Evaluation report of PIGGAREP (Dec 2016) mentions the following: "Impact on RE development in Samoa has been significant, notably in the development of RE projects that are generating and will generate more GHG emission reductions. In addition to PIGGAREP, support for the initial RE awareness programs, and subsequent institutional strengthening and capacity building assistance, the Government of Samoa (through its Renewable Energy Department within MNRE) was able to effectively implement a number of renewable energy projects in Samoa including hydropower, solar PV, wind and biogas. This included PIGGAREP support in 2012 towards hydrometric monitoring for the development of 3 new small hydro projects sites and the rehabilitation of 3 small hydro projects sites; this has led to the engineering and eventual implementation of these small hydro projects through ADB funding".

Surprisingly, the whole PIGGAREP is hardly referred to all, except for a footnote (on page 61) that "The pilot demonstrations by YWAM and PIGGAREP have encountered several constraints in scaling up. It should be noted that the pilot biogas system is used for household cooking, and has not been exemplified for other productive purposes". Rather than hiding this in a footnote, it would have been instructive to discuss in more detail what these constraints were and why the biogas system (or other renewable energy technologies) could not be developed for 'other productive uses'.

A PIGGAREP funded feasibility study on a grid-connected solar PV farm was completed, also leading to implementation with financing from the Japanese supported PEC". It further mentions that PIGGAREP+ funds are "currently being used to develop a 4 kW biogas power generation facility in the village of Piu on Upolu Island". In IMPRESS, the installation of biogas systems in 4-5 communities is one activity of Outcome 2. One would expect some reference at least in the Project Document on lessons learnt, best (or worst) practices, based on previous biogas experiences. For example, the Piu facility (with 20 kW capacity has reportedly not operated due to a lack of feedstock[25].

Regarding sustainable energy financing, several projects have been implemented in the region, such as the UNDP/GEF SEDREA[26] with its focus on financing of RE and EE. The SEDREA project supported the Renewable Energy Fund Window (REFW) of the National Development Bank of Palau. Discussing and assessing the experiences (good and bad) with and applicability of such clean energy funds in Samoa would have been benefitted project design. This might have produced at least an outline for a mechanism and suggestions for an implementing financial entity to be mentioned in the Project Document.

Logframe and indicators

Some indicators need revision. Some smaller changes (regarding targets) were proposed at project Inception. The MTR Consultant has the opinion that the list of indicators needs to be revised more thoroughly. The MTR consultant's suggestions are discussed further in the Recommendations Section. Two indicators are ill-defined or not so relevant and the MTR's suggestion is to remove them:

1. Cumulative number percentage of households benefitting from RE-based electricity generation and EE technology applications (Objective);
   Almost 100% of households are grid-connected. The electricity they receive is through the grid which is a mix of diesel and renewable. One cannot say that a household is connected to RE and the other not, all are on the same EPC grids. If the indicator is translated as 'percentage of share of RE in energy generated' than the target values are not correct, because in 2017 the share of renewables in electric energy production was already 42%. Even so, IMPRESS's focus is not on supporting solar or wind in practice and therefore should not claim progress in *all* RE, or at least should indicate the attribution to baseline and GEF-incremental intervention;
2. Cumulative % of households utilizing low carbon (EE & RE) technologies.
   This indicator a) is more of an objective indicator than an indicator of Outcome 5 (the "%" is not only determined by 'awareness' but by the result of other Components and external factors as well). Second, it is not well-defined. Presumably, it means 'all' households in Samoa. If this is this case, the same argument applies as under Ad 1), i.e. IMPRESS should not claim progress for activities that are purely baseline (or otherwise indicate what is baseline and what is GEF-incremental). Furthermore, the indicator is inconsistent, as Ad 1) gives 20% of households using RE, while the Component 5 indicator mentions 10% using RE.

3.3 Ratings for project design and relevance

Given the goal of RE target of 100% and the likely difficulties in meeting the target by adding solar and wind only, the option of biomass is quite *relevant.*

The UNDP/GEF rating requirements and criteria for mid-term do not include a '**rating on project design and formulation**', except for the item "M&E at design". The MTR Consultant's observation is that 'design' is one of the main factors, alongside 'implementation' and 'external factors' that determine the achievement of 'results', and has

[25] Source: IMPRESS CTA

[26] Sustainable Economic Development through Renewable Energy Applications (SEDREA), UNDP/GEF (2008-2018)

the personal opinion that therefore it should receive a rating. In the MTR's opinion "project design" is '*marginally unsatisfactory*', based on the arguments given in this Section 3. This low rating reflects the importance of project design as a contributing factor to the lack of progress in the above-mentioned areas (in particular regarding community-scale RE and outputs of Components 3 and 4). Project design issues need to be addressed as a condition to achieve results and these cannot be addressed by changes implementation or management arrangement only (e.g. the appointment of a Chief Technical Advisor may help guiding activities in Components 3 and 4). Also, external factors influenced the relevance or delay in execution of activities, such as recent development in utility-scale renewable energy (solar PV and battery storage) and energy efficiency (e.g. approval Act 2017) making an update of certain outputs/activities necessary.

One issue is that the Project Document does not indicate well which biomass technologies are of importance for which application and target group, how these can be linked with PUE, and supported with financial schemes. This is now being remedied by the Project by commissioning an integrated study that looks at business models, financial schemes and feasibility of RE technologies.

While (community-scale) pilot projects in the Pacific (including biogas in Samoa) have been implemented for many years and renewable energy financing is the subject of various initiatives, the results and lessons learnt are not mentioned and thus one can assume that these were not really being taken into account in the ProDoc.

The MTR Consultant proposes to give a rating for 'design' of the IMPRESS Project using a six-point rating scheme:

- Highly satisfactory (HS), no shortcomings
- Satisfactory (S), minor shortcomings
- Moderately satisfactory (MS), moderate shortcomings
- Moderately unsatisfactory (MU), significant shortcomings
- Unsatisfactory (U), major shortcomings
- Highly unsatisfactory (HU), severe shortcomings
- U/A = unable to assess.
- R = relevant; NR = not relevant

Box 9 Evaluation ratings of project design and formulation

Evaluation item	Corresponding section	Rating
Design logic and approach; addressing barriers	Section 3.2	MS
Translation of design logic into the log-frame with outcomes-outputs and progress indicators	Section 3.2	U
Lessons learnt from other projects	Section 3.2	MU
Overall project design: formulation and strategy		**MU**
Relevance	Section 3.1	R

4. FINDINGS: PROGRESS TOWARDS OUTCOMES

- To what extent have the expected outcomes of the project been achieved? (review the logframe indicators against progress made towards the end-of-project targets using the Progress Towards Results Matrix; comparison and analysis of the GEF Tracking Tool at the Baseline with the one completed right before the Midterm Review)
- What outputs has the project achieved (both qualitative and quantitative results, comparing the expected and realized end-project value of progress indicators of each outcome/output with the baseline value)?
- Were there any unplanned effects? Which external factors have contributed to or hinder the achievement of the expected results? Can the project take advantage of new opportunities, adapting its theory of change to respond to changes in the development context?
- Write one half-page paragraph that summarizes the project's progress towards results in terms of contribution to sustainable development benefits, as well as global environmental benefits

4.1 Introduction

This chapter presents progress towards results. For each of the four project components (see Section 2.2.1), an overview is given of the progress in the implementation of the project's outcomes and outputs, following the 'project results framework' format and as reported by the Project Coordination Unit (PCU) in the annual UNDP/GEF Project Implementation Reports (PIRs, 2019; with the 2020 PIR forthcoming), Quarterly Progress Reports (QPR; Q1 2018 up to Q2 2019) and based on the online discussion sessions with various stakeholders. Section 4.2 describes the progress achieved in outputs and activities for each Component/Outcome, following the ProDoc's outline of outcomes and outputs of Box 6. This section gives a quantitative and descriptive overview of the achievements of outputs and outcomes and provides a re-assessment of results in terms of progress towards attaining the objective and outcomes. Under each 'main activity', it reports the sub-activities that have been carried out to date or planned.

Section 4.3 presents a summary of the achievements of the project up to now as shown by the progress indicators. The baseline and target values of the indicators are taken from the project's logical framework (as reported in the ProDoc and PIRs), while the achievements are based on progress reported in the PIRs, supplemented by additional information obtained during the mission (including interviews with respondents) and analysis of the project technical outputs produced during 2017-2019. The greenhouse gas emissions reported in the GEF Tracking Tool have also been reviewed and re-calculated by the MTR Consultant. These are discussed in Section 4.3, together with gender and social impacts. The Chapter ends with Section 4.4, which gives a summary of the MTR Team's ratings towards results.

4.2 Progress in achieving outputs and outcomes

The following provides an overview of progress against the indicators reported in the project's results framework and subsequent PIRs. In the 'status' columns, text in blue indicates the current status of the Output as found by the MTR Consultant based on reporting and interviews with project partners. The red text indicates some additional observation by the MTR Consultant regarding baseline activities, reasons for delay or non-realization and other information as needed.

Box 10 Summary of achievements of outcomes and outputs

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
Component 1 Enhancement of renewable energy policy formulation and implementation			
1. Enforcement of clear and consistent policies and regulations that are supportive of the development and implementation of RE-based power *Progress indicators:* • Number of approved and enforced policies that support and incentivize investments in RE *(and EE)* development and utilization (BL: 0; MT: 0; EoP: 1) • Number of approved and enforced regulations that support EE *(and RE)* implementation in Samoa under the Energy Bill (BL: 0, MT: 1; EoP: 3) *Note: italics:* changes at Inception *Status at Mid-Term review:* *1. RE policies and incentives to be assessed.* *2. One EE regulation in place; two more under discussion with MOF*	1.1 Established and enforced clear and consistent RE policy and legal frameworks for RE (power and non-power) development and implementation;	1) *Conduct a review of STEC Act 1977and 1990 and prepare a clear and consistent regulatory framework on the development and implementation of RE-based power generation*. 2) Conduct review of RE resource assessments, undertake outstanding RE resource assessments and potential studies and propose revised RE targets for the national RE policy (includes the assessment of the national %RE in electricity target; 3) Formulate a clear RE policy for both power and non-power development and implementation, as well as the development and enforcement of standards, policies, and regulations on the participation of the private sector; 4) Establish a one-stop-shop for RE development and implementation	*Observation by MTR:* • A review of EPC Act 1980 and Electricity Act 2010 was carried out by EPC, hence the activity was reformulated at project inception *Status at MTR:* 1. Two reviews have been carried out, of the 1) STEC Act 1977 & 1990 A 2) Review of the National Greenhouse Gas Abatement Strategy 2008-2018 and support to the new NGGAS 2019-2029 was carried out (02/2018, annexed to PR 2018 Q2). 2. An energy audit was carried out for MNRE (Savaii and Upolu offices); attached to PR 2018 Q2. Regarding the RE assessment, potential studies and revised RE target, a tender was organised in 2019, but the study is now part of a larger ToR on "development of business models, financials schemes and cost-benefit analysis of renewable energy technologies; renewable energy management & technology" 3. A ToR for the TA on renewable energy policy is to be drafted. 4. An IMPRESS webpage has been developed that can be accessed through the MNRE website. There is also an IMPRESS Facebook page. A guideline for RE investors has been developed by MoF which is under discussion at NECC

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
	1.2 Comprehensive energy integrated development plans formulated by skilled government planners;	1) Establish institutional and operational frameworks to support national energy development, planning and implementation 2) Establish and operationalize a task force to integrate power system reliability in the Power *Sector* Plan; 3) Develop and implement a comprehensive training program for relevant agencies and responsible personnel in national energy development, planning and implementation	*Observation by MTR Consultant:* It is not clear what the relevance of activities 1.2.1 and 1.2.2 as these frameworks seem to be established already. Regarding 1.2.3, this may overlap with Component 5. *Planned:* 3. A ToR will be developed to carry out a Training Needs Assessment for Electricity Sector Planning (incl. grid stability aspects). With representatives from EPC, STEC and EU GIZ (MOF) a study tour to Fiji was conducted (to visit Nabou Green Energy - Biomass Gasification Plant, other RE facilities/research groups. .
	1.3 Formulated and approved EE implementation regulations to promote EE	1) *Conduct gap analysis on EE regulations in 2020* 2) Develop draft regulations for promotion and implementation of EE in Samoa under the umbrella of the Energy Bill; 3) Establish an inter-ministerial collaborative for implementation and enforcement of EE regulations	*At project start:* The EE Act 2017 stipulates that several appliances must now meet Minimum Energy Performance Standards (MEPS) and labelling (refrigerators & freezers, air-conditioners) and MEPS (incandescent lamps, fluorescent lamps and ballasts). The test standards and MEPS rules are set out in the Regulations (2018) 1. This activity is planned for Q3 2020 2. Formulated and approved EE implementation: Community consultation on EE implementation was carried out in July 2019. The PCU has initiated discussion with the Energy Coordination Division at MOF on the development of two (2) Regulations as per/under the Energy Efficiency Act 2017 and Energy Management Bill, focussing on:

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
			• petroleum products (land transport) • renewable energy (waste-to-energy concepts); • energy efficiency: expanding the scope of appliances to be regulated under the current Energy Efficiency Act 2017 *Observation:* There appears to be no need for activity 1.3.3, as there are regular meetings in the framework of the NECC.
	1.4 Formulated and approved policy measures to incentivize communities and the private sector for RE production	1. Conduct cost and benefit analysis of applicable RETs at the national and community levels; *2. Enhancement of the current policy instruments to incentivize RE investments at the national and community levels.* 3. Conduct stakeholder consultation and coordinate with the relevant government agencies for adoption and implementation.	*1.* C-B analysis applicable RETs: In Q4 2018, a ToR was drafted and a tender procedure weas started but not completed in 2019. The activity is now part of a larger ToR "development of business models, financials schemes and cost-benefit analysis of renewable energy technologies; renewable energy management & technology" 2. Stakeholder discussion takes place within TWG1 of IMPRESS. An IUCN workshop (11/2018) was hosted by IMPRESS/MNRE to bring together various energy sector stakeholders *Observations by MTR Consultant:* Activity 1.4.2 has not been implemented yet.

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
Component 2 RE-based energy system improvement			
2.1 Enhanced operating performance and reliability of RE power systems (generation and distribution) in major islands *Progress indicators:* • SAIDI (System Average Interruption Duration Index): (BL: 2,586; MT/EoP: 2,439 occurrences) • SAIDI (BL: 36, MT/EoP: 34 minutes (baseline and target indicators estimated based on 5% and 10% improvement of 2016 target of Upolu: SAIDI- 1300mins; Savaii: SAIDI –1400mins. *Status:* *SAIDI, 1280 minutes and frequency index: 155 times (2018)* *Observation:*	2.1.1 Completed power system profile and analysis of grid performance and power quality;	1) Conduct a comprehensive review of previous system studies and conduct proper metering and data collection for a whole year 2) Conduct a detailed analysis of power supply and demand and recommend characteristics of power plants required to improved grid performance and power quality 3) Recommend an appropriate RE project portfolio including smart grid control systems and optimum 4) Power dispatch for maximized grid reliability	*Observation by MTR Consultant:* These activities are fully implemented as baseline by EPC without specific IMPRESS project team involvement. EPC has carried out an in-house review on system status (including the impact of new or planned IPPs) and recent demand growth. An EPC Master Plan is in draft stage, which will include ambitious expansion to receive the '100% RE target' in power generation by 2025.
	2.1.2 Completed assessment of the various available biomass energy resources in Samoa, including biomass energy resource production business model;	1) Assess quantity and characteristics of various available biomass energy resources 2) Analyze physical and chemical properties of priority biomass feedstock in Samoa 3) Assess biomass feedstock supply and potential for power and non-power applications 4) Analyze social and economic benefits and costs for communities along the supply chain and possible environmental impacts 5) Assess and recommend suitable business models for sustainable biomass resource (production, harvesting, processing and supply for biomass-based power and non-power uses in Samoa	*Observation:* The Output's activity actually links with and could be merged with activities of other outputs (Output 2.2), although should be more clearly split into activities concerning gasification for power (STEC) and community biogas activities. 1-2. Assessment of the various available biomass energy resources in Samoa This consists of quantitative assessment of biomass resources available at STEC lands (in Savaii and Upolu), an assessment of chemical and thermal characteristics (with SROS). Four species were analysed (Peaock plume, West African rubber tree, Panama rubber tree and coconut shells). The report was finalised and presented (to TAG) in Oct 2019 and launched at Afolau commissioning (June 2020), The assignment has links with activity 1.1.2 (RE assessment) and the onsite assessment at STEC (2.1.2.1). The Feedstock team is involved in

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
Since IMPRESS is not directly involved in grid stabilization or technologies or utility-scale solar and wind, the suggestion is to remove these Indicators. Even if adding biomass capacity would have a stabilization impact, its share as part of RE is that small it will not have a noticeable impact. The indicator describes the progress of EPC baseline only.			harvesting of invasive trees as feedstock for the gasification plant. 3-4. Planned are a) a detailed assessment of the feedstock supply line is planned for Q2 2020 (Activity 2.1.2.3). An assessment of socio-econ benefits for communities around Afolau and the effects on the supply chain (Activity 2.1.2.4) 5. Activity 2.1.2.5 (business models bioenergy) merged with 2.2.3.4 (and 3.1.1) and is now part of an integrated study on "development of business models, financials schemes and cost-benefit analysis of renewable energy technologies; renewable energy management & technology"
	2.1.3 Applicable cost-effective RE-based power generation technologies that are feasible in Samoa, including technologies for enhancing the electricity system performance and reliability identified;	1) Evaluate applicable cost-effective RE-based power generation technologies that are feasible in Samoa; *2) Develop RE grid connection codes to specify technical, safety and reliability requirements for RE power plants, grid equipment and rank technologies according to their economic viability*	*Observation by MTR Consultant:* This Output can be deleted or activities merged with other outputs. On activity 2.1.3.4, EPC has completed the RE grid connection code. Activity 2.1.3.1 should be combined with Activity 1.1.2 (RE assessment) and Output 4.1 Completed feasibility studies
	2.1.4 Completed designs and implementation plans for the application of technologies for enhancing electricity system stability and energy performance;	1) Prepare detailed engineering designs and implementation plans for the application of technologies for enhancing electricity system stability and energy performance; 2) Design and implement a capacity building program for EPC personnel for enhancement of electricity system stability and energy performance 3) Implementation of feasible applicable technologies for enhancing electricity system stability and energy performance	*Observation by MTR Consultant:* Like Outputs 2.1.1 and 2.1.3, this is largely an EPC-implemented activity (baseline, with ADB support) rather than being considered an IMPRESS GEF-incremental one. Activity 2.1.2 could be re-located to the capacity building Component 5

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
	2.1.5 Published information on performance and impact on each implemented RE technology application and demonstration	1) Document, collect raw data and disseminate information on performance and impact on each implemented RE technology application and demonstration	*Observation by MTR Consultant* This output is better placed as part of Component 5
2.3 Increased application of power system performance and reliability enhancement technologies *Indicators:* • Number of grid systems with increased reliability due to the effective application of system reliability enhancement technologies (BL/MT: 0; EoP: 1) *Observation:* The indicator seems superfluous. There are only two grid systems (Upolu and Savaii) with large existing or planned RE share, so the EoP target is almost met by default.	2.3.1 Detailed designs and specifications for demonstrations for power system performance and grid system reliability enhancement	1) Evaluate and confirm EPC's substations/feeders for implementation of power system performance and grid system reliability enhancement projects 2) Prepare detailed engineering design of power dispatch and grid stabilization technologies demonstrations	*Observation by MTR Consultant;* EPC has organised bids for studies and carried out system protection and power stabilization (incl. battery storage). EPC is drafting a bid to introduce proper revenue metering system to its feeders and generator so that correct and accurate data is collected as representative of the system behaviour with more focus on the base load of the system These type of activities of Output 2.3 are fully EPC-implemented (with support from ADB-funded projects). Since these are baseline rather than GEF incremental, the Output does neither figure in the Work Plans no is reported on the QPR. Some tasks related to grid connection issues of biomass power can be maintained and joined with Output 2.1).
	2.3.2 Operational demonstrations of power system stabilization technologies in the EPC power grid system	1) Assist selection of qualified contractor(s) for supply and implementation of power system stabilization technologies in selected EPC's substations/feeders 2) Install and commission power system stabilization technologies in selected EPC's substations/feeders	
	2.3.3 Documented operating and energy performances of demonstrations	1) Conduct monitoring and evaluation, and prepare annual reports on the operation, energy performance and impacts of the power stabilization technology demonstration	
	2.3.4 Approved plans for the replication and/or scale up of the demos on minimizing/abating potential system instability in the EPC power grid system	1) Prepare system stabilization technology replication plans for minimizing/abating potential system instability in the other EPC systems based on demonstration results	
2.2 Increased application of biomass-based energy for power and non-power uses	2.2.1 Completed preliminary engineering designs and implementation plans for biomass-based energy	1. Validate the conceptual designs and confirm the implementation plans with the selected demonstration hosts	1. Gasification plant: Contract awarded to Ankur Scientific Energy Technologies Pvt. Ltd. for 'engineering, procurement and construction' of 750 kW Afolau Biomass facility. The plant

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
Progress indicators: • Number of biomass-based power generation units integrated into the EPC grid system (BL/MT: 0; EoP: at least 2) • Number of operational off-grid community biomass-based energy projects (BL: 0; MT: 2; EoP: 4) Status at mid-term: • Afalaou launched in June 2020 • Assessment biogas projects completed (% sites) Suggestion for first indicator: Add 1 biomass gasification facility or look at installed capacity (at mid-term: ¾ of targeted capacity installed. A strong suggestion is to split the Output in a) STEC biomass for power, and b) community-level biogas activities, according to the two Indicators	for power and non-power uses demonstrations;	2. Finalize preliminary engineering designs for biomass-based technology demonstration projects for power and non-power use	was designed and commissioned by April 2020 and officially launched in June 2020. There is no PPA for the biomass gasification demonstration project yet due to delays in approval process and tariff negotiation. EPC, STEC and MNRE only started discussion/negotiation of once the gasification facility became operational. A grid-connection trial test was done in April '20. 2. Biogas systems: Detailed assessment has been carried out for five (community) biogas systems (see Assessment report by BioEnergy Solutions Technology (BEST) Company. The sites are Manono island (Salua village), Mapuifagalele Sisters of the Poor – Elders home), Tanumalala Prison, Sa'asa'ai and Vaisala. For a summary description, see **Box 13**. Community consultations planned for Q2 2020 were postponed until Q3 due to the COVID-19 emergency situation.
	2.2.2 Operational biomass production facility for biomass-based power generation;	1) Assist selection of qualified contractor(s) for a biomass production facility for biomass-based power generation 2) Prepare detailed engineering designs for a biomass production facility for biomass-based power generation 3) Install, commission and operate a biomass production facility for biomass-based power generation	1-2. Gasification plant: Contract awarded to Transworks for plant site preparation. The plant was designed and commissioned by in April 2020. The official opening is planned for November 2020 (if COVID situation allows) 3. Regular feedstock supply reports for Afolau plant Suggestion: 2.2.2 and 2.2.3 can be merged into one output, while 2.2.3.4 is already merged with 2.2.5.1 and 3.3.1

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
	2.2.3 Operational biomass-based power generation demonstrations	*1) Acquire relevant permits and EIA (if required) for power generation demonstrations.* 2) Assist selection of qualified contractor(s) for biomass-based power generation demonstrations; Prepare detailed engineering designs for biomass-based power generation 3) Install, commission and operate a biomass production facility for biomass-based power generation *4) Develop a business model for the biomass-based power plants that is aligned with international experiences in the power sector.*	1. Gasification plant: Development consent: approved by PUMA (04/2019) after submission of Environmental Assessment Report (EAR), Waste Management plan and an Operation Management Plan 2-3. The plant was designed and commissioned by in April 2020 (connected to the grid). The official opening will be in November 2020 4. Business model for sustainable biomass (production, harvesting, processing, biomass) for power and non-power, including financing schemes The activity merges, 2.2.3.4 with 2.1.2.5 and 3.1.1. The contract will be awarded in 2020 . Activities 2.2.4.1 to 2.2.4.3 The procurement of the biogas systems and installation thereof is still pending) *Observation by the MTR Consultant:* Reporting on two different types of systems in one Output is confusing. Strong suggestion to split the Output in a) STEC biomass production and power generation (STEC), merging with activities of Output 2.1) and b) community-level biogas (or other biomass) activities
	2.2.4 Operational biomass energy technology demonstrations for non-power applications in selected communities	1) Assist selection of qualified contractor(s) for biomass energy technology demonstrations for non-power applications in selected communities 2) Prepare detailed engineering designs for biomass energy technology demonstrations for non-power applications in selected communities 3) Install and commission biomass energy technology demonstrations for non-power applications in selected communities	
	2.2.5 Documented operating and energy performances of demonstrations	1) Conduct monitoring and evaluation, and prepare annual reports on the operating and energy performances of the demonstrations	Pending

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
	2.2.6 Technically capable and qualified personnel for managing, operating and maintaining the demo units/facilities	1) Design and implement a capacity building program for personnel of biomass energy systems for power and non-power applications	Pending. Suggestion: this should be merged with relevant activities of Output 5.1

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
Component 3 Financing of initiatives for electricity saving, productive and social uses of RE electricity, and electricity system performance improvement			
3.1 Improved availability of, and access to, financing for electricity DSM, RE-based power generation and electricity system performance improvement projects *Progress indicators:* 3) Number of banks/ financial institutions that implemented and funded the designed and endorsed financing models and schemes (BL: 0; MT/EoP: 2) *Proposed change at Inception: at least 1* Status at mid-term:	3.1.1 Feasible financing models and schemes designed and developed to serve as incentives for RE and Demand Side Management (DSM)/EE projects	1) Review national and international experiences in design, establishment and operation of an effective financial scheme to promote RE and DSM/EE investment projects 2) Design and develop suitable financial scheme(s) for RE and DSM/EE projects 3) Develop an operations manual on the feasible financial scheme 4) Develop the necessary templates and draft agreements with stakeholders to establish/set up the financial scheme 5) Develop a sustainable follow-up plan for the financial scheme(s) at EOP	1. Business model for sustainable biomass (production, harvesting, processing, uses) for power and non-power, including financing scheme. The activity merges, 2.2.3.4 with 2.1.2.5 and 3.1.1 and is now part of a proposed ToR on. "development of business models, financials schemes and cost-benefit analysis of renewable energy technologies; renewable energy management & technology" 2 – 5. Pending, depending on the results of 3.1.1. *Observation by the MTR Consultant:* Possibly, Outputs 3.1 and 3.2 can be merged as there is likely only one mechanism with a private or not-for-profit entity, possibly with some government support. In activity 3.1.1.1, the relevant experiences in the region on sustainable energy financing (such as the SEDREA project in Palau) could be analysed on lessons learnt and applicability of financing mechanisms in Samoa. Second, the activity should be coordinated with the PUE/SUE study (output 4.1)

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
• 0% progress (except for stakeholder consultations)	3.1.2 Completed capacity buildings for the local banks and financial institutions (FIs) on financing RE and DSM/EE projects (incl. on PURE and SURE projects)	1) Design and conduct a promotional program on RE and DSM/EE investments for banks and financial institutions (FIs) 2) Design and implement a capacity building program on RE and DSM/EE investments for FIs.	*Observation by the MTR Consultant:* The Inception Report mentions that there is a need to utilize local technical expertise such as SBH, Development Bank of Samoa (DBS) in developing financial models that are suitable to Samoa's context.
	3.1.3 Actual RE and DSM/EE investments by end-users, project developers and investors	1) Design and implement a promotional campaign for potential investors of RE/ EE initiatives and potential beneficiaries of the financing scheme(s) 2) Assist potential financing beneficiaries in the development and implementation of RE and DSM/EE investment projects	1 – 2. Pending *Observation:* Suggestion to merge 3.1.3 with 3.2.2
3.2 Government of Samoa (GoS) and financial sector providing financing for EE, and productive & social uses of RE *Progress indicators:* • ~~*Total investments mobilized through the implemented financing schemes (BL: 0; MT: USD 355,000; EoP: USD 710,000)*~~	3.2.1 Established and operationalized government financing scheme(s) for feasible RE and DSM/EE technologies projects	1) Assist the partner bank/financial institutions (FIs) in complying with the government permitting requirements for the establishment and operationalization of the schemes 2) Finalize agreements with relevant stakeholders to establish the financial scheme(s); 3) Develop and implement a plan to promote the loan uptakes, and the generation of the pipeline of projects for possible financing	1 – 3. Pending *Question/observation*: The question is if there is a need for a new financing scheme at all. The Inception Report mentions that Samoa has projects such as YEP, SACEP and others that have established financial schemes. The suggestion is for PCU and relevant stakeholders to review these financial schemes in place successful to see if they are applicable and can deliver direct benefit to selected households. The need for financing is to be identified as part of Output 4.1 (feasibility study PUE/SUEm as part of an integrated assessment of business models, financing options, PUE/SUE and RE feasibility)

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
• Cumulative number of RE/EE projects supported by the implemented financing models (BL: 0; MT: 25 RE and 165 EE fridges; EoP: 164 RE and 330 refrigeration projects) Status: • 0% (awaiting TA in progress) *Observation:* Indicator and/or values need to be redefined	3.2.2 DSM/EE and RET application projects financed either through the established financing scheme or by private sector investment	1) Assist potential financing beneficiaries in accessing established financial scheme(s) and concluding financial agreements with FIs; 2) Regular tracking of the operation of the implemented DSM/EE and RET projects, and evaluation of their performance (energy utilization, operational and economic) 3) Evaluation of the overall performance of the financing schemes, including the formulation of recommendations	1 – 3. Pending *Observation:* It is mentioned in the Inception Report (on page 19) that "highlighted that there is a need to engage financial institutions and getting them involved in RE and EE projects. None of the financial institutions or banks would want to use their loan schemes for RE and EE projects, unless the project subsidies the interest rates". It is mentioned, however, in the Project Document, that "there is keen interest and commitment from the local financial sector in championing this cause and taking a lead in implementing effective financial support for RE and EE in Samoa" (page 118). Although not lending for RE/EE yet, the willingness seems there. Possibly, lenders can be supported by UNDP's new 'performance-based payments' (PBP) modality. At the time of IMPRESS formulation, such a PBP option in UNDP projects did not exist. The Project/CTA or a consultant should investigate using the PBP scheme in IMPRESS. Even if it is not possible for such a financial mechanism to become operational during the IMPRESS period, the Project can lay the foundation by means of concrete proposals for post-IMPRESS implementation.

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
Component 4: Productive & social uses of RE			
4.1 Increased demand and utilization of RE for productive and social uses *Progress indicators:* • Number of businesses utilizing biomass-based energy for productive and social uses (BL: 0; MT/EoP: 3). • *Suggested change at Inception: MT/EoP: at least 3* 4) Percentage of household expenses on fuel in pilot communities (BL/MT: 5%; EoP: 4%). Average value from Household Income and Expenditure Survey 2013 / 2014, Samoa Bureau of Statistics Status at mid-term: 0% (community consultations; Feasibility study PUE/SUE will start	4.1 Completed feasibility studies of new business ideas for productive and social uses of RE	1) Conduct a feasibility study of RE electricity for productive and social uses; 2) Conduct a feasibility study of non-power RE for productive and social uses; 3) Conduct a feasibility study of RET service providers	1 -3. Feasibility study on new business ideas for productive and social uses of RE. The contract awarded on March 2020, but is now linked with the ToR on "development of business models, financials schemes and cost-benefit analysis of renewable energy technologies; renewable energy management & technology" It should be noted that the team has made an initial assessment of Vaisala Hotel, Sa'asa'ai bakery (on the 5 biogas sites) and Misuluki Spa retreat. *Observation by the MTR Consultant:* Most activities in Component are pending, based on the completion of the feasibility study and business schemes proposed
	4.2 Established appropriate business models for RE power and non-power applications for productive and social uses	1) Assess capacity and available resources of potential communities, entrepreneurs and social institutions for development of business models; 2) Develop appropriate business models and replication plan for potential communities, entrepreneurs and social institutions	1 – 2. Pending
	4.3 Established and operationalized business(es) involving productive and social uses of RE	1) Train potential communities, entrepreneurs and social institutions on productive use of RE in both products and services; *2) Assist local private entrepreneurs during the start-up and operation of business.* 3) Monitor and evaluate business operation performance of the private entrepreneurs 4) Develop communication materials on successes and lessons learned for information dissemination	1 – 3. Pending *:*

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
Component 5: Enhancement of awareness of the applications			
5.1 Improved awareness about RE and EE technology *Progress indicators:* • Cumulative % of households utilizing low carbon (EE & RE) technologies (MT: 5% RE, 25% EE; EoP: 10% RE and 50% EE) • Number of trained local authorities, i.e., local government officials) that are capable of developing, planning and implementing RE, DSM/EE and PURE/SURE projects (BL: N/A; MT: 10; EoP: 20). *Suggested at Inception: at least 10, at least 20* *Status*: - Data collected from MOF EE database. TA in Q1/Q2 2020 to carry out survey - Refresher course on SCADA in Q2 2020 *Observation:* Indicator on % of HH using RE/EE is not a good indicator for Outcome 5 (see main text)	5.1 Completed capacity development on RET (design, engineering, financing, construction, operation & maintenance) for schools and universities	*1) Develop and review RE and DSM/EE courses (design, engineering, financing, construction, operation and maintenance and optimum power dispatch) including training course materials for schools and universities* 2) Organize and conduct stakeholder meetings to support submission of documentations for endorsement and adoption of training courses by relevant authorities 3) Conduct training of trainers for RE and DSM/EE courses and prepare implementation plan 4) Implementation of training courses and conduct training course evaluations, and impact evaluation a year later. 5) Develop a sustainable follow-up plan for the RE/EE technologies capacity development program for schools and universities.	1 – 2. Formal and non-formal trainings (subjects: a. energy development and planning, b. biogas technology, c. energy efficiency d. solar). Status: • SQA approve Project to use Nationally Competence Standards (NCSs) for climate change, disaster management and sustainable energy. This allows the Project to conduct 'training of trainers' (TOT) who will develop formal and non-formal training. NUS has been approached to set up the TOT. • Meeting in Sept 2019 with EU Pac TVET team on RE and EE courses in Pacific. Discussions with SQA on TVET-supported courses on Sustainable Energy Certificates I-IV • Refresher course was with EPC personnel on SCADA (Q2/2020)
	5.2 Established operational information network for the promotion, dissemination and information sharing of RE and DSM/EE technology, policy measures, incentives and financial schemes	1) Establish and operationalize the information network for RE and DSM/EE promotion and information sharing 2) Organize and conduct stakeholder meetings to form a network/association to promote and dissemination of knowledge of RE and DSM/EE 3) Coordinate network regular meetings for information sharing and network interventions on the draft of national RE target, policy incentives and measures for RE and DSM/EE and Energy Bills	1-2. Quarterly meetings take place at a policy level at NECC. Also, the meetings in the framework of IMPRESS (TAG and meetings of the working groups, TWG1, TWG2, TWG3-4 and TWG5) can be regarded as networking. 3. A number of (regional) meetings and workshops have been hosted by or held with IMPRESS participation: • A study tour to Fiji was conducted (to visit Nabou Green Energy - Biomass Gasification Plant, other RE facilities/research groups (with representatives from EPC, STEC and MOF); • National IPP Workshop hosted (August 2019) • 4th Regional Energy and Transport meeting (Sept/2019);

Outcome	Output	Activity *(changes at project inception indicated in italics)*	Status
			• Support Energy Sector Capacity Needs Assessment workshop (Q1, 2020) • Training on NDCs (June 2020) *Observation*: Ideas exist on supporting the establishment of relevant association(s), such as a 'biogas association' (for farmers and practitioners) or a 'renewable/sustainable energy associations'.
	5.3 Completed promotional activities of communities, entrepreneurs, institutions and local government authorities on RE and DSM/EE technologies, applications and policy planning	1) Conduct surveys and assessments of RE/EE awareness levels in target groups (communities, entrepreneurs, institutions, and local government authorities) 2) Develop and implement awareness and training workshops on RE, DSM/EE and PURE/SURE for communities and local authorities 3) Design and implement communication campaigns to increase awareness on RE, DSM/EE and PURE/SURE 4) Demo of EE technology applications for supporting socio-economic development in rural areas	1 – 3. Activities carried out: • Pre-assessment RE/EE on students in selected colleges in Savaii (Q4 2018) • Awareness materials prepared for National Renewable Energy Day (Q4 2018, Q4 2019, Q1 2020) as well as video advertisements on local TV and online media • IMPRESS social media outreach (Energy quiz is run fortnightly, since Q4 2018 • Student awareness on RE and EE in 9 schools in Upolu (Q3-Q4 2019) 4. Tender for procurement of 300 solar street lights (100 requests by communities). Contract signed with Mai Company in Q4 2018. Solar lights were distributed by Q3 2018. The solar lights have mainly been installed at schools, churches and village communities *Observation:* This activity was discussed at the Inception Workshop (see Inception Report, page 18-19)

Note: Outcomes, outputs and outcome indicators are taken from ProDoc. Changes at project inception in outcome indicators are indicated in the table in italics, while text removed at inception is indicated by strikethrough).

4.3 Climate change and other impacts

4.3.1 Emission reductions

The Project Document provides an estimate of direct, post-project, and indirect greenhouse gas emission reductions, which are summarised in Box 11. The direct emission reduction of demonstration activities that have become operational during the IMPRESS implementation period, as mentioned in the ProDoc, are the planned 500 kW biomass gasifier and the expected investment of USD 195,000 in 195 energy-efficient refrigerators. The ProDoc further mentions that the project's interventions result in the post-project replication of the biomass gasification and add another 500 kW (bringing the total to 1 MW). The IMPRESS project will also improve stability of the EPC's grid allowing additional integration of solar PV power plants and other RE electricity generation which will displace the projected diesel-generated electricity of 42,184 MWh.

The IMPRESS project creates an enabling environment that will facilitate the widespread applications of RE and DSM/EE technologies in Samoa. Capacity development and awareness activities that will be conducted under the project are expected to influence the relevant stakeholder entities in the promotion, support, design, and installation, financing, operation, and maintenance of RE for power and non-power projects. The indirect (or consequential[27]) $CO_{2\ consequential\ BU}$ = ($CO_{2\ direct}$ + $CO2_{\ direct\ post\ project}$) * RF, for which a default replication factor = 3 is chosen.

The MTR Consultant has reviewed the calculations of the ProDoc (see Box 11). These have been revised and replaced by estimates of direct and consequential emissions based on the information *available at mid-term* with the following changes:

- Size of the gasifier facility is 750 kW, used 24 hours a day at 75% of capacity;
- Biogas plants are planned at the five sites and an estimate has been included in the calculation.
- Solar street lighting has been installed;

Box 11 Expected direct and indirect emission reduction (at CEO endorsement)

Biomass gasification

Assunptions		
Gasifier capacity	500	kW
Operating lifetime	20	years
Utilization factor	51.4%	
Emission factor grid	0.7133	tCO_2/MWh
Energy and GHG		
Annnual electricity generation	2,250	MWh/yr
Annual GHG avoided	1,605	tCO_2/yr
Direct (equipment lifetime)		
Energy substitution	45,000	MWh
Cumulative GHG substituted	32,099	tCO_2
Post-project (equipment lifetime)		
Energy savings (gasidiers, 1 MW)	90,000	MWh
Cumulative GHG avoided	64,197	tCO_2

EE refrigerators

Assumptions		
Savings per 5-star fridge	0.35	MWh/yr
Number of fridges	195	
Savings per 5-star fridge	68.25	
Lifetime fridges	15	years
Direct (over project period)		
Energy savings	1,024	MWh
Cumulative GHG avoided	730	tCO_2
Post-project (equipment lifetime)		
Savings (same # of fridges)	1,024	MWh
Cumulative GHG avoided	730	tCO_2

Renewable energy (solar PV; other)

Post-project (equipment lifetime)		
Electricity generation by RE	42,184	MWh
Lifetime	20	years
Cumulative GHG avoided	601,797	tCO_2
Consequential (indirect)		
Replication factor	3	

SUMMARY

Direct emission (lifetime)	32,829	tCO_2
Post-project	666,724	tCO_2
Indirect emission reduction	2,098,659	tCO_2

Source:
Compiled from UNDP Project Document

[27] The *Guidelines for Greenhouse Gas Emissions Accounting and Reporting for GEF Projects* (GEF/C.48/Inf/09, May 2015) replace 'indirect emissions' with a new terminology, 'consequential emission reduction', defined as those projected emissions that could result from a broader adoption of the outcomes of a GEF project, plus longer-term emission reductions from behavioural change'. In GEF-7, the GEF Tracking Tools (Excel-based) are replaced by GEF Core Indicator Tables.

- EE refrigeration has been taken out, since the project is not directly supporting the procurement thereof
- A lower grid emission factor has been chosen (reflecting the higher penetration of RE in the Samoa grids)

The MTR Consultant has tried to estimate the lifetime energy substitution (assuming the baseline is formed by diesel-powered diesel generation). The calculation method is explained in Box 12**.** If the biogas systems will be installed (in addition to the gasifier and solar street lights already installed) and assuming the energy service is provided over the assumed equipment), the total direct cumulative energy saving will be 85,104 MWh with resulting lifetime GHG emission avoidance of 57,135 tCO_2. Given the fact that no other energy substitution (e.g. another gasifier) or energy savings (e.g. EE equipment) is planned, the post-project emission reductions are estimated at zero. However, more energy investments could take place or at least planned in the remaining period, so that the post-direct emissions could be re-assessed at the end of the project. Consequential emissions can be estimated by multiplying the direct emissions with a replication factor of three.

Box 12 Expected direct and indirect emission reduction

Biomass gasification

Assumptions		
Gasifier capacity	750	kW
Operating lifetime	20	years
Utilization factor	75%	
Emission factor grid	0.694	tCO_2/MWh
Energy and GHG		
Annnual electricity generation	3,942	MWh/yr
Annual GHG avoided	2,736	tCO_2/yr
Direct (equipment lifetime)		
Energy substitution	78,840	MWh
Cumulative GHG substituted	54,715	tCO_2

Solar street lighting

Assumptions - solar lanterns		
Lifetime LED lamp	15	yrs
Number of solar street lights	300	
Wattage LED lamp	60	W
Operating hours	3650	hrs/yr
Wattage conventional HID-HPS lamp	115	W
Electricity savings per PV lamp	420	kWh/yr
Energy and GHG		
Electriciity savings	126	MWh/yr
GHG avoided	90	tCO_2/yr
Direct (lifetime)		
Energy savings	1,889	MWh
Cumulative GHG avoided	1,347	tCO_2

Community institutions - biogas

Assumptions		
Operating lifetime biogas	10	yr
Number of projects	4	
Number of beneficiaries per project	**25**	
Replaced biomass consumption	1.0	ton/pp/yr
Calorific value biogas	22.5	GJ/m3
Calorific value wood ($NCV_{biomass}$), 75%	15	GJ/ton
Calorific value wood ($NCV_{coconut}$), 25%	18	GJ/ton
Average $NCV_{biomasst}$	15.8	GJ/ton
EF - kerosene (10%)	0.0715	tCO_2/GJ
EF - LPG (48%)	0.0613	tCO_2/GJ
EF - electricity (22%)	0.1981	tCO_2/GJ
$EF_{project\text{-}fossil\ fuel}$	0.0802	tCO_2/GJ
f_{NRB}	85%	
Energy and GHG		
Quantity of biomass replaced	100	ton/year
Emissions avoided	107.3	tCO_2/yr
Direct (lifetime)		
Energy substitution	4,375	MWh
Cumulative GHG substituted	1,073	tCO_2

SUMMARY

Direct emission reduction	57,135	
Consequential		
Replication factor (RF)	3	
Cumulative GHG emissions	171,406	tCO_2

Source: own estimates

- Grid emission factor taken from the World Bank Group FY15 GHG Inventory Management Plan
- For the calculation of the emissions avoided due to the use of biogas, the CDM methodology AMS.II-G version 3) - *Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass* is used. The shares of fossil and biomass fuels in the calculation of the calorific value of biomass and for emission factor (EF) of fossil fuels is based on consumption reported in Samoa Energy Sector Review 2017. The fNRB (fraction of non-renewable biomass) = 85% (UNFCC – ERL_12_12_115002). The replaced biomass consumption is based on the assumption of cooking needs of 5 MJ per person per day, which can be supplied by 8.2 kg tons of wood/coconut shells per year or 0.4 m^3 of biogas a day. Based on estimates of biogas production per day in the proposed household and institutional biogas systems at the five projects (around 10 m^3/day on average per site), the number of beneficiaries per project is about 25.
- The wattage used in solar street lighting is taken from the MNRE bidding document for the 300 solar street lights, assuming that the solar PV with LED lamp substitutes for a grid-connected street light using a conventional lamp;
- The estimates do not need the effect of net of CO_2 from trees cut down for feedstock, unless replaced by new plants in cyclic manner. For example, based on 40 kg biomass per tree; plant biomass consumption of 15 ton/day or total of 375 trees/day; and absorption of 23 kg of CO_2 per tree per year, CO_2 absorption loss from feedstock cutting is 3.15 kilotons per year

Box 13 Biogas application in Samoa

Biogas generation relies on anaerobic digestion, which occurs naturally in landfills and in specially designed digesters. Which can generate burnable gas and, at the same time, convert animal waste into sterile, high-quality fertiliser. Biogas has not received the attention that other renewables, solar, wind and hydro, have received in recent decades. This does reflect the continuing drop in investment costs per kW installed (in particular of solar) and also the focus on electricity rather than on heat applications (in households and businesses).

The implementation of biogas in Samoa and other Pacific Islands has so far been limited to just small demonstrations. Biodigesters connected to small piggeries are demonstrated at the Youth With A Mission (YWAM) at their school facilities. Another biogas demonstration has been with household-scale biogas installations at Vaitale (near Apia) using human, food organic and on-site green as feedstock. A third application was installed by the Wellington-based Bioenceptionz in 2013 at Piu villages supported under the SIDS-DOCK programme* with Danish/British funding as a follow-up activity coming out of the regional UNDP/GEF PIGGAREP project. One objective was to show that the invasive Merremia vine can be used as feedstock. Merremia is prevalent in many parts of Samoa (and in many other Pacific Island countries). It is a highly destructive invasive species as it grows over and kills all plant species and trees in what could be (and may once have been) croplands and tree lots. The British support biogas activities at the Samoan Tourism Authority village, Matefale, Apia, with the idea of testing a range of feedstocks (green waste" such as grasses, vines, foliage drop and food waste and, as well, crop residues (such as taro leaves, crop processing wastes, and over abundant crop products with low market value). In short, there are a few examples of biodigester systems in Samoa but results have been mixed with installations abandoned. There have been, to the knowledge of the MTR Consultant, no real independent evaluations of the few biogas applications. Samoa has abundant potential feedstock resource for biodigesters, so the possibility to produce nationally significant amounts of bioenergy in distributed systems at farms (chicken, cows, piggeries), villages and in plantation estates, but the question is how much and how much can be practically used. These feedstocks include crop residues (and potentially crops if they are overabundant and very low price); food and beverage processing residues; invasive and overgrown weeds, grasses and bushes; purpose grown energy crops; food waste; animal waste; and potentially human waste where there are sanitation system problems to be solved.

The IMPRESS has identified a number of sites for biogas demonstration: a) Mapuifagalele (Sisters of the Poor – Elders home), b) Salua village on Manono island, c) Tanumalala Prison (Upolu), d) Sa'asa'ai and e) Vaisala. A description of the possible biogas production at the sites is as follows:

- *Tanumalala* Prison has about 450 prisoners (of which 420 male and 30 female). Current source of energy for cooking (meals are prepared 3 times a day) is wood which is collected from land allocated to the prison. Available feedstock for biogas, apart from human waste, is formed by cow dung (about 70-100 cows produce 700-1000 kg of dung a day). A piggery is planned at the prison and the pig dung would add to the feedstock. Depending on whether the piggery will be added, one or two biogas installations are proposed. For the supplementary water needs of the biogas facility, there is the option of using rain water catchments. A back-of-the-envelope estimate by the MTR Consultant is that 250 kg of cow dung (not all dung is collected) a day produces 7.5 m^3 of biogas (in a digester the size of around 20 m^3).
- *Salu'a village* has about about 500-1000 people. Many households raise pigs (2-4 per household) that are usually penned. The ProDoc mentions that single pig sty could provide for a 1.5-2 m^3 digester producing 1-1.2 m^3 of gas. Some are close to each other, so one biodigester could be served by 3 to 4 pens, providing feedstock for a larger 4-6 m^3 digester. Around 20 small digesters (*note:* biogas production estimate made by MTR Consultant; the cost of a digester is about USD 2500-7500 for a 3-15 m^3 system). The recent IMPRESS assessment refers to the installation of one large digester
- The Sisters of the Poor (Mapuifagalele) nursing home has about 45 residents. It has 15-20 pigs that can produce about 3 m^3 a day with a digester size of about 5 m^3 (*note*: biogas production estimate made by MTR Consultant). Human waste is collected in four septic tanks that at hard to direct to one storage facility. Not having much funding, biogas could help the Sisters of the Poor save spending on LPG for cooking.
- Sa'asa'i is a village on Savaii island. Many families are involved in farming (coconut, cocoa, taro). A biogas facility is planned at a family piggery (currently about 10 pigs) with the gas to be used in the local bakery.
- *Vaisala*. The local hotel in the village has about 30-50 guests every week. Currently near the hotel are about 10 pigs, while the hotel owner has 100 cows. The piggery would need to be reconstructed, while the cow dung would need to be collected.

* SIDS-DOCK is an initiative to promote sustainable energy in small island nations supported by UN organisations and bilateral donors. Source: UNDP Project Document; IMPRESS 2020 Q1 progress reporting; Biogas-in-Poutasi-Village-Samoa (at ceres.org.au; https://sustainabledevelopment.un.org/partnership/?p=7630; IMPRESS Biogas reports (by BEST Co. Ltd; 2020)

4.3.2 Gender and social impacts

While realizing global environmental benefits, as discussed in the previous section, in the form of GHG emission reductions, the project will also bring about local benefits mainly through contributions to the protection of the natural environment through the reduction of fossil fuel combustion-generated air pollution, and proper disposal of biomass waste materials; diversification of the energy resource base of the economy; and, improvement in the country's foreign exchange reserves due to reductions in petroleum products import bill due to substitution of fossil energy utilization by indigenous RE resources.

The Project is designed to enhance the involvement of women in multiple areas, including operation of biomass production and gasification facilities, income generation through PURE and SURE, development, and implementation of capacity building and awareness programs. The Ministry of Woman, Communities and Social Development (MWCSD) will be involved in social monitoring of the demonstration projects to be implemented by the IMPRESS project, in particular, the community-based RE projects, and the monitoring would include the flow of project benefits to communities and facilitate a gender-balanced distribution of benefits.

In general, the project has environmentally sustainable impacts, and it can also potentially generate environmental problems that need to be addressed, in particular concerning the gasifier. For this reason, harvesting plans are being carried out regularly. The recommended biomass feedstock for future biomass-based power generation units will be those that are sustainable (e.g. cutting and re-planting) and can also include biomass waste materials (e.g., agricultural waste). Regarding safety in operations, it is mentioned (in the ProDoc) that the gasifier contractor will be selected, among other reasons, according to known experience in applying all the relevant safety and environmental standards in the engineering and construction (including OSHE aspects) of the gasification unit. The contractor was required to develop a safety and security plan. It is expected that such standards will be maintained during operations.

4.3.3 Ratings of progress towards the objective and outcomes

The table below gives a summary of the ratings of the 'progress towards results', based on the findings presented in Chapter 4. In assessing the progress towards results of the IMPRESS Project at its mid-point, a six-point rating scheme is used:

- Highly satisfactory (HS), no shortcomings
- Satisfactory (S), minor shortcomings
- Moderately satisfactory (MS), moderate shortcomings
- Moderately unsatisfactory (MU), significant shortcomings
- Unsatisfactory (U), major shortcomings
- Highly unsatisfactory (HU), severe shortcomings
- U/A = unable to assess.

Box 14 Evaluation ratings of progress towards results

Evaluation item	Rating
Objective achievement	S
Component 1	S
Component 2	HS
Component 3	U
Component 4	U
Component 5	MS
Overall progress towards results	**MS**

The motivation for giving the ratings mentioned in the Box is summarised as follows:

- Components 1 and 5 can be considered as on-track, although eventually depending on the successful realization planned RE resource assessment, REW technology study, and analysis of the RE target, as well as further elaboration of awareness creation and capacity building activities
- Component 2 has advanced most with the realization of the STEC 750 kW gasifier, implying also that %% of the IMPRESS GEF budget has been spent. However, an assessment of the biogas plants has only just been finalised;
- Components 3 and 4 have not advanced and the further definition and work planning depend on the results of a planned integrated study on biomass, business models, financing schemes, and PUE/SUE.

5. FINDINGS: PROJECT IMPLEMENTATION

This part of the Evaluation Report describes the assessment and rating of the quality of the execution by the GEF Implementing Agency (IA), UNDP, and the national Implementing Agency MEM. Building on the previous Chapter's critical look at project results, an assessment is made of the partnerships established and stakeholder interaction during implementation and the important role of adaptive management. The Mid-Term Report presents an assessment and rating of the project monitoring and evaluation (M&E) plan design and implementation. A special section is dedicated to the budget, expenditures, and co-financing of the SE4All Lesotho project.

5.1 Implementation and management

5.1.1 Management arrangements and adaptive management

- Are adequate project management arrangements in place at project entry? Review overall effectiveness of project management as outlined in the Project Document. Have changes been made and are they effective? Are responsibilities and reporting lines clear? Is decision-making transparent and undertaken in a timely manner? Recommend areas for improvement.
- What is the quality of execution of the Executing Agency/Implementing Partner(s) and the GEF Partner Agency (UNDP) and are there recommended areas for improvement?
- Review any delays in project start-up and implementation, identify the causes and examine if they have been resolved. Are work-planning processes results-based? If not, suggest ways to re-orientate work planning to focus on results?

Management arrangements and execution

The project is implemented through the NIM execution modality with MNRE (Ministry of Natural Resources and Energy) as the project Implementing Partner (IP) with and UNDP being the GEF Implementing Agency (IA) for the project. Samoa's National Energy Coordinating Committee acts as the Project Steering Committee (PSC). The PSC/NECC is chaired by the Minister of Finance. Since NECC has the key responsibility of overseeing the development of the Energy Sector in Samoa, this arrangement sees the project being implemented under existing government frameworks for sustainable energy to ensure effective and efficient project coordination. The CEO of MNRE acts as the National Project Director (NPD). The National Project Director is assisted by a small Project Coordination Unit (PCU) that consists of the Assistant CEO of MNRE's Renewable Energy Division as Project Manager (PM) and a Project Coordinator. Reporting to the NPD, the PCU's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specific constraints of time and cost.

A Technical Advisory Group (TAG) is the strategic decision-making body of the project, providing overall guidance and direction to the Project Manager and approves all major revisions in project strategy and implementation approach, Annual Work Plans (AWPs)

Box 15 Technical Working Groups

Technical Working Groups (per Component)				
	TWG1	TWG2	TWG 3-4	TWG 5
Participating entities	MNRE MCIL MFR STEC MOF EPC NUS	MNRE MWTI EPC STEC MOF SROS	MNRE MAF SBH DBS MWCSD SCB ANZ YWAM BSP WIBDI NBS	MNRE MESC USP-SAFT APTC SQA NUS SROS

and any essential deviation from the original plan, as well as the quarterly progress reports. Four Technical Working Groups (TWG) have been established focussing on one or more project Components that discusses issues and subjects more on an operational and technical level and an effective way of interaction with the main stakeholders. Meetings have been held in an organised and effective manner. The TWG meetings of each component are held in the last month of every quarter. The Technical Advisory Group (TAG) meeting is held in the first month of every quarter, after the TWG meetings.

Delays and adjustments; adaptive management

There were no delays in the commencement of the IMPRESS Project. After CEO Endorsement in June 2017, the Project Document was signed in August 2017 and the project's Inception workshop was held on 31 October 2017. A large part of the project budget has been dedicated to Outcome 2 on the preparation, design, installation, and commissioning of the Afolau gasifier facility and, at mid-term, 87% of the project funds meant for investment support have been spent.

The progress in Component 2 with the utility-scale biomass gasifiers masks the lack of progress on the development of community-scale renewable energy (in particular biogas) linked with PUE/SUE and financing. To the opinion of the MTR Consultant this stems from three reasons. The first is implementation and management. Understandably, a lot of IMPRESS attention has gone to realising the first real gasification operation in Samoa, an important milestone putting biomass on the renewable power generation map[28]. Second, the delays in realising the community-scale biogas and PUE/SUE also originate in a lack of focus and good argumentation in the project design document (Project Document) regarding certain Outputs and activities, as discussed at length in Section 4. Third, rapid advances in the expansion of grid-connected renewable energy capacity realized and planned during 2015-2025 and the approval of the Energy Efficiency Act in 2017, has implied that some IMPRESS activities need to be reconsidered and/or re-designed.

Thus, various activities in the Components 1, 3 and 4 will now be re-assessed, based on the results of a new assignment that integrates studies (that were originally planned as part of Outputs 2.1, 2.2 and 3.1) into one assessment of business models, financing schemes and cost-benefit analysis of RETs and biomass production, business ideas for productive and social uses of RE, as well as energy efficiency applications and technologies. This approach has the advantage the assessment of issues and options of community-based RE is not spread over three Components (biogas: 2; financing: 3: PURE and SURE: 4) but can be looked at in an integrated way. The MTR Consultant appreciates this more holistic approach, provided that it comes with solutions for specific technology-application-beneficiary' combinations.

5.1.2 Monitoring and evaluation; reporting

M&E: design at entry and implementation

The Project Document provided an elaborate structure for Monitoring & Evaluation, which follows the 'standard' M&E Plan with an inception activity (workshop, report), annual reporting (PIRs), project steering committee meetings, periodic status, financial and progress reporting, as well as audits, and field visits. A total of USD 102,000 was allocated, about 3% of the total GEF budget, which is deemed sufficient for this type of project.

[28] The Afolau project has met some initial delays in the procurement. For example, the financial modelling study project for different RE technologies started late. In fact, following then example of the three solar IPPs in Samoa, the question was raised if such detailed financial modelling would have been needed for Afolau rather than going straight to the discussions on power purchase agreement and negotiations of the power sale price.

- Does the project have an effective M&E plan to monitor results and track progress towards achieving project objectives? Review the monitoring tools currently being used: Do they provide the necessary information? Do they involve key partners? Are they aligned or mainstreamed with national systems? Do they use existing information? Are they efficient and cost-effective? How could they be made more participatory and inclusive?
- Examine the use of the project's results framework/ logframe as a management tool and review any changes made to it since project start.
- Examine the financial management of the project monitoring and evaluation budget. Are sufficient resources being allocated to monitoring and evaluation? Are these resources being allocated effectively?
- Examine the financial management of the project monitoring and evaluation budget. Are sufficient resources being allocated to monitoring and evaluation? Are these resources being allocated effectively?
- Were progress reports produced accurately and timely, and did they respond to reporting requirements including adaptive management changes? In particular, assess how well the Project Team and partners undertake and fulfil GEF reporting requirements (i.e. how have they addressed poorly-rated PIRs, if applicable?)

Reporting

Quarterly reports provide a good overview of project progress with detailed information (progress on outputs in the quarter, financial report, TWG and TAG minutes of meeting (if held), technical annexes, work plan for the next period). Unfortunately, the format chosen is not user-friendly with its focus on implementation issues and reporting results per quarter rather than summarising cumulative results. The first annual GEF-UNDP project review reports (PIR) has been drafted (2019) with the 2020 version still pending at the time of the MTR mission. This report details activities and the status of the progress indicators as listed in the project's results framework (summarised in Box 6). The MTR Team concludes that reporting so far has been carried out diligently but that the format of presenting information needs to be improved.

5.2 Stakeholder involvement and communication

- Project management: Has the project developed and leveraged the necessary and appropriate partnerships with direct and tangential stakeholders?
- Participation and country-driven processes: Do local and national government stakeholders support the objectives of the project? Do they continue to have an active role in project decision-making that supports efficient and effective project implementation?
- Participation and public awareness: To what extent has stakeholder involvement and public awareness contributed to the progress towards achievement of project objectives?
- Review external project communication: Are proper means of communication established or being established to express the project progress and intended impact to the public (is there a web presence, for example? Or did the project implement appropriate outreach and public awareness campaigns?)

Stakeholder involvement and partnerships; knowledge management

A list of stakeholders and their relation with IMPRESS is presented in Box 7. Stakeholders from government, NGOs, and universities meet quarterly in the Technical Working Group meetings of IMPRESS. The project will work with local beneficiaries, in particular stakeholders and beneficiaries in the village where biogas systems will be installed.

The project can be found at the MNRE website www.mnre.gov.ws/impress-project/, including some links for business registration. IMPRESS is also at Facebook www.facebook.com/IMPRESSProjectSamoa/ with photos and stories, including the school awareness campaign.

Gender

Furthermore, there has been consideration of all target groups (youth, men, women) during workshops and meetings, although no record was made available on the share of female participants in IMPRESS-related workshops and events. Regarding the gasification demonstration project, the project has reportedly been able to improve the participation of women in project activities (source: PIR 2019). Some gender issues are stemming from the feedstock side. For example, women are involved typically in the replanting of trees and men are mostly involved in the harvesting of feedstock.

5.3 Project finance and co-financing

- Consider the financial management of the project, with specific reference to the cost-effectiveness of interventions.
- Review the changes to fund allocations as a result of budget revisions and assess the appropriateness and relevance of such revisions.
- Does the project have the appropriate financial controls, including reporting and planning, that allow management to make informed decisions regarding the budget and allow for timely flow of funds?
- Informed by the co-financing monitoring table to be filled out, provide commentary on co-financing: is co-financing being used strategically to help the objectives of the project? Is the Project Team meeting with all co-financing partners regularly in order to align financing priorities and annual work plans?

Box 16 Budget and co-financing

	Planned budget (ProDoc)	Revised (Inception)	Expenditures 2017 SAT	2018 SAT	2019 SAT	2020 SAT	Q1-Q2 2020 SAT	Total SAT	Total USD	Share of expenditures
Component 1	329,000	319,000		56,597	121,834	0	46,574	**225,005**	**87,551**	27%
Component 2	772,450	762,450	0	0	0	0	0	**0**	**0**	0%
Component 2 (INV)	3,836,700	3,846,700	0	427,857	7,526,112	0	579,937	**8,533,907**	**3,320,586**	87%
Component 3	337,700	337,700	0	300	10,500	0	138	**10,938**	**4,256**	1%
Component 4	175,950	190,950	0	3,500	750	0	0	**4,250**	**1,654**	1%
Component 5	334,703	334,703	13,915	76,653	409,688	0	18,008	**518,264**	**201,659**	60%
Project management	289,325	284,325	8,475	125,556	95,785	0	45,514	**275,331**	**107,133**	37%
TOTAL - SAT			**22,390**	**690,463**	**8,164,670**	**0**	**690,171**	**9,567,694**	**3,722,838**	
TOTAL USD	**6,075,828**	**6,075,828**	**8,712**	**268,663**	**3,176,915**	**0**	**268,549**	**3,722,838**	**3,722,838**	61%

	Budget line	Planned budget (ProDoc)	Expenditures 2017 SAT	2018 SAT	2019 SAT	2020 SAT	2020 SAT	Total SAT	Total USD
71200	Internat consultant	915,000	0	357,163	422,495	0	37,018	**816,676**	**317,773**
71400	National consultant / Contract-inc	832,700	0	82,888	82,248	0	32,731	**197,868**	**76,991**
71300	Local Consultants		0	47,848	190,614	0	38,134	**276,595**	**107,625**
71600	Travel	134,700	0	13,655	47,956	0	4,791	**66,402**	**25,837**
72100	Contract-company / Equipment	4,041,525	0	56,759	7,281,262	0	526,080	**7,864,101**	**3,059,961**
75700	Training, workshops, conference	70,000	20,918	24,459	82,486	0	34,653	**162,515**	**63,236**
74200	Audiovisual, printing prod. cost	51,000	1,472	53,659	47,535	0	8,771	**111,437**	**43,361**
72200	Equipments		0	36,453	10,014	0	7,993	**54,460**	**21,190**
72500	Supplies		0	17,581	0	0	0	**17,581**	**6,841**
74100/74500	Professional services; Misc.	30,903	0	0	60	0	0	**60**	**23**
	TOTAL - SAT		**22,390**	**690,463**	**8,164,670**	**0**	**690,171**	**9,567,694**	**3,722,838**
	TOTAL USD **0**	**6,075,828**	**8,712**	**268,663**	**3,176,914**	**0**	**268,549**	**3,722,838**	**3,722,838**

Co-financing

(in USD)	Type	Planned	Realised
Government of TL	Grant	38,189,200	38,189,200
(MOF and MNRE)	In-kind	2,250,000	
STEC	In-kind	6,000,000	5,000,000
UNDP	Grant	50,000	
WSCU	Grant	188,862	188,862
EU-GIZ	Grant	1,057,168	
Communities-Biogas	In-kind	50,000	
	TOTAL	**47,785,231**	**43,378,062**

Source: Project Document and data provided by the Project Coordination Unit

An overview of expenditures and realized co-financing is given in Box 16. Given the realization of the gasification demonstration project and its large share in the IMPRESS budget, the overall financial delivery of the Project at midterm is ahead of schedule with approximately 61% of the budget spent. But this reflects the progress concerning the investment and construction of the STEC gasifier facility only (Component 2). There is some progress budget-wise in the knowledge management and communication activities (e.g. consultations and awareness programmes targeting schools in Component 5. The problem is in the Components 3 and 4 that have not progressed at all.

5.4 Ratings of project M&E and project implementation/execution

A summary of ratings is given in Box 17. In assessing 'implementation and adaptive management' of the IMPRESS Project at its mid-point, a six-point rating scheme is used:

Box 17 Evaluation ratings of project implementation and execution

Evaluation item	Corresponding report section	Rating
Adaptive management, management arrangements, M&E, work planning, reporting (UNDP, Project Team, DoE)	Section 5.1.1	S
Stakeholder involvement; communications	Section 5.1.2	S
Budget, utilisation of GEF and co-financing	Section 5.1.3	S
Overall UNDP implementation and implementing partner execution		**S**

- Highly satisfactory (HS), Implementation of all components, 1) management arrangements, work planning, reporting, project-level monitoring and evaluation, 2) stakeholder engagement and communications, 3) finance and co-finance, is leading to efficient and effective project implementation and adaptive management. The project can be presented as "good practice".
- Satisfactory (S), implementation of most of the components is leading to efficient and effective project implementation and adaptive management except for only few that are subject to remedial action
- Moderately satisfactory (MS), implementation of some of the components is leading to efficient and effective project implementation and adaptive management, with some components requiring remedial action.
- Moderately unsatisfactory (MU), implementation is not leading to efficient and effective project implementation and adaptive, with most components requiring remedial action.
- Unsatisfactory (U), implementation of most of the components is not leading to efficient and effective project implementation and adaptive management.
- Highly unsatisfactory (HU), implementation of none of the components is leading to efficient and effective project implementation and adaptive management.
- U/A = unable to assess.

The PCU has worked effectively, as evidenced by the realization of the gasifier facility at STEC, which is reflected in the fact that 72% of funds in Component 2 have been spent. In this sense, the Project has advanced well. Overall, implementation is rated as 'satisfactory'. However, whether this remains so in the second half of IMPRESS will dependent on the progress with respect to the biogas investments of Component 2 and the activities regarding financial support and PUE/SUE (Components 3 and 4) and energy efficiency. Given the late start at mid-term, there is a real risk that even if progress is made, this will not yield satisfactory results on time when the Project will end by August 2022.

6. FINDINGS: SUSTAINABILITY

- *Institutional framework and governance risks.* Do the legal frameworks, policies, and governance structures and processes within which the project operates pose risks that may jeopardize sustainability of project benefits? Are requisite systems for accountability and transparency, and required technical know-how, in place?
- *Environmental and social risks.* Are there any environmental risks that may jeopardize sustainability of project outcomes? Are there any social or political risks that may jeopardize sustainability of project outcomes? What is the risk that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained? Do the various key stakeholders see that it is in their interest that project benefits continue to flow? Is there sufficient public/stakeholder awareness in support of the project's long-term objectives?
- *Financial risks.* Are there any financial risks that may jeopardize sustainability of project outcomes? What is the likelihood of financial and economic resources not being available once GEF assistance ends?
- *Capacity risks.* Have partners and stakeholders successfully enhanced their capacities and do they have the required resources to make use of these capacities?

Sustainability is generally considered to be the likelihood of continued benefits after the project ends. Consequently, the assessment of sustainability considers the risks that are likely to affect the continuation of project outcomes (discussed in detail in the previous Section 5). Many risks are in one way or another related to the "barriers" mentioned in Section 2.1). One can argue that some of the "risks' the Project might face, actually means not being able to lower corresponding "barriers" substantially, thus negatively affecting the likeliness of "sustainability" of the project's interventions. The critical "assumptions" then is that the "internal risks" (i.e. risks that can be mitigated or managed by Project management), and 'external risks' have a low incidence and/or impacts, in such a way that sustainability remains (moderately) likely. The quality of adaptive management (discussed in Section 5.1) is determined by the mitigation response of Project management to these external and internal risk factors as these manifest themselves more intensely and/or more frequently than expected.

In assessing the 'sustainability' of the IMPRESS Project at its mid-point, a simple rating scheme is used:
• Likely (L): negligible risks to sustainability;
• Moderately Likely (ML): moderate risks to sustainability;
• Moderately Unlikely (MU): significant risks to sustainability; and
• Unlikely (U): severe risks to sustainability; and
• U/A = unable to assess.

Three main areas are considered in this section and then rated as to the likelihood and extent that risks will impede sustainability.

<u>Governance and institutional sustainability</u>

- *Country-related (external risks)*

Samoa has ambitious targets regarding the penetration of renewable energy that are formulated in the Samoa Energy Sector Plan 2017-2022 and the Nationally Determined Contribution (including the goal of achieving 100% electricity production from renewable sources) and recent energy efficiency legislation (introducing energy efficiency standards and labelling for several electric appliances. Some of the IMPRESS's outcomes are closely aligned with the outcome as formulated in the SESP regarding renewable energy and efficiency in electricity supply

and use (see Section 2.1). These goals have been firmly supported by consecutive governments so it is not likely that changes in government will change the commitment to these strategic goals.

- *Project-level*

The government counterpart organisation, MNRE, has set up a small, but effective, Project Coordination Unit (PCU) and made available own staff for project management (the Project Manager is also Assistant CEO of MNRE's Renewable Energy Division) ensuring ownership in project management. The Project's Technical Advisory Group meets frequently together with the thematic Technical Working Group with consistent participation of representatives from the various ministries, financial and business organisations, and educational and research institutes.

- *Rating*

The country has very pronounced sustainable energy objectives with sustainable energy plans and legislation. The MTR Consultant observes regarding IMPRESS regular coordination and discussion between government entities, NGOs and institutes and private sector in the TAG and TWGs. The 'governance and institutional capacity' is judged as '*likely*'.

Socio-economic and financial sustainability

- *Country-level*

Regarding larger biomass-for-energy investments, sustainability depends on government or government-owned agencies and companies (such as EPC or STEC) making financial resources available. The website of MPE (the ministry responsible for the state-owned enterprises EPC and STEC) mentions, for example, "EPC plays a crucial role in the development of Samoa's economy and operates under the Energy Sector alongside other government bodies, striving to provide efficient, affordable and reliable electricity supply in order to achieve the Sector goal of "Sustainable energy supply." As part of the Master Plan to achieve 100% RE in 2025, a bid was issued for IPPs to finance, develop and operate additional renewable energy, which may result in the addition of about 77 GWh per year thus bringing total renewable energy penetration to 90% of country's total electricity demand in 2023. This is indicative of the government's financial commitments for utility-scale renewable energy investments. However, there are no investment plans or financial schemes mooted for distributed renewable energy at the moment.

- *Project level*

There is a willingness of some banks or lenders to include lending with a sustainable energy component. The financial mechanism or scheme proposed to be supported in Component 3 has not materialised and whether this will be realised or even proposed will partly on the results of the planned assessments on a) biomass technologies, business models and financing, b) RE for productive and social uses (PUE/SUE) biomass technologies and c) renewable energy technologies and energy efficiency.

- *Rating*

Although the government-support for financing of investment in renewable energy by small investors (bioenergy, distributed RE) is not certain, the Government has been investing substantially in utility-scale power production with renewable energy. In general, the MTR Consultant regards 'financial sustainability' as '*likely,* regarding Re in general, but '*moderately unlikely*' for bioenergy or small RE investments. Regarding 'socio-economic' sustainability it is difficult to make any statement on the likeliness of sustainability, as long as IMPRESS has not finalised a planned survey on consumer awareness on energy efficiency and of the before-mentioned assessment on renewable energy technology, energy efficiency and PUE/SUE.

Environmental and public health sustainability

- *Country (external risks)*

The country has been subject in recent years to natural disasters such as flooding of coastal areas and cyclones. For example, cyclone Evan that caused considerable damage to the road, water, and power infrastructure. Such events can have disruptive effects on projects as IMPRESS by causing delays in scheduled activities and possible

damage to works supported by the project. Also, Samoa is no stranger to pandemics. The Spanish flu killed almost one-fifth of the population in 1918-19. Just recovering from a measles outbreak in the last quarter of 2019, the country has been affected by the worldwide COVID-19 pandemic, imposing travel to and from and within and other restrictions. International travel is still closed (hence the MTR Consultant could not undertake a mission to Samoa). The situation has negatively affected many sectors, such as tourism. It is not possible to forecast the occurrence of such events, but if they do happen, they can have a significant impact.

- *Project-related*

The COVID-19 situation negative impact on the activities of the project, where several activities have been delayed and others had to be re-planned. However, as in other countries, the use of new technologies for holding meetings (Zoom, etc.) can facilitate online training sessions and collecting information, among others.

- *Rating*

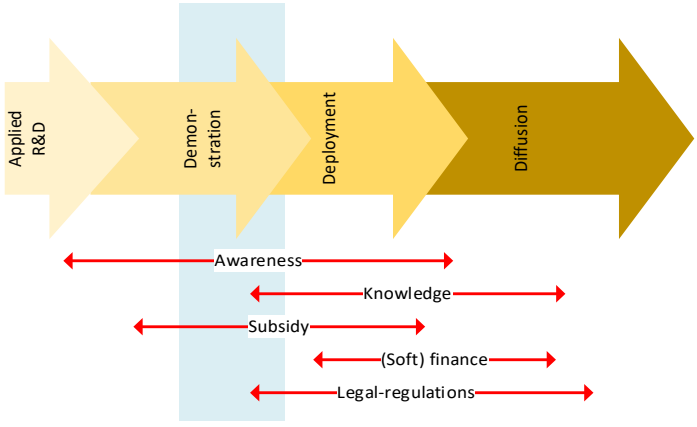
On the environmental impacts of the gasification plant (at Afolau), the project addresses the issues as set out in the IMPRESS 'social and environment screening' plan. The environmental rating is *'likely'*.

Technology and capacity sustainability

- *Biomass for power and non-power application*

While this mid-term review focusses on bioenergy in Samoa, the issue of sustainability should be seen in a wider context of technology innovation and geographical context. The timeframe of subsequent phases of more widespread deployment let alone larger-scale dissemination of the biomass-for-energy technology is much larger than typical period of 4 to 5 years of a GEF project like IMPRESS. In this respect, it may be too early to tell to have a judgment on technological sustainability.

Box 18 Technology innovation



Grid-connected renewable energy (solar, hydro) capacity is rapidly increasing and may reach 90% of energy supply if recent expansion plans go ahead, in other words, technology sustainability of utility-scale RE is not in doubt. The IMPRESS project has strategic importance to demonstrate the successful functioning of biomass technology in particular and at the same time embedding 'bioenergy' in the country's sustainable energy planning to achieve the 100% target. In the past, the biomass resource has been investigated but has largely remained in studies and applications limited to a few household and community biogas plants with mixed results. This situation resembles the 'chicken and egg' question. Until there is some progress in proving the effectiveness of biomass-for-energy then the Government will not be tempted to set up a biomass energy plan backed up with sufficient funds. In this sense, the Afolau bio-gasification facility is an important step forward

- *Rating*

On the other hand, biomass-for-energy cannot be deployed seriously unless adequate funding for investment is made available as part of an overall renewable energy planning and enabling framework (distinguishing between larger facilities for power production and decentralised and heat applications) with continuing capacity-building support. If biomass initiatives continue to be deployed on a project-by-project basis, the danger is that the 'wheel gets invented' again each time a project is set up supported by yet another donor. A recommendation in the next section is therefore to have 'biomass-for-energy' plan formulated as a subset of the overall renewable energy planning. Meanwhile, the MTR rates technological sustainability of bioenergy as '*moderately unlikely*', while technology sustainability for RE as a whole is '*likely*'.

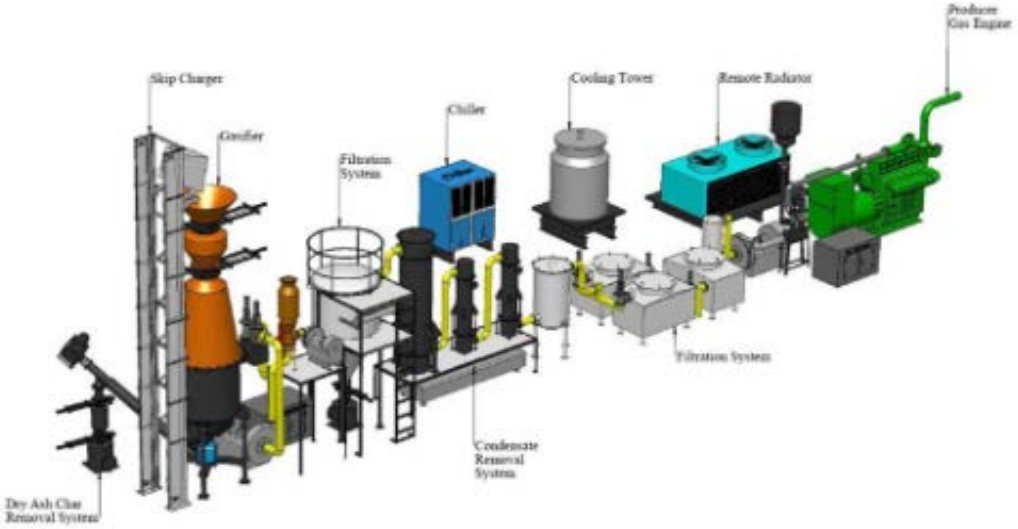
Box 19 Biomass gasification in Samoa

Biomass gasification is a process of converting solid biomass fuel (wood/ wood-waste, agricultural residues, chicken manure, coal, solid municipal waste, etc.) into a gaseous combustible gas (called producer gas or syn-gas) in a series of thermo-chemical reactions. A limited amount of oxygen or air is introduced into the reactor to allow some of the organic material to be "burned" to produce carbon dioxide CO_2 and energy, which drives a second reaction that converts further organic material to hydrogen and additional carbon dioxide CO_2. The gas (consisting of nitrogen N_2, CO and H_2) can be used replacing fossil fuels in thermal applications, retrofitted into devices such as ovens, furnaces or boilers and in gas turbines for electricity generation. One advantage is that, if pre-treated and dried, can use a range of low-quality feedstock, but is more energy-efficient than direct biomass combustion. The gas can be cleaned from tars and particulates to be used in generators.

Sorting of coconuts and husk waste after extraction of copra meat
Source: Feasibility study gasification (2011, SME Cambodia)

Gliricidia trees have overrun the plantation

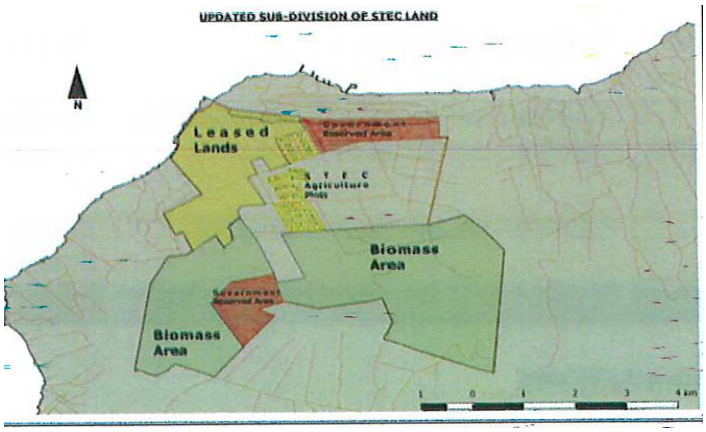
In Samoa, a feasibility study was carried out in 2011, commissioned by MNRE, on application of bio-gasification. One site investigated in the study was the STEC plantation at Afolau near the airport on Upolu. The STEC coconut plantation consists of 2700 ha. Years of low maintenance has left a large quantity of overgrowth biomass available for clearing on about 1200-1800 ha. The overgrowth is mainly Gliricidia and other invasive species that are choking the plantation area and reduce coconut growing and livestock-raising activities. If cleared, the overgrowth biomass is estimated at 35-50 kilotons. Additionally, fast-growing regenerative trees species can be used as well as coconuts shells and husks. The 2011 study mentions that he annual potential sustainable biomass from replanted regenerative species between the coconut tress was estimated in the study at about 10 kilotons a year. Additionally, the husks and shells remaining from coconut oil pressing can be used as feedstock, estimated at 40 tons a week (wet weight). In IMPRESS four species were analysed (Peaock plume, West African rubber tree, Panama rubber tree and coconut shells).



Source: Ankur Scientific Technology

Box Biomass gasification in Samoa (cont'd)

Planting seedlings on STEC land



A 750 kW gasifier will need about 6.5-8.5 kilotons of dry biomass a year which could be provided for by the cleared biomass during the first 4-5 years and thereafter from the systematically harvested feedstock. The Indian-based company Ankur Scientific Technology, which has sold and installed over 1000 gasifiers in 35 countries was awarded the contract to build the gasification facility at Afolau. Currently, the systems started operations in February at 8 hours a day but is planned to work full-time in the near future. EPC will purchase all the electricity produced by the gasifier.

The PPA for the biomass gasification demonstration project was recently concluded yet. The feed-in tariff aimed at is WST 0.50/kWh (or USD 0.20/kWh), in accordance with current regulations. The 2011 study mentions that the cost per kWh generated of a 500 kW gasifier-generation facility would be about USD 0.162/kWh and have a 9% IRR, assuming a biomass price of USD 35/ton and electricity sales at USD 0.24/kWh.

Sources:
QPR Q$ 2019, Feasibility Study for a Biomass Gasification Power Plant in Samoa (by SME Cambodia, 2011); www.ankurscientific.com;

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The IMPRESS project is now about 2.5 years under implementation with still about 2 years to go. Regarding **implementation,** the MTR Consultant observes that there is a small but effective Project Coordination Unit integrated with the Ministry of Natural Resources and Environment with the Assistant CEO of its Renewable Energy Division also acting as Project Manager with other staff involved. It has an active group of stakeholders participating in the Project's Technical Advisory Group and the four thematic Technical Working Groups that have been created. In terms of budget expenditure, the Project is ahead of schedule with 61% of the project budget disbursed. Implementation thus is rated as "**satisfactory**", although noting that there is a lack of implementation progress in two of the five project components.

The bulk of project funds have been spent in Component 2, resulting in the construction and commissioning of the biomass gasifier at Afolau on STEC lands and the conclusion of a PPA with EPC. This is the first large bioenergy project in Samoa and therefore presents an important milestone in bioenergy promotion. The achievements regarding gasification contrast with the advances in the community-scale biogas installations at five sites (also part of Component 2) and the development in general of productive and social uses of energy (PURE/SURE) in rural areas (Component 4). Some activities have to be redesigned in a way that will not penalise the overall project achievement.

Some of the delays can be explained by the project planning. Given the relative importance of the gasification, the activities (mainly in Component 2) have been given priority in the first two years of IMPRESS, while work plans indicate that the activities related to small-scale biomass (biogas, community PUE/SUE) have been planned to start later in the implementation schedule. Second, new developments have occurred that lead to a need for re-thinking, in particular regarding energy efficiency. Approved in 2017, the Energy Efficiency Act brings the introduction of energy standards and labelling for some electric appliances (refrigerators, lighting, air-conditioning), so other activities need to be considered (for example, putting more emphasis on EE promotion, or including other appliances under the EE Act) as well as expansion to other sectors (e.g. land and marine transport). In Component 2, activities on the issue of integration of variable sources (such as solar and wind) are addressed by EPC and the activities in Outcomes 2.1 and 2.3 are implemented without noticeable IMPRESS project involvement and are to be considered as IMPRESS baseline. Component 5 has progressed by hosting or facilitating workshops and events, awareness activities in the media, and a school awareness programme. As activities on PURE/SURE in the Components 3 and 4 have stalled, so have the awareness and capacity building activities on PURE/SURE.

As a third factor, the delays may be explained by a lack of good train of thought in the **project design** regarding small-scale biogas and PUE/SUE development and the role of financing mechanisms to promote EE and PURE/SURE. The Project Document dedicates 44 pages detailing outputs and activities that seem to suggest completeness but in reality, is often beating around the bush. For example, only in a few places, hidden in the main text, the gasifier at Afolau is mentioned as such an and the five sites of the biogas projects are only referred to once. This is remarkable as over 60% of project funds go to supporting the construction of these facilities. The same vagueness surrounds the financial scheme and the nature of "PURE/SURE' without detailing how financing can help realise biogas (or other RE in rural areas) with associated productive uses in a holistic way and how financing can help realise EE in buildings, or indicating well what are the financial needs of specific target groups that can range from low-income rural dwellers to buildings owners and tenants, and small to larger businesses.

The MTR Consultant gives ratings for '**progress towards** results' that vary considerably by **components**. Component 2 is rated 'highly satisfactory' (despite the delayed start of biogas), Components 2 and 5 are rated

'moderately satisfactory', while Components 3 and 4 are judged as 'unsatisfactory' (as most activities have not even started). This gives an overall average of '**moderately satisfactory'**. With Component 2 dominating in terms of budget, one can also conclude that the larger part of the budget has been spent as planned. Due to the size of the gasifier-related activities, the overall **objectives** of avoided greenhouse gas emissions have already been met as well. This also justifies giving an overall **'moderately satisfactory'** rating regarding the **progress towards results (components and objective).**

Regarding sustainability, there is a strong commitment by the Government as evidenced by having the ambitious 100% target of renewables in power generation. Regarding energy efficiency, Samoa has made progress with the approval of the EE Act in 2017 and the extension of regulations to more appliances is mooted. While focus in utility-scale renewable energy has been on hydro and solar, biomass offers an interesting opportunity for diversification of energy supply. The Afolau gasifier forms an important milestone for commercial bioenergy in Samoa. However, there is no clear bioenergy programme (as part of the overall renewable energy planning) with plans for specific investments in more biomass-for-power capacity and how funds can be mobilised (other than from the international community). Regarding small-scale investments, such as for rural productive uses or energy efficiency improvements in buildings, other countries in the region (such as Palau and Fiji, see Box 20**)** have attempted to set up sustainable energy financing facilities, but this has not been done so far in Samoa.

At the moment **sustainability** is judged as **likely** for utility-scale renewable energy, but **moderately unlikely** for bioenergy and small RE investments. If bioenergy become an integral part in renewable energy planning and some incentives/financing/support can be institutionalised for sustainable energy investments by communities, businesses and/or in buildings would have been formulated, the rating could be changed (at terminal evaluation) into 'moderately likely'.

7.2 Recommendations

Corrective actions for strategy and programming of the project.

1. **Re-draft the list of outputs and outcome indicators**
   Responsible: UNDP, MNRE, PCU

The current framework of outcomes, outputs, and activities needs to be revised with baseline activities that are clearly separated from GEF-incremental, and selecting technology-application-target group combinations to focus on within the overall GEF-approved framework. Some outcome progress indicators need to be redefined as well. The MTR Consultant has therefore proposed a revised list outputs and outcome indicators (see Box 3 and Box 22) with the project Components on the vertical axis (as in the project's results framework) and major thematic areas on the horizontal axis, namely a) sustainable energy policy, b) utility-scale RE (bio-gasification), c) community-scale RE for PUE/USUE (biogas for on-site heat applications), d) energy efficiency and integration of RE in buildings (and other sectors).

The biogas activities need to be more clearly linked with PUE and SUE in these communities. The MTR Consultant hopes this brings more focus on certain technology-target group combinations. Examples are larger-scale bioenergy (biomass gasification), small-scale bioenergy (biogas application in rural communities linked with local development), and application of energy efficiency and renewable energy (e.g. rooftop PV, solar water heating) in buildings. Financial support schemes need to address the real needs of specific technology-application-beneficiary combinations and build on existing schemes. It is premature to consider a financial mechanism (with a bank) for the cluster formed by biogas, rural PUE and SUE. At this stage, these applications have not been (commercially) proven in this area and, given the income levels of beneficiaries, grant support may be more appropriate. For EE and RE integration in buildings and (commercial) productive uses, a financial mechanism might be an option, provided these go hand-in-hand with favourable government regulations (e.g. net-metering).

Proposals for future direction

2. Work plan for IMPRESS and the CTA

Responsible: MNRE, UNDP CO, UNDP RTA, PCU

Due to the emergencies in Samoa (e.g., COVID-19), the evaluation of candidates for the post of CTA was delayed. The CTA was recently appointed[29] and will be instrumental in helping to (re-)define and implement activities in which the project has been lagging, notably in the area of community-scale biomass and related productive and social uses, and energy efficiency. In this respect, it is suggested that:

- The CTA will audit the Project based on the originally planned outcomes/outputs and scheduled activities (as given in ProDoc and in the work plan mentioned in the latest QPR);
- The Project, UNDP CO and UNDP RTA have a discussion based on 1) the CTA's audit of originally planned outputs/activities, 2) results of a planned integrated study on RE and EE[30]; 3) the suggestions given by the MTR consultant for re-drafting the list of 'outputs and outcome indicators', presented in the Boxes 3 and 22
- For the remaining implementation period with the IMPRESS budget remaining of about USD 2.5 million, the MTR recommends that the re-drafted outputs have activities that are well-described in a budgeted work plan be made for the remaining 2-year period of with a clear list of remaining activities and deliverables to be produced.
- Last, but not least, the CTA could take a lead role not only in revising activities, but also in having responsibility for implementation with an agreed timeline.

Proposals for future direction

3. Topic-specific recommendations

Responsible: PCU, MNRE

When re-drafting the IMPRESS work plan for 2021-2022, the following recommendation can be taken into account:

a) The role of biogas. The Piu project (installed before IMPRESS started) has not been functioning and reasons should be incorporated in the study together with recommendations on the way forward. One needs to look very critically add the role of community-level electrification and its competitiveness and need for IMPRESS support, in view of the fact that almost 100% of Samoa is supplied with electricity;

b) Expanding biomass for heat applications (replacing fuels) to villages must be approached too with caution because of the lack of capacity in villages, sustainable supply of feedstock, economy of scale, and competitiveness concerns;

c) Study and discuss issues and options in recent IPP developments (apart from Afolau, the solar IPPs) and lessons learnt for future IPP development. This may serve as a guideline for the planned grid-connected solar PV development, as well as RE additions beyond the period 2023-25;

d) Initiating studies and discussion on efficiency and fuel use in marine and land transportation and needs for financial and technical support;

e) The MTR feels that it is premature to consider a financial mechanism (with a bank) for the cluster formed by biogas, rural PUE and SUE. At this stage, energy applications in this area are far from being commercially viable and, given the income levels of beneficiaries, grant support is likely to be more appropriate. It is suggested that the above-mentioned 'integrated study' under CTA guidance explores other 'energy and financing' options,

[29] Fonoti Perelini

[30] An integrated study is planned on a) business model and financial schemes for the sustainable supply of biomass resources (production, harvesting, processing and supply of biomass for power and non-power uses), b) cost-benefit of RE technologies, integration into the existing EPC grid, and role of decentralised RE power generation, c) energy efficiency.

such as a financial mechanism for EE and RE integration in buildings and (commercial) productive uses in combination with the introduction of appropriate government regulations (e.g. on net-metering or fiscal incentives for 'green' investments as an expansion of regulation un EE Act or Energy Bill).

In this respect, the new CTA may want to add to the tasks a review of international experiences (in particular in the Pacific region, see **Box 20**) on the design, establishment, and operation of sustainable energy financing schemes to promote RE and EE. Taking this into account, the Outputs of Component 3 need to be revised and re-drafted. It should be noted IMPRESS should follow the guidelines of UNDP Programme and Operations Policies and Procedures (POPP) regarding the use of 'micro-capital grants' for credit and non-credit purposes and the regulations regarding 'performance-based payments' (PBP). At the time of IMPRESS formulation, this PBP was not yet been approved. The Project/CTA or a consultant should investigate the need and options for using PBP-type schemes in IMPRESS. Even if it is not possible for such a financial mechanism to become operational in the IMPRESS period, the Project can lay the foundation by means of concrete proposals for post-IMPRESS implementation.

Corrective actions for implementation and monitoring of the project

4. Make more 'easy-to-read' reporting.

Responsible: PCU

The results of the Project are reported on in the Quarterly Reports that, apart from the progress reporting, comes with Minutes of TAG and TWG meeting, annual/quarterly work plans, and technical reporting on subjects that are of interest in the particular quarter. However, the QPRs are not accessible to outsiders. Even if available on the web, the information on progress is be scattered over the multitude of QPRs and annexes. It is suggested that drafting of the next PIR (for UNDP/GEF internal reporting) is accompanied with an 'annual progress report' for 1) internal readers which gives a summary of a) concise narrative of key results in the particular year and a summary on progress per component in general, b) overview of planned actions and priorities for the coming year(s), and 2) for external readers a summary with success stories and highlights as well as issues and lessons learnt. To avoid having to write different annual reports two times a year, it is proposed that the timeframe of the 'annual report' coincides with that of the PIR. Many UNDP/GEF projects produce such reports. For example, the Nepal UNDP/GEF RERL project has been drafting quite detailed annual reports (see http://www.aepc.gov.np/rerl/public/).

5. Project transportation

Responsible: UNDP, MNRE

The Project has indicated the need for a project vehicle. Having this type of mobility will be more important now the project will shift to small interventions at various sites (e.g., the biogas sites) and to do M&E.

Proposals for future direction

6. **Sustainable energy and bioenergy planning**

Sustainable energy master plan (with bioenergy component)

Towards the end of IMPRESS, have a consultancy assignment (guided by the CTA and project management) to formulate a "renewable energy master plan, with a separate section on bioenergy". The RE master plan would build on the results of the before-mentioned integrated study (see point 4) and the latest expansion plans that would boost electric energy production from RE to about 90%. The bioenergy section should cover opportunities at least in the two main areas, a) larger-scale power generation by IPPs for the grids on Upolu and Savaii (gasification or larger-scale biogas for power generation), and b) small-scale biomass for heat applications in agrobusiness, tourism facilities and social services (biogas, other). The national bioenergy action plan should cover short, and medium-term with targets aligned with the current SESP 2017-2022, EPC's Power Plans, and Samoa's longer-term development goals and come with an operational plan indicating institutional responsibilities and budget.

Box 20 Sustainable energy financing in the Pacific region

This text box describes a number of recent experiences with sustainable energy financing, in Palau and in Fiji that could be of interest for replication in Samoa, adapted to its particular circumstances.

The Palau Energy Administration has set up the following sustainable energy schemes:

- Under its Energy Efficiency Subsidy Programme (EESP), the National Development Bank of Palau offers a subsidy to new home owners who install energy efficiency measures. The subsidy funds for this program are from the Governments of Italy and Austria, managed by IUCN. The bank provides subsidies to the borrower ranging from a minimum of USD 3000-10,000, depending on the type and number of features selected by the new home owner. Home owners will have a range of energy saving options to choose from energy saver lights and using energy star appliances to using tinted or high-performance glass, solar water heaters, hot water piping insulation, exterior window shading or awnings and more. In terms of initial costs, the energy-efficient house could cost 2% to 10% more than a house without energy efficient features. However, applicants pay less in electricity bills each month and plus the subsidy this is usually more than enough to offset any increase in mortgage payments;
- A spin-off of EESP is the RETRO-Energy Efficient Subsidy Program. Under this program, a micro finance loan with a 6% interest and 5-year term with a maximum of up to USD 10,000 loan is available for the renovation to upgrade and improve existing homes or business, with subsidy of up to USD 5,000.00 available for specific energy efficient measures that are incorporated to the building during the renovation. Funds for our RETRO-Energy Efficient Subsidy Program-are from EU under the regional NorthRep project managed by SPC (with participation of Palau, FSM and RMI);
- To check on the results of the EE loan programmes, an urban household survey was organised which can be downloaded from http://palauenergyoffice.com/documents/.
- Renewable Energy Subsidy Program (previously called REFW) NDBP provides financing for the purchase and installation of renewable energy equipment for homes and businesses. Eligible under this program are, on-grid solar PV systems, off- grid solar PV systems and solar hot water systems. Grant funds from GEF through the Palau SEDREA project provides a subsidy for a portion of the total cost of purchasing and installation of the RE system. The other portion for the cost of the complete installation is provided through a low interest loan at 6%, with loan terms of up to 20 years from the Bank. Regarding on-grid PV, it was important that in 2012 Net Metering Act was passed.

In Fiji, the World Bank is supporting the Sustainable Energy Financing Project (SEFP). Under the SESP, loans can be provided through participating financial institution (PFIs), currently FDB or ANZ Bank, for renewable energy and energy efficiency. Products that qualify are solar PV, pico-hydro (up to 5 kW), coconut oil fuel (used in generators up to 100 kVA), wind turbines (less than 5 kW for grid-connected and 100 kW for off-grid systems), energy efficiency (fluorescent or LED; power factor correction) and solar water heaters. A mid-term review (2016) found that the participating banks had lent approximately USD 22 million to approximately 40,000 individuals and small businesses to support investments in renewable energy and energy efficiency of over USD 40 million. Under the programme, 50% partial guarantee the repayment of an agreed percentage of each loan by a borrower for an investment in the before-mentioned sustainable energy categories. The credit guarantees guarantee the repayment of an agreed percentage of each loan made. This allows the loan to be paid back into more manageable amounts for the borrower and at lower interest rate.

Sources: The World Bank Sustainable Energy Finance Project (P098423); https://www.iucn.org/content/model-energy-homes-palau; http://palauenergyoffice.com/ndbp-loan-programs/

The Plan should provide suggestions for pilot project activities (e.g. second gasifier facility and biogas for PUE) as well as guidance to prospective IPPs on incentive schemes (feed-in tariffs, fiscal measures) and incentives for small-scale schemes with special attention for rural communities, youth employment, and gender.

Bio-energy replication

Some decades ago, Samoa used biomass for copra drying for producing steam for coconut oil production, for electricity production from wood product manufacturing waste along with steam production for timber drying.

This type of biomass energy production was abandoned as coconut export market declined and natural resources protected against logging. Biomass is no longer used for commercial energy production. The formulation of the '100% renewable energy' target led to reconsider the use of biomass for energy, provided that feedstock can be produced sustainably and reliably. The realization of the biomass gasifier at Afolau is an important milestone.

The next step is replication. The 2011 feasibility study on gasification mentions five sites as having potential for biomass production, harvesting, and gasification on both Upolu (Pupu Pué National Park, apart from the STEC plantation) and Savaii (three sites). As in the case of the STEC plantation, these areas could be cleared of the overgrowth of invasive species to be replanted in an organized manner with fast-growing tree species to ensure a predictable supply of woody biomass. The total production of the five sites was estimated at 37,347 tonnes of dry wood a year (on a total area of 1,248 ha, of which 10,800 tons a year on the STEC coconut plantation.

Although the IMPRESS project does not have the funds to develop a second scheme as Afolau, nonetheless, a pre-feasibility study or project concept formulation could be undertaken for another site (e.g. Savaii is being considered for such a site) to be offered for further development post-project by project investors with financial support from development partners. Based on the results and experiences with the five biogas systems and outcome of the studies planned on business models for local biogas systems with productive uses, follow-up activities can be designed, including a government-enabled technical and financial support schemes for integrating small-scale bioenergy production (and other renewable energy) for productive and institutional uses.

IMPRESS can generate a lot of useful information and knowledge on bioenergy, through RE and biomass resource assessments, and documenting the experiences with the gasification project and community-scale biogas for PUE/SUE. To ensure that these will not remain loose ends by the time IMPRESS ends, one recommendation is to formulate a "*bioenergy action plan for Samoa*" as part of an overall "renewable energy master plan".

Energy-efficient appliances

Regarding energy efficiency, it is important to have appliance **energy efficiency** standards and labelling to achieve market transformation towards higher energy-efficient models. The success of mandatory standards (MEPS) depends on having an effective MVE system, i.e. monitoring (i.e. verify product efficiency), verification (i.e. verify declarations of conformance); and enforcement (i.e. actions taken against non-compliant suppliers) of the regulations. The IMPRESS project can contribute to the capacity strengthening of monitoring, verification, and enforcement (MVE) by means of workshops and seminars and sharing of experiences and skills in other countries.

Second, having accurate market information will be needed to redefine the energy efficiency standards and labelling (EE S&L) categories (in future revisions) according to a range of products available on the market. Apart from assessing awareness and knowledge and capacity strengthening on energy efficiency (as planned under IMPRESS), it is important to have accurate market information to be able to evaluate EE S&L regulations on existing appliances. After the first introduction of EE S&L (for refrigerators, A/C and lighting) some stocktaking may be considered by carrying out a market assessment. The results of this assessment may influence the formulation of IMPRESS (and future) awareness and media campaigns on EE, training needs (retailers, importers, Government staff, adding new appliances under the EE S&L regulations and of possible incentives and financial-delivery mechanisms. Possible elements of such a market assessment are given in Box 21.

Box 21 Energy efficiency appliances market assessment

A. Criteria, scope, methodology, sampling
B. Appliance demand and energy consumption
   - Consumer profiles (socio-economic; urban/rural)
   - Purchase decision-maker (gender-sensitive); attitudes, preferences and frequency in appliance purchase; knowledge on prices, lifetime and energy consumption; perception of quality of electricity supply; perception of street lighting), average use per day of appliance (as applicable)
   - Number of lighting points and appliances; type, brand and power consumption; sales outlets
   - Aggregate data on stock (installed appliances at homes/buildings lighting points) per type and power; annual demand, energy consumption

B1. Residential sector (low/middle/higher income; urban/rural)
B2. Public buildings (offices, schools, hospitals, etc.) and street lighting
B3. Commercial-industrial buildings

C. Historical demand and forecast of appliances
   - Imports and supplier analysis
D. Capacity building and awareness raising needs
E. Cost analysis, comparison EE with conventional products
F. Projections of appliance and lighting products market development;
   - Scenarios and substitution potential
   - Energy savings, GHG emission reduction and peak load demand reduction

7.3 Lessons learnt

Sustainable biomass can be a source of electricity production and can play an important role in the energy mix

The example of Samoa shows that commercial-scale biomass-for-power can play an important role in the energy mix as a non-intermittent source of renewable energy alongside the variable sources of solar and wind, i.e. if the feedstock supply can be guaranteed on a regular basis. However, should be seen in a wider context of technology innovation and geographical context. In this respect, the implementation of biogas in the 2010s in Samoa forms an example of a number of small donor-supported interventions without much interrelation. Thus, in the end these did have 'mixed' results due to a lack of technology delivery infrastructure supported by government targets and planning. The timeframe of subsequent phases of more widespread deployment let alone larger-scale dissemination of the biomass-for-energy technology is much larger than the typical 3-5 year of a technical assistance project. The momentum gained should not be lost and that bioenergy projects are replicated and interventions take place within the framework of a nationally-endorsed bioenergy plan.

Project management and implementation

The project has gone through a learning curve with initial delays. For a project, such as the gasification facility, it is important to have a) a good experienced project manager / engineer got involved and went to task to (ii) good tender and procurement methods with tender information that is adequate to attract bidders; (c) selection of a reputable and contractor/designer/manufacturer to build the facility, in which (d) contracts (with clear milestones) and construction are well-managed right from start to completion and commissioning, based on (e) a well-planned project design, study, planning, and selection of site, technology, plant concept, and partners for project and decision making.

Box 22 Suggestions by MTR for adjustments in the project outputs and activities for consideration by UNDP and MNRE/Project

Objective	Indicators
Improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa	A1. Cumulative (direct) electricity generation using RE resources (*from RE-based energy systems that are assisted with GEF resources during the IMPRESS Project implementation period*) Baseline value (BL): 0, Midterm target (MT): 28 GWh; End-of-Project (EoP): 86 GWh[31] A2. Cumulative (direct) GHG emission reduction (as a result of energy savings/substitution) (BL: 0; MT: 19 $ktCO_2$; EoP: 57 $ktCO_2$) B. Number of direct beneficiaries) of project interventions (newly added indicator) Baseline: 0 At MT: 1370 households (benefitting from solar street lighting); At EoP: 1370 households (street lighting) and 1050 households (gasifier)[32]

Components	Sustainable energy (biomass and non-biomass)	Investment in biomass for power (gasification)	Investment in community-based biogas and PURE/SURE and	Energy efficiency (and distributed PV applications)
1. Enhancement of renewable energy policy formulation and implementation *Indicators:* C. Number of approved and enforced policies that support and incentivize investments in RE (and EE) development and utilization	**Output 1.1** Within SESP and as part of the Energy Bill, established planning and legal-regulatory framework for renewable energy (power and non-power) • Review of NGGAS • Review of STEC Act and biomass feedstock management • Inputs into new Energy Bill (incl. revised RE target and integration in EPC grid), incorporating results of Output 1.2 and 1.4 • Training needs assessment on electricity sector planning • Develop guidelines for RE investors and developers		**Output 1.4** Formulated policy measures to incentivize communities and the private sector for rural and small RE technologies (based on Output 1.2) • Public consultations and stakeholder meetings; • Study with recommendations on renewable energy policy and fiscal and non-fiscal incentives	**Output 1.5** Expanded legal-regulatory framework for EE and distributed RE (incl. incentives) • Gap analysis in current EE Act and develop new regulations proposals, incl. incentives (for newly added appliances and equipment; incorporating

[31] See also Box 9. Mid-term: installation of 750 kW gasifier (operating 1/3 of time at 80% of capacity) and 300 solar street lights, avoiding/substituting 56 gigawatt-hours (GWh) over the equipment's lifetime with lifetime GHG emission reduction of 39 kilotons of CO_2; EoP: 750 kW installed gasification capacity, 300 street lights and five installed community/institutional biogas projects, avoiding 80 GWh over the equipment's lifetime with lifetime GHG emission reduction of 51 ktCO2;

[32] Since the gasifier produces to the grid, one cannot say which households get RE and other energy. One can say that the gasifier will produce 3942 MWh per year which is about 2.57% of Samoa's electricity production in 2017/18. Assuming that,proportionally, the gasifier benefits 2.57% of EPC's 40,000, which is about 1,050 households (clients).

Components	Sustainable energy (biomass and non-biomass)	Investment in biomass for power (gasification)	Investment in community-based biogas and PURE/SURE and	Energy efficiency (and distributed PV applications)
(BL: 0; MT: 0; EoP: 1)[33] D. Number of approved and enforced regulations that support EE (and EE) implementation in Samoa under the Energy Bill (BL: 0, MT: 1; EoP: 3)[34]	**Output 1.3** Renewable energy (and bioenergy) master plan for increased performance and stability in view of RET targets (incorporating results of Output 1.2) • Electricity demand and supply and recommend optimal power generation portfolio, indicating the role of variable and non-variable renewable energy[35]; • Plans for replication of biomass-based power o Assessment of previous proposals on gasification or biogas for power, including previous experiences o Stakeholder consultation o Develop plan and pre-feasibility for post-project biomass-for-power projects • Use of RE in non-power applications (biogas, PUE/SUE; solar water heating, etc.), incorporating results of Outputs 4.1 and 4.2; • Public consultation and information dissemination on RE			results of Output 1.2 and 5.4) • Assessment of net-metering options in Samoa and integration of distributed electricity (e.g. rooftop solar, small biomass-generated power) • Workshops on EE S&L (incl. monitoring, verification, and enforcement)
	Output 1.2 Consultancy assignment on (i) Development of business models, financials schemes and cost-benefit analysis of renewable energy technologies for power and non-power uses, in particular, business models for the sustainable supply of biomass resources (production, harvesting, processing, supply); (ii) renewable energy management & technology (incl. cost-benefit analysis RE technologies; PUE and SUE; integration into grid of RE, and (iii) decentralised RE and EE efficiency technologies and applications			**Output 1.6** Assessment of issues and options on efficiency and fuel use in marine and land transportation and needs for financial and technical support

[33] Adapted or revised renewable energy policy or plan

[34] One regulation regarding incentives for RE and/or EE and regulations regarding one or two appliances for MEPS/labelling added to the current

[35] Taking into EFC's work on storage and smart grid options for optimum performance and maximized stability as well as the results of RET and resource studies of Output 1.1

Components	Sustainable energy (biomass and non-biomass)	Investment in biomass for power (gasification)	Investment in community-based biogas and PURE/SURE and	Energy efficiency (and distributed PV applications)
2. RE-based energy system improvement • Outcome 2a: Increased application of biomass-based energy for power and non-power uses • Outcome 2b: Increased grid performance and reliability *Indicators:* E. Number of biomass-based power generation units integrated into the EPC grid system and installed capacity BL/MT: 1; EoP: 1 unit operational at 750 kW F. Number of operational off-grid community biomass-based energy projects planned and installed (BL/MT: 0, EoP: 4)	**Output 2.1** Completed assessment of available biomass resources • Assessment of the various available biomass energy resources in Samoa (on STEC and other lands). Will be linked with Output 1.1 (RE assessment)	**Output 2.2** Installed and operational biomass-based power generation at Afolau • Assessment and regular reporting on the feedstock supply • Analysis of properties of the feedstock material • Design and study of Afolau gasifier and biomass production facility • Construction of gasification facilities • PPA with EPC and generation license from OOTR • Commissioning and operation • Trainings (on SCADA integration with grid, feedstock and gasifier operation) • Techno-economic evaluation on (energy) performance • Carry out social-environment assessment of communities around STEC lands (and impact on supply chain)	**Output 2.3** Installed and operational biomass-based technologies for non-power applications in selected communities • Assessment of five proposed biogas project sites • Technical design of the systems • Construction and installation • Technical training for biomass feedstock handling and biogas operation • Commissioning and operation • Techno-economic evaluation on (energy) performance with social-environment assessment	**Output 2.4** Installation of solar street lighting • 300 solar lights installed
3. Financing of Initiatives for electricity savings, PURE and SURE • Outcome 3a Improved financing and access to financing for RE and DSM/EE			**Output 3.1** Assessed need and modality financial support scheme for bioenergy for (rural) productive and social uses • Conduct surveys and assessments of RE of PUE	**Output 3.2** Assessed need and modality of public-private financing scheme (and incentives) for EE and RE for buildings (incorporating results of Output 1.2):

Components	Sustainable energy (biomass and non-biomass)	Investment in biomass for power (gasification)	Investment in community-based biogas and PURE/SURE and	Energy efficiency (and distributed PV applications)
Indicators: G. Number of banks/ financial institutions that implemented and funded the IMPRESS-supported financing model and/or schemes (BL/MT: 0, EoP: at least 1)			needs levels in target groups (communities, entrepreneurs, and local government authorities/Social services • Feasibility study on new business ideas for productive and social uses of bioenergy and other RE (building on Output 1.2) • Outline provided of 'greening' existing support schemes for (rural) PUE and SUE (and/or new public-private scheme)	• Review national and international experiences in design, establishment and operation of an effective financial scheme to promote RE and DSM/EE investment projects • Propose and launch financing scheme with Samoan financial institutions or EE and distributed RE (e.g. rooftop PV) in buildings and small businesses (building on results of Output 1.2 and 4.2
			Output 3.3 Workshop and consultations with government (MOF, MNRE), financial and business support organizations (e.g. SBH, SCB, DBS, others) existing lending and need for new schemes • Discussions on grant support, financing and incentives (financing mechanism) on EE measures to reduce power consumption in residential, public and industrial buildings and integration of RE in buildings and productive sectors	
4.. Productive and social uses • Outcome 4a Increased demand for PURE/SURE *Indicators:* H. Number of businesses utilizing biomass-based energy for productive			Output 4.1 Plans for replication of (community-scale) biogas for PURE and SURE applications • Evaluation of results of output 3.2; • Support provided to PUE/SUE in addition to outputs 2.3 and 2.4 • Identification of sites for biogas for post-project replication of	Output 4.2 Update of consumer/user survey on RE and EE awareness • Review existing info and statistics (SBS, Customs, private importers) • Define objectives of survey and design • Carry out a survey and synthesize results

Components	Sustainable energy (biomass and non-biomass)	Investment in biomass for power (gasification)	Investment in community-based biogas and PURE/SURE and	Energy efficiency (and distributed PV applications)
and social uses (BL: 0; MT: 0; EoP; 3)			community-based biogas d PUE/SUE with pre-feasibility analysis and appropriate business model	
5. Enhancement of awareness on sustainable energy *Indicators:* I. Number of trained local authorities (and bank and NGO/private sector officials that are capable of developing, planning and implementing RE, DSM/EE and PURE/SURE projects (BL: N/A; MT: at least 15, at least 30) and share of women participation (BL: N/A, MT: 20%; EoP: 35%) J. Number of schools, local community groups and Government departments that took part in RE and EE awareness campaign (BL:0; MT: 5; EoP: 10)	Output 5.1 Completed capacity development on RET for schools and universities • Consultations with SQA and NUS to set up 'Training of Trainers' (subjects: energy planning, biogas, solar, EE); Consultations with PacTVET team (to endorse or adapt training courses in Samoa) • Conduct training of trainers for RE and DSM/EE courses and prepare an implementation plan • Implementation of training courses and conduct training course evaluations, and impact evaluation a year later. Output 5.2 Established networking and info sharing on RE and EE • IMPRESS webpage established and convert into full OSS webpage • Set up a network/association(s) to promote and dissemination of knowledge of RE and DSM/EE • Participation/support by IMPRESS in regional and national energy-related workshops		Output 5.3 Capacity building for beneficiaries (end-users), financing institutions, and project developers • Capacity building and awareness program designed and implemented for communities – linking biogas with PURE/SURE • Capacity building program for personnel of RE-for-power (gasification) and grid management • Conduct workshops with investors, financing intuitions and facilitators (SHB, YEP, WBI, other) and relevant ministries (MNRE, MWCSD, MAF)	Output 5.4 Completed promotional activities • School awareness (quarterly) • Participate in regular events (e.g. annual RE Day) • Advertisements of IMPRESS and RE/EE (TV, newspapers, radio, internet)' • An awareness campaign for the general public on efficient use of appliances and equipment

Note: Text in green are activities that have been implemented. Blue text indicates activities that under implementation or starting up. The text in red gives changes as suggested by the MTR Consultant or newly proposed activities. For a detailed description of the correspondence of outputs and activities in the existing results framework with proposed adjustments, the reader is referred to Annex D.

1. INTRODUCTION

This is the Terms of Reference (ToR) for the UNDP-GEF Midterm Review (MTR) of the full-sized project titled *Improving the Performance and Reliability of RE Power Systems in Samoa* (IMPRESS) (PIMS 5669) implemented through the *Ministry of Natural Resources and Environment*, which is to be undertaken in *2020*. The project started on the *2nd August 2017* and is in its *third* year of implementation. In line with the UNDP-GEF Guidance on MTRs, this MTR process was initiated before the submission of the second Project Implementation Report (PIR). This ToR sets out the expectations for this MTR. The MTR process must follow the guidance outlined in the document *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects*.

2. PROJECT BACKGROUND INFORMATION

Samoa is a small island developing state in the Pacific that is highly vulnerable to the impacts of climate change, and it is only responsible for an insignificant amount of global greenhouse gas emissions. However, Samoa is committed to combating and addressing issues associated with climate change including adaptation and mitigation measures to demonstrate to the world that all nations can take responsibility for a low-carbon future. Samoa submitted its Samoa's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) in 2007 and submitted Intended Nationally Determined Contribution (INDC) and information to facilitate the clarity, transparency and understanding of the contribution in September 2015.

It is clearly highlighted in the INDC report that the Energy Sector with a focus on the Electricity sub sector is the main target sector for GHG emission reduction, and Samoa aims to achieve 100% electricity generation from RE by 2025. Assistance required to reach this target include human, technological and financial resources. Further economy-wide emissions reductions are conditional on Samoa receiving external financial assistance from the international community.

This project does not only directly respond to the requirements highlighted in the INDC report, but also complement the SDS, the Samoa Energy Sector Plan and the Energy Bill being planned and implemented by GOS. MNRE is the designated implementing agency for this GEF-funded project, and the key agency for RE development and implementation in Samoa with key partners beings SOEs such as STEC and EPC.

The objective of the IMPRESS project therefore is the improved sustainable and cost-effective utilization of indigenous renewable energy resources for energy production in Samoa. This will be realized through development of RE and DSM/EE policies and regulatory frameworks, adoption of RE- based technologies in electricity generation and financing RE, and DSM/EE investments in Samoa. The project comprises the five (5) components:

- Component 1: Enhancement of Renewable Energy Policy Formulation and Implementation;
- Component 2: RE-based Energy System Improvements;
- Component 3: Financing of Initiatives for Electricity Saving, Productive and Social Uses of RE Electricity, and Electricity System Performance Improvement;
- Component 4: Productive & Social Uses of RE;
- Component 5: Enhancement of Awareness on the Applications and Benefits of RE/EE.

This project will be implemented over a 60 months period and is expected to achieve GHG emission reductions through the displacement of diesel electricity generation. Direct GHG emission reduction over the lifetime of the project is estimated to be 25,267 tCO_2e.

The project is implemented over the course of 5 years and has started in 2017. UNDP is the GEF Implementing Agency and the Ministry of Natural Resources and Environment (MNRE), is the project's lead Implementing Partner and STEC and EPC being responsible parties.

The project is being nationally executed as per UNDP National Implementation Modality (NIM) procedures. According to UNDP guidelines on National Implementation Modality (2011), the Government is responsible for the management and delivery of programme activities to achieve project outcomes/outputs. Government regulations, rules and procedures therefore apply to project implementation to the extent that they do not contravene the principles of the Financial Regulations and Rules of UNDP.

Project monitoring and evaluation will be conducted in accordance with established UNDP and GEF procedures and will be provided by the project team and the UNDP Multi-Country Office (UNDP-MCO) in Apia with support from the UNDP Regional Bureau for Asia-Pacific (RBAP) region in Bangkok.

The total GEF trust funds for this project is US$ 6,075,828 with in kind co-financing of US$ 46,439,200

3. OBJECTIVES OF THE MTR

The MTR will assess progress towards the achievement of the project objective and outcomes as specified in the Project Document and assess early signs of project success or failure with the goal of identifying the necessary changes to be made in order to set the project on-track to achieve its intended results. The MTR will also review the project's strategy, its risks to sustainability.

4. MTR APPROACH & METHODOLOGY

The MTR must provide evidence-based information that is credible, reliable and useful. The MTR team will review all relevant sources of information including documents prepared during the preparation phase (i.e. PIF, UNDP Initiation Plan, UNDP Environmental & Social Safeguard Policy, the Project Document, project reports including Annual Project Review/PIRs, project budget revisions, lesson learned reports, national strategic and legal documents, and any other materials that the team considers useful for this evidence-based review). The MTR team will review the baseline GEF focal area Tracking Tool submitted to the GEF at CEO endorsement, and the midterm GEF focal area Tracking Tool that must be completed before the MTR field mission begins.

The MTR team is expected to follow a collaborative and participatory approach[1] ensuring close engagement with the Project Team, government counterparts (the GEF Operational Focal Point), the UNDP Country Office(s), UNDP-GEF Regional Technical Advisers, and other key stakeholders.

[1] For ideas on innovative and participatory Monitoring and Evaluation strategies and techniques, see UNDP Discussion Paper: Innovations in Monitoring & Evaluating Results, 05 Nov 2013.

Engagement of stakeholders is vital to a successful MTR.[2] Stakeholder involvement should include interviews with stakeholders who have project responsibilities, including but not limited to the *Ministry of Natural Resources & Environment – Ministry of Finance – Ministry of Works, Transport, and Infrastructure (MWTI) – Ministry of Women, Communities and Social Development – Ministry of Commerce Industry and Labour – National Energy Coordinating Committee – Samoa Trust Estates Corporation – Electric Power Corporation – Scientific Research Organization of Samoa – Office of the Regulator – Small Business Enterprise Centre - Educational Institutions – Banks and Financial Institutions – Office of the Attorney General– Project Management Unit*, executing agencies, senior officials and task team/ component leaders, key experts and consultants in the subject area, Project Board, project stakeholders, academia, local government and CSOs, etc. Additionally, the MTR team is expected to conduct field missions to Samoa, including a selection of the project sites on Samoa.

The final MTR report should describe the full MTR approach taken and the rationale for the approach making explicit the underlying assumptions, challenges, strengths and weaknesses about the methods and approach of the review.

5. DETAILED SCOPE OF THE MTR

The MTR team will assess the following four categories of project progress. See the *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects* for extended descriptions.

i. Project Strategy

Project design:

- Review the problem addressed by the project and the underlying assumptions. Review the effect of any incorrect assumptions or changes to the context to achieving the project results as outlined in the Project Document.
- Review the relevance of the project strategy and assess whether it provides the most effective route towards expected/intended results. Were lessons from other relevant projects properly incorporated into the project design?
- Review how the project addresses country priorities. Review country ownership. Was the project concept in line with the national sector development priorities and plans of the country (or of participating countries in the case of multi-country projects)?
- Review decision-making processes: were perspectives of those who would be affected by project decisions, those who could affect the outcomes, and those who could contribute information or other resources to the process, taken into account during project design processes?
- Review the extent to which relevant gender issues were raised in the project design. See Annex 9 of *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects* for further guidelines.
- If there are major areas of concern, recommend areas for improvement.

Results Framework/Logframe:

- Undertake a critical analysis of the project's log frame indicators and targets, assess how "SMART" (Specific, Measurable, Attainable, Relevant, Time-bound) the indicators are, and whether the midterm and end-of-project targets are realistically achievable, and suggest specific amendments/revisions to the targets and indicators as necessary.
- Are the project's objective and outcomes clear, practical, and feasible to be realized within its time frame?
- Are each of the project components comprised of the relevant and necessary activities that will deliver the required outputs that will collectively bring about the expected outcome in each component?
- Examine if progress so far has led to or could in the future catalyze beneficial development effects (i.e. income generation, gender equality and women's empowerment, improved governance etc...) that should be included in the project results framework and monitored on an annual basis.
- Ensure broader development and gender aspects of the project are being monitored effectively. Develop and recommend SMART 'development' indicators, including sex-disaggregated indicators and indicators that capture development benefits.

ii. Progress Towards Results

Progress Towards Outcomes Analysis:

- Review the log frame indicators against progress made towards the end-of-project targets using the Progress Towards Results Matrix and following the *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects*; color code progress in a "traffic light system" based on the level of progress achieved; assign a rating on progress for each outcome; make recommendations from the areas marked as "Not on target to be achieved" (red).

Table. Progress Towards Results Matrix (Achievement of outcomes against End-of-project Targets)

Project Strategy	Indicator[3]	Baseline Level[4]	Level in 1st PIR (self-reported)	Midterm Target[5]	End-of-project Target	Midterm Level & Assessment[6]	Achievement Rating[7]	Justification for Rating
Objective:	Indicator (if applicable):							
Outcome 1:	Indicator 1:							
	Indicator 2:							
Outcome 2:	Indicator 3:							
	Indicator 4:							
	Etc.							
Etc.								

Indicator Assessment Key

Green= Achieved	Yellow= On target to be achieved	Red= Not on target to be achieved

In addition to the progress towards outcomes analysis:

- Compare and analyze the GEF Tracking Tool indicator values at the Baseline with those achieved right before the Midterm Review.
- Identify remaining barriers to achieving the project objective in the remainder of the project, as well as barriers to the implementation of the project activities that could potentially affect the successful and timely completion of the project.
- By reviewing the aspects of the project that have already been successful, identify ways in which the project can further expand these benefits.

[2] For more stakeholder engagement in the M&E process, see the UNDP Handbook on Planning, Monitoring and Evaluating for Development Results, Chapter 3, pg. 93.

[3] Populate with data from the Logframe and scorecards
[4] Populate with data from the Project Document
[5] If available
[6] Color code this column only
[7] Use the 6 point Progress Towards Results Rating Scale: HS, S, MS, MU, U, HU

iii. Project Implementation and Adaptive Management

Management Arrangements:

- Review overall effectiveness of project management as outlined in the Project Document. Have changes been made and are they effective? Are responsibilities and reporting lines clear? Is decision-making transparent and undertaken in a timely manner? Recommend areas for improvement.
- Review the quality of execution of the Executing Agency/Implementing Partner(s) and recommend areas for improvement.
- Review the quality of support provided by the GEF Partner Agency (UNDP) and recommend areas for improvement.

Work Planning:

- Review any delays in project start-up and implementation, identify the causes and examine if they have been resolved.
- Are work-planning processes results-based? If not, suggest ways to re-orientate work planning to focus on results?
- Examine the use of the project's results framework/ log frame as a management tool and review any changes made to it since project start.

Finance and co-finance:

- Evaluate the financial management of the project, with specific reference to the cost-effectiveness of interventions.
- Review the changes to fund allocations as a result of budget revisions and assess the appropriateness and relevance of such revisions.
- Does the project have the appropriate financial controls, including reporting and planning, that allow management to make informed decisions regarding the budget and allow for timely flow of funds?
- Informed by the co-financing monitoring table to be filled out, provide commentary on co-financing: is co-financing being used strategically to help the objectives of the project? Is the Project Team meeting with all co-financing partners regularly in order to align financing priorities and annual work plans? Are the committed co-financing by the project partners/co-financers being realized?

Project-level Monitoring and Evaluation Systems:

- Review the monitoring tools currently being used: Do they provide the necessary information? Do they involve key partners? Are they aligned or mainstreamed with national systems? Do they use existing information? Are they efficient? Are they cost-effective? Are additional tools required? How could they be made more participatory and inclusive?
- Examine the financial management of the project monitoring and evaluation budget. Are sufficient resources being allocated to monitoring and evaluation? Are these resources being allocated effectively?

Stakeholder Engagement:

- Project management: Has the project developed and leveraged the necessary and appropriate partnerships with direct and tangential stakeholders?
- Participation and country-driven processes: Do local and national government stakeholders support the objectives of the project? Do they continue to have an active role in project decision-making that supports efficient and effective project implementation?
- Participation and public awareness: To what extent has stakeholder involvement and public awareness contributed to the progress towards achievement of project objectives?

Reporting:

- Assess how adaptive management changes have been reported by the project management and shared with the Project Board.
- Assess how well the Project Team and partners undertake and fulfil GEF reporting requirements (i.e. how have they addressed poorly-rated PIRs, if applicable?)
- Assess how lessons derived from the adaptive management process have been documented, shared with key partners and internalized by partners.

Communications:

- Review internal project communication with stakeholders: Is communication regular and effective? Are there key stakeholders left out of communication? Are there feedback mechanisms when communication is received? Does this communication with stakeholders contribute to their awareness of project outcomes and activities and investment in the sustainability of project results?
- Review external project communication: Are proper means of communication established or being established to express the project progress and intended impact to the public (is there a web presence, for example? Or did the project implement appropriate outreach and public awareness campaigns?)
- For reporting purposes, write one half-page paragraph that summarizes the project's progress towards results in terms of contribution to sustainable development benefits, as well as global environmental benefits.

iv. Sustainability

- Validate whether the risks identified in the Project Document, Annual Project Review/PIRs and the ATLAS Risk Management Module are the most important and whether the risk ratings applied are appropriate and up to date. If not, explain why.
- In addition, assess the following risks to sustainability:

Financial risks to sustainability:

- What is the likelihood of financial and economic resources not being available once the GEF assistance ends (consider potential resources can be from multiple sources, such as the public and private sectors, income generating activities, and other funding that will be adequate financial resources for sustaining project's outcomes)?

Socio-economic risks to sustainability:

- Are there any social or political risks that may jeopardize sustainability of project outcomes? What is the risk that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained? Do the various key stakeholders see that it is in their interest that the project benefits continue to flow? Is there sufficient public / stakeholder awareness in support of the long term objectives of the project? Are lessons learned being documented by the Project Team on a continual basis and shared/ transferred to appropriate parties who could learn from the project and potentially replicate and/or scale it in the future?

Institutional Framework and Governance risks to sustainability:

- Do the legal frameworks, policies, governance structures and processes pose risks that may jeopardize sustenance of project benefits? While assessing this parameter, also consider if the required systems/ mechanisms for accountability, transparency, and technical knowledge transfer are in place.

Environmental risks to sustainability:

- Are there any environmental risks that may jeopardize sustenance of project outcomes?

Conclusions & Recommendations

The MTR team will include a section of the report setting out the MTR's evidence-based conclusions, in light of the findings.[8]

Recommendations should be succinct suggestions for critical intervention that are specific, measurable, achievable, and relevant. A recommendation table should be put in the report's executive summary. See the *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects* for guidance on a recommendation table.

The MTR team should make no more than 15 recommendations total.

Ratings

The MTR team will include its ratings of the project's results and brief descriptions of the associated achievements in an *MTR Ratings & Achievement Summary Table* in the Executive Summary of the MTR report. See Annex E for ratings scales. No rating on Project Strategy and no overall project rating is required.

Table. MTR Ratings & Achievement Summary Table for IMPRESS

Measure	MTR Rating	Achievement Description
Project Strategy	N/A	
Progress Towards Results	Objective Achievement Rating: (rate 6 pt. scale)	
	Outcome 1 Achievement Rating: (rate 6 pt. scale)	
	Outcome 2 Achievement Rating: (rate 6 pt. scale)	
	Outcome 3 Achievement Rating: (rate 6 pt. scale)	
	Etc.	
Project Implementation & Adaptive Management	(rate 6 pt. scale)	
Sustainability	(rate 4 pt. scale)	

6. TIMEFRAME

The total duration of the MTR will be approximately *25* over a time period of *18 weeks* starting *4th May 2020* and shall not exceed five months from when the consultant(s) are hired. The tentative MTR timeframe is as follows:

TIMEFRAME	ACTIVITY
22nd May 2020	Application closes
5th June 2020	Select MTR Team
19th June 2020	Prep the MTR Team (handover of Project Documents)
26th June 2020: 4 working days	Document review and preparing MTR Inception Report
3rd July 2020	Finalization and Validation of MTR Inception Report- latest start of MTR mission
3rd August – 14th August 2020: 10 working days	MTR mission: stakeholder meetings, interviews, field visits
12th or 13th August 2020	Mission wrap-up meeting & presentation of initial findings- earliest end of MTR mission
26th August 2020: 8 working days	Preparing draft report
31st August 2020: 3 working days	Incorporating audit trail from feedback on draft report/Finalization of MTR report
14th September 2020	Preparation & Issue of Management Response
18th September 2020	Expected date of full MTR completion

Options for site visits should be provided in the Inception Report.

7. MIDTERM REVIEW DELIVERABLES

#	Deliverable	Description	Timing	Responsibilities
1	**MTR Inception Report**	MTR team clarifies objectives and methods of Midterm Review	No later than 2 weeks before the MTR mission: *26th June 2020*	MTR team submits to the Commissioning Unit and project management
2	**Presentation**	Initial Findings	End of MTR mission: *14th August 2020*	MTR Team presents to project management and the Commissioning Unit
3	**Draft Final Report**	Full report (using guidelines on content outlined in Annex B) with annexes	Within 3 weeks of the MTR mission: *4th September 2020*	Sent to the Commissioning Unit, reviewed by RTA, Project Coordinating Unit, GEF OFP
4	**Final Report***	Revised report with audit trail detailing how all received comments have (and have not) been addressed in the final MTR report	Within 2 weeks of receiving UNDP comments on draft: *30th September 2020*	Sent to the Commissioning Unit

*The final MTR report must be in English. If applicable, the Commissioning Unit may choose to arrange for a translation of the report into a language more widely shared by national stakeholders.

8. MTR ARRANGEMENTS

The principal responsibility for managing this MTR resides with the Commissioning Unit. The Commissioning Unit for this project's MTR is the UNDP Samoa Multi-country office for Cook Islands, Niue, Samoa and Tokelau based in Samoa.

The commissioning unit will contract the consultants and ensure the timely provision of per diems and travel arrangements within the country for the MTR team. The Project Team will be responsible for liaising with the MTR team to provide all relevant documents, set up stakeholder interviews, and arrange field visits.

[8] Alternatively, MTR conclusions may be integrated into the body of the report.

ANNEX B. ITINERARY OF THE EVALUATION MISSION

Virtual interview sessions

Regular meetings PCU and UNDP CO	19 June – 21 June - 22 June – 23 June – 2 July – 20 July – 28 July – 19 Aug - 15 Sept
UNDP RTA (Mr. Manuel Soriano)	23 June
ProDoc consultant (Mr. Sommai)	14 July
Interview sessions with stakeholders (see List below)	6 July (morning) – STEC, MOF, EPC 7 July (morning) – SROS, USP, APTC; (afternoon) – NUS 9 July (morning) – SBH, DBS, BSP

List of stakeholder representatives

UNDP	Yvette Kerslake – yvette.kerslake@undp.org (Assistant RR)
	Jeffery Leung Wai – Jeffery.leung.wai@undp.org (Programme Officer)
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ANNEX C. LIST OF DOCUMENTS COLLECTED AND REVIEWED

Project concept and progress reports:

- Project Document; GEF CEO ER document
- Inception Report (2017)
- PIR (Project Implementation Review) 2019
- Quarterly Progress Reports, from Q1 2018 to Q2 2020 (with minutes of meeting of TAG and TAWG meetings, work plans and technical annexes)
- Terms of Reference for consultancy services: (i) development of business models, financials schemes and cost benefit analysis of renewable energy technologies, (ii) renewable energy management & technology experts for impress project

UNDP documents:

- Subregional programme document for the Pacific Island Countries and Territories (2018-2022)
- UN Development Framework for the Pacific Region 2013-2017
- UN Pacific Strategy 2018-2022
- Country Programme Document 2018-2022 (2019)

Other reports and documents:

- Asian Development Bank, *Proposed Loan, Asian Development Fund Grant, and Technical Assistance Grant Independent State of Samoa: Power Sector Expansion Project* (Oct 2007)
- Asian Development Bank, *Proposed Grants and Administration of Grant Independent State of Samoa: Renewable Energy Development and Power Sector Rehabilitation Project* (Oct 2013)
- Asian Development Bank, *Proposed Grant Independent State of Samoa: Samoa AgriBusiness Support Project* (May 2014)
- Asian Development Bank, Loan and Administration of Loan Jarcon Pty Limited and Sun Pacific Energy Limited Solar Power Development Project (Samoa), July 2017
- Bioconceptz, *a Feasibility study for biogas in peri-urban area of Vaitele in Apia, Samoa* (2013)
- CERES, *Biogas in Poutasi Village* (2016)
- FAO, *Feasibility study for the production of biogas and organic fertiliser in the agriculture and food management sectors in Samoa* (2013)
- SME Cambodia, *Feasibility study for a Biomass Gasification Power Plant* (2011)
- Electric Power Corpoartion, *Annual Report 2017-2018*
- GIZ-Government of Samoa, *Project Design Document, Energy Bill and the development and implementation of sustainable bioenergy in Samoa*
- IRENA, *Renewable energy opportunities and challenges in the Pacific Islands region* (2013)
- Ministry of Finance, *Samoa Energy Review 2015*
- Ministry of Finance, *Samoa Energy Review 2016*
- Ministry of Finance, *Samoa Energy Sector Plan (2017-2022)*
- PIGGAREP, *Project Factsheet;* and UNDP/GEF *Project Document*
- SIDS DOCK program -PIGGAREP "plus" supplementary project; Samoa component: biogas generation and application for power generation (BIOGEN)
- Government of Samoa, *Energy Efficiency Act* (2017) and *Energy Efficiency Regulations* (2018)
- Government of Samoa, *Samoa's Intended Nationally Determined Contribution* (2015)
- UST Beijing, *Assessment of potential feedstocks and feedstock processing methods for biogas power station at Piu, Samoa* (2016)

ANNEX D. CORRESPONDENCE OF SUGGESTED WITH ORIGINAL LIST OF OUTPUTS

Component and outcomes	Proposed changes Outputs and activities	Rationale for changes (comparison proposed *new* and existing *old* list of outputs
Component 1 **Enhancement of renewable energy policy formulation and implementation**	**N/A**	
Outcome: 1. Enforcement of clear and consistent policies and regulations that are supportive of the development and implementation of RE-based power	**Output 1.1** Within SESP and as part of Energy Bill, established planning and legal-regulatory framework for renewable energy (power and non-power) 1) Review of NGGAS 2) Review of STEC Act and biomass feedstock management 3) Inputs into new Energy Bill (incl. revised RE target and integration in EPC grid), 4) Training needs assessment on electricity sector planning 5) Develop guidelines for RE investors and developers **Output 1.2** Consultancy integrated assignment 1) Development of business models, financials schemes and cost-benefit analysis of renewable energy technologies for power and non-power uses, in particular, business models for the sustainable supply of biomass resources 2) Renewable energy management & technology (incl. cost-benefit analysis RE technologies; PUE and SUE; integration into grid of RE, and 3) Decentralised RE and EE efficiency technologies and applications) **Output 1.3** Renewable energy (and bioenergy) master plan for increased performance and stability in view of RET target (incorporating results of Output 1.2) 1) Electricity demand and supply and recommend optimal power generation portfolio, indicating role of variable and non-variable renewable energy; 2) Plans for replication of biomass-based power (assessment of previous proposals on gasification or biogas for power; stakeholder consultation; develop plans and pre-feasibility for post-project biomass-for-power projects 3) Use of RE in non-power applications (biogas, PUE/SUE; solar water heating, etc.)	Output 1.1 (new) integrates Outputs 1.1 (old) and 1.2 (old) • Activity 1.1.1 (new) has been added • Activity 1.1.2 (new) corresponds with 1.1.1 (old) • Activity 1.1.3 (new) integrates 1.1.3 and 1.2.2 (old) and links with Output 1.3 (new) • Activity 1.1.4 (new) corresponds with 1.2.3 (old) • Activity 1.1.5 (new) corresponds with activity 1.1.4 (old) On the institutional side, 1.2.1 (old) and 1.3.3 (old) have already taken place and are considered baseline. Output 1.2 (new) incorporates a number of activities of the original framework, namely activity 1.4.1, 2.1.2.5, 2.1.3.1 as well as 3.1.1.1 and partly output 4.1 and 4.2 and activity 5.3.1 Output 1.3 (new) corresponds and integrates (parts of) activity 1.1.2 (old), 1.3 (old), 1.4.2 (old), and build on results of Output 1.2 and Outputs 3.1 and 3.3 Output 1.4 (new) corresponds with 1.4.2 (old) and has links with Components 3 and 4, buildings on the results of the studies of Output 1.2 (new) The activities on EE/RE in buildings (Output 1.5, new) correspond with activities 1.3.1 (old) and 1.3.2 (old).on EE and are expanded with net-metering and RE integration in buildings (activity 1.5.2, new), building on the results of Outputs 3.3 (new) and 4.2 (new)

Component and outcomes	Proposed changes Outputs and activities	Rationale for changes (comparison proposed *new* and existing *old* list of outputs
	4) Public consultation and information dissemination on RE **Output 1.4** 1) Formulated policy measures to incentivize communities and private sector for rural and small RE technologies (linked with Output 1.3) 2) Public consultations and stakeholder meetings; **Output 1.5** Expanded legal-regulatory framework for EE and distributed RE (incl. incentives) 1) Gap analysis in current EE Act and develop new regulations proposals, incl. incentives 2) Assessment of net-metering options in Samoa and integration of distributed electricity 3) Workshops on EE S&L (incl. MVE) **Output 1.6** Assessment of issues and options on efficiency and fuel use in marine and land transportation and needs for financial and technical support	Activities 1.4.2 (new) and 1.5.3 (new) correspond with activity 1.4.3 (old) The following activities are considered baseline (not IMPRESS incremental): 1.2.2 In Output 1.3, activity 2 (biomass power replication) is also newly added, although having an overlap with the previous 2.1.1.3 (old), building on the 2.1.2.5 (old; now in Output 1.2 (new) Approved plans for the replication and/or scaling-up of the demos is important for sustainability and scaling up. Hence the activity 3) in Output 1.3 (new) on gasification-for-power and 4.1 (biogas for non-power) have been added. Output 1,6 is added as suggested by the newly appointed CTA

Component and outcomes	Proposed changes	Rationale for changes (comparison proposed *new* and existing *old* framework)
Component 2 **RE-based energy system improvement**	Outcome 2.2 is renamed Outcome 2a, while Outcomes 2.1 and 2.3 have been merged into Outcome 2b, changing or deleting outputs and activities	Outcome 2 and 3 (Old) is carried out by EPC with support from other development partners (like ADB) and IMPRESS is not directly involved. Most activities can be deleted, while some activities are maintained or merged as part of the new Outcomes 2a and 2b
• **Outcome 2a:** Increased application of biomass-based energy for power and non-power uses • **Outcome 2b:** Increased grid performance and reliability	**Output 2.1** Completed assessment of available biomass resources 1) Assessment of the various available biomass energy resources in Samoa (on STEC lands) **Output 2.2** Installed and operational biomass-based power generation at Afolau 1) Assessment and regular reporting on the feedstock supply 2) Analysis of properties of feedstock 3) Design and study of Afolau gasifier and biomass production facility 4) Construction of gasification facilities 5) PPA with EPC and generation license from OOTR 6) Commissioning and operation 7) Trainings (on integration with grid, feedstock and gasifier operation)	Outputs 2.1.1 (old) and 2.1.4 (old), activity 2.1.3.2 as well as Outcome 2.3 (old)_can be deleted. These are part of IMPRESS but EPC-implemented baseline rather than GEF-incremental; activities. Parts of outputs 2.1.2-2.1.4 (activities 2.1.1.2, 2.1.1.3, 2.1.3.1, 2.1.4.3) have been retained and combined into a new activity 1.2.2 (new) and 1.3.1 (new). Output 2.1.5 (old) should be part of Output 5.2 (new) and activity 1.3.4 (new) Output 2.2 (old) encompasses both the Afolau gasification plant and community biogas demonstrations supported by IMPRESS up to activity level. It is proposed that these are re-organised per technology type in the new Outputs 2.2 (gasification) and Output 2.5 (biogas for non-power).

Component and outcomes	Proposed changes	Rationale for changes (comparison proposed *new* and existing *old* framework)
	8) Techno-economic evaluation on (energy) performance with social-environment assessment **Output 2.3** Installed and operational biomass-based technologies for non-power applications in selected communities 1) Assessment of five proposed biogas project sites 2) Technical design of the systems 3) Construction and installation 4) Technical training for biomass feedstock handling and biogas operation 5) Commissioning and operation 6) Techno-economic evaluation on (energy) performance with social-environment assessment **Output 2.4** Installation of solar street lighting 1) 300 solar lights installed	Output 2.4 is newly added and concerns non-biomass energy (i.e, the installation of 300 solar street lights). Activity 2.1.1 (new) links with Outputs 2.2 and Output 1.2 (new) and combines the output 2.2.1 (old) regarding STEC land biomass assessment. Part of activity 2.1.2.3 (old) concerns bioenergy resource assessment in general and should be part of Output 2.1 (new) and 1.2.2 (new). The activities 2.2.1 to 2.2.8 (new), regarding gasification, and 2.3.1 to 2.3.6 on biogas (new) replace the activities grouped in the Project Document as Outputs 2.2.1 to 2.2.5 (old). The output 2.2.6 (old) is recombined in activity 2.3.4 (new) and with activities of Outcome 5 (i.e. 5.3.1 and 5.3.2 new).

Component and outcomes	Proposed changes	Rationale for changes (comparison proposed *new* and existing *old* framework)
3. Financing of Initiatives for electricity savings, PURE and SURE		
• **Outcome 3a** Improved financing and access to financing for RE and DSM/EE	**Output 3.1** Assessed business and financing models for (non-power) applications of biomass 1) Conduct surveys and assessments of RE of PUE needs levels in target groups (communities, entrepreneurs, and local government authorities/Social services 2) Feasibility study on new business ideas for productive and social uses of bioenergy and RE 3) Outline provided of 'greening' existing support schemes for (rural) PUE and SUE (and/or new public-private scheme) **Output 3.2** Assessed need and modality of public-private financing scheme (and incentives) for EE and RE for buildings (incorporating results of Outputs 1.2, 4.2	In the ProDoc it is not so clear what the difference in practice will be between bank/FIs' financing schemes and government schemes implemented by banks/FIs. In both cases, financing schemes are likely to be some form of public-private partnership. In the proposed new setup, the schemes are linked with type of activities to be financed, 1) community-scale biogas applications and (rural-based) PUE/SUIE, and 2) focusing on EE (and distributed RE) in urban (and rural) buildings. As the first target group will in general be poorer than target group two, the financing support given may be different in terms of grant/loan mix. The MTR feels that it is premature to consider a financial mechanism (with a bank) for the cluster formed by biogas, rural PUE and SUE. At this stage, these applications have not been (commercially) proven and given the income levels of beneficiaries grant support may be more plausible than a financial scheme with a bank or FI. Thus, Outcome 3.2 (old)

Component and outcomes	Proposed changes	Rationale for changes (comparison proposed *new* and existing *old* framework)
	1) Review national and international experiences in design, establishment and operation of an effective financial scheme to promote RE and DSM/EE investment projects 2) Propose and launch financing scheme with Samoan financial institutions or EE and distributed RE (e.g. rooftop PV) in buildings and small businesses **Output 3.3** Workshop and consultations with government (MOF, MNRE), financial and business support organizations (e.g. SBH, SCB, DBS, others) existing lending and need for new schemes 1) Discussions on grant support, financing and incentives (financing mechanism) on EE measures to reduce power consumption in residential, public and industrial buildings and integration of RE in buildings and productive sectors	has been largely deleted and replaced by activity 3.1.3 (new), building on the activities 3.1.1-3.1.2 (new) and Output 1.2 Activity 3.2.1 (new) corresponds with 3.1.1.1 (old) and 3.2.1.1 (old). Activity 3.1.1.2 (old) is now the new activity 3.2.2 (new). Output 3.3 (new) covers Output 3.1.2 (old) For EE and RE integration in buildings and (commercial) productive uses, a financial mechanism might be an option, depending on the results of Output 1.2 and Output 4.2. However, as it is not clear what modality will be and with what funds such a financial mechanism would be replenished it is premature to talk about detailed design, templates, promotional plan and number of loans or beneficiaries. Thus, the remainder of the activities of the Outcomes 3.1-3.2 (old) are not likely to be implemented during the IMPRESS lifetime, but might be part of a post-IMPRESS project (old activities 3.1.1.3 to 3.1.1.5, Output 3.1.3, Outcome 3.2)

Component and outcomes	Proposed changes	Rationale for changes (comparison proposed *new* and existing *old* framework)
4. Productive and social uses		
• **Outcome 3/4.a** Increased demand for PURE/SURE	Output 4.1 Plans for replication of (community-scale) biogas for PURE and SURE applications 1) Evaluation of results of output 3.2; 2) Support provided to PUE/SUE in addition to outputs 2.3 and 2.4 3) Identification of sites for biogas for post-project replication of community-based biogas d PUE/SUE with pre-feasibility analysis and appropriate business model Output 4.2 Update of consumer/user survey on RE and EE awareness 1) Review existing info and statistics (SBS, Customs, private importers) 2) Define objectives of survey and design 3) Carry out survey and synthesize results	Outputs 4.1 and 4.2 (old) are now integrated in the new Output 1.2 (feasibility power and on-power) and Output 3.1 (survey). Output 4.1 (new) and Output 4.2 (new) have been added, focussing on PURE/SURE and EE/RE in buildings respectively Activities 4.3.2 (old) corresponds to activity 4.1.2 (new), while activities 4.3.1 and 4.3.3 (old) now are move to Output 5.3 (new)

Component and outcomes	Proposed changes	Rationale for changes (comparison proposed *new* and existing *old* framework)
Component 5 Enhancement of awareness of the applications	N/A	
• **Outcome 5:** Enhancement of awareness on sustainable energy	**Output 5.1** Completed capacity development on RET for schools and universities 1) Consultations with SQA and NUS to set up 'Training of Trainers' (subjects: energy planning, biogas, solar, EE); Consultations with PacTVET team (to endorse or adapt training courses in Samoa) 2) Conduct training of trainers for RE and DSM/EE courses and prepare implementation plan 3) Implementation of training courses and conduct training course evaluations, and impact evaluation a year later. **Output 5.2** Established networking and info sharing on RE and EE 1) IMPRESS webpage established and convert into full OSS webpage 2) Participation/support/organisation (by IMPRESS) in regional and national energy-related workshops 3) Set up a network/association to promote and dissemination of knowledge of RE and DSM/EE (such a biogas association or RE association). **Output 5.3** Capacity building for beneficiaries (end-users), financing institutions and project developers 1) Capacity building program designed and implemented for communities – linking biogas with PURE/SURE 2) Capacity building program for personnel of RE-for-power (gasification) and grid management 3) Conduct workshops with investors, financing intuitions and facilitators (SHB, YEP, WBI, other) and relevant ministries (MNRE, MWCSD, MAF) **Output 5.4** Completed promotional activities 1) School awareness (quarterly) 2) Participate in regular events (e.g. annual RE Day) 3) Advertisements of IMPRESS and RE/EE (TV, newspapers, radio, internet)' 4) Awareness campaign for public at large on efficient use of appliances and equipment	The Output 5.1 largely corresponds with the Output 5.1 (old), except for change in wording. In Output 5.2, the previous activity 1.1.4 (old) is integrated as 5.2.1 (new) with the observation that having an IMPRESS website is not the same as having a one-stop-shop (OSS). This needs more development not only from the information side on the page as well as institutional setup The activities 5.2.2 and 5.2.3 (new) correspond with the activities 5.2.1-5.2.3 (old). Activity 2.1.5.1 (old) should be integrated in Output 5.2 (new). The activity 5.3.1 (new) absorbs the activities 3.1.3.1 (old), 4.3.1 (old) and parts of 5.3.2 (old) and 5.3.3 (old). Similarly, activity 5.3.2 (new) corresponds with activities 2.1.4.2 (old), 2.2.6.1 (old). Activity 5.3.3 (new) has elements of the activities of Output 3.1.2 (old). The activity 5.3.1 (old) has been split according to the survey in the different target group, i.e. for biogas and PUE beneficiaries – activity 3.1.2 (new) and a survey on energy consumption, use of EE appliances and awareness – output 4.2 (new). Activity 5.3.4 (old) refers to the instalment of solar street lights and is now converted into the new Output 2.6. Output 5.4 is a more detailed version of part of activities 5.2.3 (old) and parts of activities 5.3.2-5.3.3 (old)

ANNEX E. QUESTIONNAIRE AND EVALUATION MATRIX

Contents	Model evaluation criteria and/or questions	Indicator(s)	Means and sources of information	Sources of verification
Findings: Relevance and design • Relevance and country drivenness • Stakeholder involvement • Assessment of logframe and M&E design	• **Relevance and design** o Does the project adequately take into account the national realities, both in terms of institutional and policy frameworks in its design? Are project outcomes contributing to national development priorities and plans in accordance with the national local policy legal and regulatory frameworks (country priorities)? o Consistency with the GEF focal areas in Climate Change/operational program strategies of the GEF CC and with the UN and UNDP country programming in Lesotho? o Is the Project addressing the needs of the target beneficiaries? Relevance of the project's objectives, outcomes and outputs to the different target groups of the interventions. Review decision-making processes: were perspectives of those who would be affected by project decisions, those who could affect the outcomes, and those who could contribute information or other resources to the process, taken into account during project design processes? o Are relevant gender issues raised in the project design? Are broader development and gender aspects of the project being monitored effectively (do SMART 'development' indicators, include sex-disaggregated indicators and address future catalyse beneficial development effects (i.e. income generation, gender equality and women's empowerment, improved governance etc...) that should be included in the project results framework and monitored on an annual basis. **Design:** • Are lessons from other relevant projects properly incorporated in the project design? • Are the project's objectives and outcomes or components clear, practical, and feasible within its time frame? Is the project internally coherent in its design? Are there any incorrect assumptions or changes to the context to achieving the project results or are any	**Relevance:** • Extent to which Project supports national energy priorities, policies and strategies • Adequacy of project design and implementation to national realities and existing capacities • Extent to GEF climate change focal area is incorporated • Degree to which the project supports aspirations and/or expectations of stakeholders and beneficiaries (incl. females) **Design:** • Coherency and complementarity with other national and donor programmes • Number and type of performance measurement indicators (SMART indicators) • Degree of involvement of government partners and other stakeholders in the Project design process	• Desk review of project design and technical documents; Documents from GEF; national policies and strategies; • Interviews with project staff management, project partners (incl. former staff), stakeholders (local and national government entities, private sector, universities/NGOs) and UNDP staff	• Interviews with project partners and stakeholders and analysis • Document and report analysis*

Contents	Model evaluation criteria and/or questions	Indicator(s)	Means and sources of information	Sources of verification
	amendments to the theory of change/logframe been made or planned during the Project's implementation? • Undertake a critical analysis of the project's logframe indicators and targets, assess how "SMART" the midterm and end-of-project targets are (Specific, Measurable, Attainable, Relevant, Time-bound), and suggest specific amendments/revisions to the targets and indicators as necessary. • Review the extent to which relevant gender issues were raised in the project design Ensure broader development and gender aspects of the project are being monitored effectively. Develop and recommend SMART 'development' indicators, including sex-disaggregated indicators and indicators that capture development benefits. • M&E design. Does the project have an effective M&E plan to monitor results and track progress towards achieving project objectives (see also Implementation)			
Findings: Results • Global environmental and other impacts • Assessment of outcomes and outputs (cf. with baseline indicators)	**Results and effectiveness** • To what extent have the expected outcomes and of the project been achieved? (review the logframe indicators against progress made towards the end-of-project targets using the Progress Towards Results Matrix; comparison and analysis of the GEF Tracking Tool at the Baseline with the one completed right before the Midterm Review) • What outputs has the project achieved (both qualitative and quantitative results, comparing the expected and realized end-project value of progress indicators of each outcome/output with the baseline value)? • Were there any unplanned effects? Which external factors have contributed or hinder the achievement of the expected results? Can the project take advantage of new opportunities, adapting its theory of change to respond to changes in the development context? • Write one half-page paragraph that summarizes the project's progress towards results in terms of contribution to sustainable development benefits, as well as global environmental benefits	**Results and effectiveness:** • Level of achievement (as laid out in the logframe) • Achievement of outputs (qualitative, quantitative) and description of activities • Evidence of adaptive management and/or early application of lessons learned	• Desk review of project design and technical documents other relevant docs • Interviews with project staff management, project partners (incl. former staff), stakeholders (local and national government entities, private sector, universities/NGOs) and UNDP staff • Interviews with project experts (national and international)	• Interviews with project partners and stakeholders and analysis • Document and report analysis* • Check with publicly available information

Contents	Model evaluation criteria and/or questions	Indicator(s)	Means and sources of information	Sources of verification
Findings: implementation, and processes • Management and administration; role of EA and IA • Monitoring and evaluation systems • Stakeholder engagement and communications • Budget, expenditures and co-financing; procurement	**Implementation and adaptive management** • Are adequate project management arrangements in place at project entry? Review overall effectiveness of project management as outlined in the Project Document. Have changes been made and are they effective? Are responsibilities and reporting lines clear? Is decision-making transparent and undertaken in a timely manner? Recommend areas for improvement. • What is the quality of execution of the Executing Agency/Implementing Partner(s) and the GEF Partner Agency (UNDP) and are there recommend areas for improvement? • Review any delays in project start-up and implementation, identify the causes and examine if they have been resolved. Are work-planning processes results-based? If not, suggest ways to re-orientate work planning to focus on results? **Assessment of M&E system; reporting** • Review the monitoring tools currently being used: Do they provide the necessary information? Do they involve key partners? Are they aligned or mainstreamed with national systems? Do they use existing information? Are they efficient? Are they cost-effective? Are additional tools required? How could they be made more participatory and inclusive? • Examine the use of the project's results framework/ logframe as a management tool and review any changes made to it since project start. • Examine the financial management of the project monitoring and evaluation budget. Are sufficient resources being allocated to monitoring and evaluation? Are these resources being allocated effectively? • Were progress reports produced accurately and timely, and did they respond to reporting requirements including adaptive management changes? In particular, assess how well the Project Team and partners undertake and fulfil GEF reporting requirements (i.e. how have they addressed poorly-rated PIRs, if applicable?) • Assess how lessons derived from the adaptive management process have been documented, shared with key partners and internalized by partners. **Stakeholder involvement**	**Implementation and management** • Extent to which project partners committed time and resources to the project • Extent of commitment of partners to take over project activities • Evidence of clear roles and responsibilities for operational and management structure **M&E** • Actual use of the M&E system to change or improve decision- making/adaptive management • Share of M&E in the budget • Quality and quantity of progress reports **Stakeholders and communications** • Extent to which project partners committed time and resources to the project • Extent of commitment of partners to take over project activities **Financial planning** • Extent to which inputs have been of suitable quality and available when required to allow the Project to achieve the expected results; • Timely delivery of funds, mitigation of bottlenecks.	• Desk review of project design and technical documents (incl, PIRs; data on budget; other relevant docs; media coverage, official notices and press releases • Interviews with project staff management, project partners (incl. former staff), stakeholders (local and national government entities, private sector, universities/NGOs) and UNDP staff • Interviews with project experts (national and international)	• Interviews with project partners and stakeholders and analysis • Document and report analysis*

Contents	Model evaluation criteria and/or questions	Indicator(s)	Means and sources of information	Sources of verification
	• Project management: Has the project developed and leveraged the necessary and appropriate partnerships with direct and tangential stakeholders? • Participation and country-driven processes: Do local and national government stakeholders support the objectives of the project? Do they continue to have an active role in project decision-making that supports efficient and effective project implementation? • Participation and public awareness: To what extent has stakeholder involvement and public awareness contributed to the progress towards achievement of project objectives? **Financial planning and procurement** • Consider the financial management of the project, with specific reference to the cost-effectiveness of interventions. • Review the changes to fund allocations as a result of budget revisions and assess the appropriateness and relevance of such revisions. • Does the project have the appropriate financial controls, including reporting and planning, that allow management to make informed decisions regarding the budget and allow for timely flow of funds? • Informed by the co-financing monitoring table to be filled out, provide commentary on co-financing: is co-financing being used strategically to help the objectives of the project? Is the Project Team meeting with all co-financing partners regularly in order to align financing priorities and annual work plans?	• Level of satisfaction of partners and beneficiaries in the use of funds		
Findings: sustainability • Risks and external factors • Replication	**Sustainability** • *Financial risks.* Are there any financial risks that may jeopardize sustainability of project outcomes? What is the likelihood of financial and economic resources not being available once GEF assistance ends? • *Sociopolitical risks*. Are there any social or political risks that may jeopardize sustainability of project outcomes? What is the risk that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained? Do the various key stakeholders see that it is in their interest that project benefits continue to flow? Is there sufficient public/stakeholder awareness in support of the project's long-term objectives? • *Institutional framework and governance risks.* Do the legal	**Sustainability** • Extent to which risks and assumptions are adequate and are reflected in the project documentation and are still up-to-date • Extent to which project is likely to be sustainable beyond the project; • Extent to which main stakeholders plan to provide sustainability to the project's results in the future, including commitment of financial	• Desk review of project design and technical documents (incl, PIRs; other relevant docs) • Interviews with project staff management, project partners (incl. former staff), stakeholders (local and national government entities, private sector, universities/NGOs)	• Interviews with project partners and stakeholders and analysis • Document and report analysis* • Check with international practices and publicly available information

Contents	Model evaluation criteria and/or questions	Indicator(s)	Means and sources of information	Sources of verification
	frameworks, policies, and governance structures and processes within which the project operates pose risks that may jeopardize sustainability of project benefits? Are requisite systems for accountability and transparency, and required technical know-how, in place? • *Environmental risks.* Are there any environmental risks that may jeopardize sustainability of project outcomes? • *Capacity risks.* Have partners and stakeholders successfully enhanced their capacities and do they have the required resources to make use of these capacities?	resources • Extent to which partners and stakeholders are applying new ideas outside of the immediate project context	and UNDP staff	
Conclusions and recommendations • Conclusions on attainment of objectives and results • Lessons learned • Recommendations	• Evaluation conclusions related to the project's achievements and shortfalls (comprehensive and balanced statements which highlight the strengths, weaknesses and results of the project). Where applicable: • Comprehensive and balanced statements (that are evidence-based and connected to the MTR's findings) which highlight the strengths, weaknesses and results of the project. Where applicable: o Examine if progress so far has led to, or could in the future catalyse beneficial development effects (i.e. income generation, gender equality and women's empowerment, improved governance etc...) that should be included in the project results framework and monitored on an annual basis. Can the project take advantage of such new opportunities and expand benefits, adapting its theory of change, if needed, to changes in the development context? o Identify remaining, unaddressed, barriers to achieving the project objective in the remainder of the project. • Summary of ratings (on a six-point scale) • What lessons can be learnt from the project regarding design and implementation? • What recommendations, if any, can be made to o follow up or reinforce initial benefits from the project; Proposals for future directions related to the main objectives	• Perceptions of or actual levels of relative effectiveness and/or efficiency of the project cf. with other projects; Perceptions of partners, and other stakeholders as to tangible development results from activities • Lessons that have been learned regarding achievement of outcomes and efficiency (implementation) • Changes could have been made (if any) to the design to improve the achievement of the results	• Interviews with project staff and partners • Desk review of project docs and reports as well as external policy and other docs	• Interviews with project partners and stakeholders and analysis • Document and report analysis*

* See Annex C

ANNEX F. CONSULTANT CODE OF CONDUCT FORM

Evaluators/reviewers:

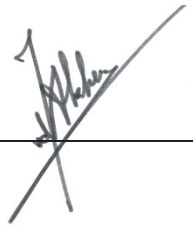
1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners, and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study limitations, findings, and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation/reviewer Consultant Agreement Form

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: J.H.A. VAN DEN AKKER (Team Leader)
Name of Consultancy Organization (where relevant): _____
I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at Westerhoven, Netherlands
Signature: _____



ANNEX G. ABOUT THE REVIEWER

Mr. Jan van den Akker is a technology management scientist with a Master's degree from Eindhoven University of Technology (Netherlands), specializing in international development cooperation. He is an expert on sustainable energy policy and technologies. Mr. Van den Akker specializes in studies and analytical work, project design and development, project coordination and implementation, project monitoring and evaluation, knowledge management, capacity strengthening and public-private partnerships in the field of sustainable energy strategies, energy efficiency, energy technologies and supply, climate change and the Clean Development Mechanism. He has lived and worked abroad for over 7 years in Zambia, Mexico, and Thailand. In addition, has undertaken numerous short missions to about 45 countries in Africa, Latin America, and Asia & the Pacific.

In 2003/2004, he founded ASCENDIS, as an independent office, and has been providing consultancy on sustainable energy and climate change, specializing in development issues. ASCENDIS is based in Westerhoven, Netherlands, but offers services in Africa, Asia and the Pacific, Europe and Latin America & the Caribbean, often by associating itself with local freelance experts, professionals, and organizations. As a long-term expert with the United Nations system, Mr. Van den Akker has provided advice to governments and organizations on the design of investment and capacity building programs for UNEP, UNDP and UNIDO (mostly in GEF-funded activities), UNFCCC, European Commission and for NGOs/consultancy companies (e.g., Practical Action Consulting, Winrock, GFA) in the area of renewable energy, energy efficiency, and sustainable transportation.

As an independent consultant, he has reviewed and evaluated about 40 GEF-funded sustainable energy projects and assisted in the design of about 41 sustainable energy projects. He worked as UNDP Regional Technical Advisor on climate change mitigation (in Eastern and Southern Africa) during 2007-2009 and as Key Expert in the European Union Technical Assistance Facility for Sustainable Energy for All (2015-16). He also worked as Technical Advisor in the implementation of individual projects in Guatemala, Peru, and Malawi.

ANNEX H. AUDIT TRAIL

To the comments received on the draft of the Mid-term Review are provided in a separate file.

ANNEX I : EVALUATION REPORT CLEARANCE FORM

(to be completed by CO and UNDP GEF Technical Adviser based in the region and included in the final

Evaluation Report Reviewed and Cleared by

UNDP Country Office

Name: Verena Linneweber, Deputy Resident Representative

Signature: _____ Date: 08 October 2020

UNDP GEF Regional Technical Advisor

Name: Manuel Soriano

Signature: _____ Date: 08 October 2020