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Project Title: Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV)		
Country: Vanuatu	**Implementing Partner:** Department of Energy, Ministry of Climate Change & Natural Disaster (DOE-MCCND)[1]	**Management Arrangements:** National Implementation Modality (NIM)
UNDAF/Country Programme Outcome*: UN Pacific Strategy 2018-2022*: Outcome 1 – Climate Change, Disaster Resilience and Environmental Protection. *UNDP Sub-Regional Programme Document 2018-2022*: Outcome 1 – By year 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.		
UNDP Strategic Plan Output: *Output 1.4*: Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented. *Output 1.5*. Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy)		
UNDP Social and Environmental Screening Category: Moderate	**UNDP Gender Marker:** Gen1	
Atlas Project ID/Award ID number: 00099978	**Atlas Output ID/Project ID number:** 00103158	
UNDP-GEF PIMS ID number: 5926	**GEF ID number:** 9574	
Planned start date: May 1, 2018	**Planned end date:** April 30, 2022	
LPAC date: September 28, 2018 (tentative)		
Brief Project Description: BRANTV has the objective of enabling the achievement of the energy access, sustainable energy, and green growth targets of Vanuatu, as represented in the country's National Energy Road Map (NERM). Without incremental support, Vanuatu is unlikely to meet its NERMs' 2020 and 2030 targets. As of 2017, about 71% of the nation's over 270,000 people lacked access to grid electricity. Over 80% of the population cooks over open hearth fire. Of the off-grid population, over half have no other access to power aside from a solar lantern. While donor efforts to improve energy access in rural areas via renewable energy (RE) have been substantial and some more limited efforts to promote energy efficient (EE) cook stoves have been initiated, results have far underperformed targets. Particularly, it is widely agreed that sustainability of off-grid RE power systems is poor. Even when systems are installed for free, lack of funds for repairs and lack of local access to parts and services repeatedly result in broken down systems for the long-run. For village-scale RE power systems, in-country capabilities are extremely limited, so that the few systems set up require costly international contractors and take protracted periods to complete. Dissemination of EE cook stoves in rural areas is virtually imperceptible.		

[1] The DOE is a department under the Ministry of Climate Change, Adaptation, Meteorology, Geo-Hazards, Environment and Energy and NDMO. The short name of this ministry is Ministry of Climate Change and Natural Disaster (MCCND).

BRANTV takes a multi-pronged approach to removing the barriers that are resulting in unsustainable, unviable, or weakly disseminated RE and EE systems. It does so in the interrelated areas of capacity, policy and planning, institutional framework, financing, and technical and economic viability. Central to the approach is BRANTV's implementation of Vanuatu's Rural Off-Grid RE and EE Promotion Program, which includes demonstration sub-programs in each of hydropower, village-scale PV, household and family compound-scale PV, EE cook stoves, and productive, livelihood-enhancing uses of RE and EE. Critical to success of these demonstrations and their replication will be the payment and management system introduced to achieve savings for repairs of the RE systems and the nationwide road show to introduce EE cook stoves to the rural population. Training programs, design and adoption of policy and plans, institutional coordination mechanisms, financing mechanisms, and work in sourcing, best price costing, and in-country parts supply will be carried out to influence the widespread application of low carbon technologies to achieve the energy access, sustainable energy and green growth targets of the country.

FINANCING PLAN	
GEF Trust Fund	USD 2,639,726
(1) Total Budget administered by UNDP	**USD 2,639,726**
PARALLEL CO-FINANCING (*all other co-financing that is not cash co-financing administered by UNDP)*	
Department of Energy, Ministry of Climate Change and Natural Disaster (DOE-MCCND), grant	USD 16,348,000
Department of Energy, Ministry of Climate Change and Natural Disaster (DOE-MCCND), in-kind	USD 714,444
Ministry of Tourism, Trade, Commerce and Ni-Vanuatu Business, grant	USD1,000,000
UNDP, grant	USD 100,000
(2) Total co-financing	**USD 18,162,444**
(3) Grand-Total Project Financing (1) + (2)	**USD 20,802,170**

SIGNATURES		
Signature: print name below	**Agreed by Government**	**Date/Month/Year:**
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II. DEVELOPMENT CHALLENGE

Description of development challenge project seeks to address and relevance to national development priorities: BRANTV has the objective of enabling the achievement of the energy access, sustainable energy, and green growth targets in Vanuatu's National Energy Road Map (NERM) via facilitating the application of renewable energy (RE) and energy efficiency (EE) technologies. Without incremental support, Vanuatu is unlikely to meet the NERM's ambitious 2020 and 2030 targets in these areas. Lack of progress towards targets, in turn, is associated with stymied progress toward other development objectives, such as increased incomes, improved standards of living, and improved health.

Off-grid renewable energy power generation: From a development perspective, low levels of electricity access in rural areas results in both a lower quality of life than might otherwise be enjoyed and a lack of access to income generating activities that depend on access to power. The original NERM (2013) had a target of achieving 100% electricity access in long-term off-grid areas by 2020. The updated NERM (2016) indicates that only 9% access in these long-term off-grid areas had been achieved by 2015. Vanuatu's 2017 census indicates that 71% of the nation's roughly 280,000 people lack access to grid electricity. Of those off-grid households, as per the census, over half have no access to power aside from a solar lantern; and around 72% of have access only at this solar lantern level or somewhat better level of pico-PV systems (usually 10 to 20 W). While donor efforts to improve energy access in rural areas via renewable energy (RE) have been substantial, it is widely agreed that poor sustainability of off-grid RE power systems has resulted in repeated failures of such donor projects. Even when systems are installed at no up-front cost to households, lack of funds for repairs and lack of local access to parts and services repeatedly result in broken down systems for the long-run. For village-scale RE power systems, in addition to such sustainability problems, an issue regarding replicability is that in-country capabilities are extremely limited, so that the few systems set up require costly international contractors and take protracted periods to complete.

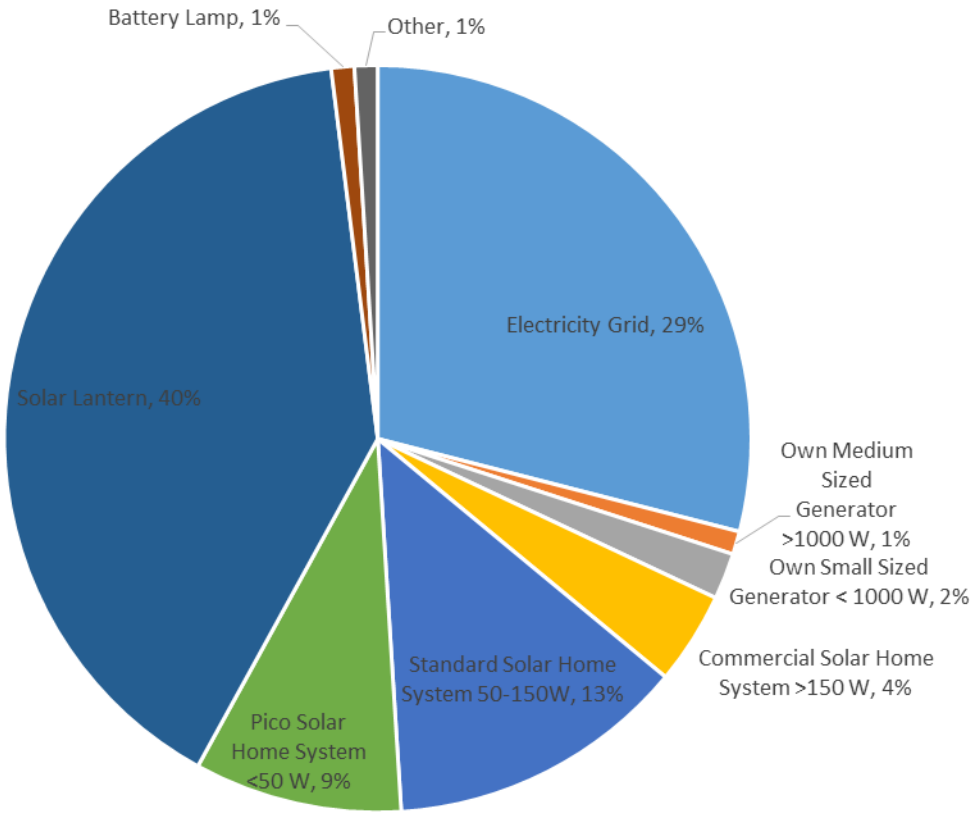
Energy efficiency in rural areas: In terms of energy efficiency in rural areas, two important opportunities in Vanuatu are energy efficient cook stoves and energy efficient crop drying. Currently, large amounts of wood are used in open hearth fires by almost all rural families in Vanuatu for cooking. Wood is also used in an inefficient process for drying crops in rural areas. Worldwide, indoor air pollution from open hearth fires in village huts is considered the air pollution problem negatively impacting the most people; and it disproportionately affects women and children. The situation in Vanuatu appears to correspond to these worldwide trends. Further, cutting of wood for fires is already leading to deforestation in certain areas of the nation, where fuel wood is becoming scarce. Vanuatu's NERM recognizes that EE cook stoves may reduce air emissions by 90% and energy consumption by 50%. It further calls for the promotion of such cook stoves and EE crop driers as among its highest rated priorities. While EE cook stoves have begun to be sold on a very limited level in Vanuatu's urban areas, such stoves are mostly unknown to people living in rural areas.

Relevance to global environment and the SDGs: BRANTV's aim to enable Vanuatu to achieve its NERM targets via the application of RE and EE technologies is relevant to both to the global environment and to the SDGs. In terms of the global environment, achievement of NERM targets will have substantial benefits in reducing greenhouse gas (GHG) emissions from the business as usual scenario. New RE power generation in off-grid areas will represent the alternative to diesel generators. The updated NERM (2016) targets that 65% of national electricity generation be from RE in 2020, though indicates that a level of only 29% had been met by 2012. As for EE cook stoves and EE crop driers, these will reduce GHG emissions for burning of wood by about 50%. An ambitious program for nation-wide dissemination of such products, if successful, will lead to substantial GHG emission reductions. Enabling achievement of the development targets of increased energy access, sustainable energy, and green growth targets

clearly addresses SDG 7, “Ensure access to affordable, reliable, sustainable, and modern energy for all;” and it also addresses SDG13, “Take urgent action to combat climate change and its impacts.” Such work as envisioned in the project design also has the potential to address other SDGs including: SDG8 “Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all” (via productive uses of RE and EE for income generation); and SDG3 “Ensure healthy lives and promote well-being for all at all ages” (via improved air quality achieved via EE cook stoves and RE power systems as compared to business as usual with open hearth fires and diesel generators).

Evidence from data and field work: During the Project Preparation Grant (PPG) phase of project design, it was found that there was a lack of clarity on the real situation of electricity access in Vanuatu’s rural areas. While the PPG was being conducted, the results of the nation’s 2017 Census about electricity access were made public. The data roughly corresponds to findings from extensive field work during the PPG, thus solidifying confidence in some of the key assumptions on which project design is based. The 2017 Census indicates that, while most of the rural population has access to lighting, most the off-grid population has only very limited access to electricity, such as via solar lanterns alone (56% of off-grid households) or the somewhat larger pico-PV systems (9%) that usually run 10 to 20 W. Exhibit 1 shows the relevant result from the 2017 Census.

Exhibit 1. Household Main Source of Lighting in Vanuatu (2017 Census)



Field work to numerous villages suggest that actual access is either at the level of the census or lower. Households in villages in more remote, inland areas of islands tended to have only solar lanterns with perhaps just a few households having a better system, such as pico-solar (usually 10 or 20 W) or a solar home system (SHS) of around 50 W. Villages in more accessible areas might have a higher proportion of households with solar home systems (SHSs) -- up to 50% -- usually all owned by families who have a member who out-migrates to New Zealand for seasonal work under the agreement between Vanuatu and New Zealand for such seasonal labor. As for other types of RE systems, particularly village-scale RE power systems, only a few such systems are known to have been completed and become operational in Vanuatu. Namely, there is a pico-hydro system in the village of Loltong, Pentecost, that is operational and a few such systems on Malekula, though those are reported to have problems. Historically, there were similar pico-/ small micro-hydro systems developed by missionaries, though these have not been operational for many years. Vanuatu also has an operational bio-fuel mini-grid and a few others in the development pipeline.

As for EE cook stoves and crop driers, field work shows that uptake of these is in a very nascent stage in Vanuatu. A few purveyors of such cook stoves do their own fabrication work and sell such stoves in Port Vila, the capital, providing a few systems sporadically upon special request to other locations. Further, one team was found in Port Vila to be developing a crop drying technology based on an energy efficient stove model combined with solar-powered fan. Yet, field work did not reveal much penetration of either EE cook stoves or driers to rural areas. Most persons interviewed in rural areas, in fact, were completely unfamiliar with the concept of an EE cook stove.

Potential for poverty reduction and reduction of inequalities and exclusion: Addressing the development challenge of enabling achievement of NERM targets via the application of RE and EE technologies has the potential for poverty reduction, enhancement of the position of women, and enhancement of the position of other marginalized groups. Off-grid rural RE and EE have the potential to support income-generating initiatives that make use of RE power or EE equipment (e.g. refrigeration of meat, drying of kava, sewing with machines, etc.). In addition to generating income generally, such initiatives can be tailored to support income-generating efforts mainly carried out by women or other marginalized groups, thus enhancing their positions.

Root causes and barriers: Stakeholder input during the log-frame analysis (LFA) workshop and two PPG missions facilitated identification of root causes to address and associated barriers to remove so that RE power generation to be deployed sustainably and for EE cook stoves and crop drying to be adopted on a large scale. The key root causes are: lack of national capacity in RE and EE technologies; lack of Government of Vanuatu policies, guidelines, standards, and plans to promote RE and EE; lack of an institutional framework to sustainably deploy systems and leverage potential synergies between government departments in promoting RE and EE in rural areas; lack of financing for RE and EE; and lack of the needed tools to achieve and proof for the technical and financial viability of RE and EE systems. Barriers associated with each of these root causes are as follows:

Capacity and awareness barriers: There is a lack of technical persons in Vanuatu with the skills to design, install, operate, and troubleshoot rural, off-grid RE systems. There is a lack of high level designers of systems as well as a lack of persons living on various islands that can operate and repair village-scale RE systems. These is also much too limited number of people living on various islands who can repair household-scale PV systems. At present, there is only one known person fabricating the preferred model of such stoves (the “rocket stove”) in the country and no other persons trained in and interested in making their living via fabrication of such stoves. In terms of awareness, the public, in general is not aware of the potential of certain types of RE technologies/ technology configurations, such as pico-hydro and village-scale community to increase their level of access to electricity in a viable way. The majority also lack awareness of EE cook stoves and crop driers.

Policy and regulatory barriers: There is a lack of policies and plans and good enforcement of these to support the development of RE and EE in Vanuatu. Particularly, there is a lack of standards in the areas of pico-/small micro-hydro and village-scale PV; there is a lack of guidelines for village-scale and household-scale RE power systems and for EE cook stoves and crop driers; and there is a lack of policies to incentivize and promote off-grid RE systems. Finally, despite high targets for RE power generation in off-grid areas, there is a lack of a specific road map detailing what kind of system will be most suitable for each of Vanuatu's 2,000 villages and with what prioritization such systems should be developed over time.

Institutional barriers: Institutionally there are several key barriers, ranging from the RE system level, to the government department level, to the government inter-departmental level. As noted, a critical problem that must date stymied most donor efforts to support off-grid RE power generation is a lack of management mechanism that will ensure funds are available for repairs. There is also a lack of an institutional framework to ensure availability of parts and repair services locally. In addition, for DOE, there is a lack of regional presence to better monitor demonstration projects. (DOE currently has just one office and locale for its personnel, in Port Vila.) Finally, there is a lack of cooperation between DOE and various other government departments on productive uses of RE and EE, site identification for promotion of RE and EE, and enforcement of relevant policies.

Financing barriers: One of the major barriers to households and communities adopting RE power generation technology and productive uses thereof in Vanuatu is lack of financing. Rural households and communities typically do not have large reserves of cash to cover the up-front costs of such systems. Yet, there is a lack of bank activity in making loans; and, for village-scale systems, there is a complete lack of investors in the private sector interested in investing in such systems.

Technical and financial viability barriers: There is a lack of information and transparency in the Vanuatu market about the best quality products and the appropriate prices thereof for renewable energy and energy efficiency parts and equipment. Experience to date, in fact, shows that RE equipment is overpriced in Vanuatu as compared to international standards. For example, the market price of 10 W pico-solar systems was found in 2017 to be about USD 200, whereas international norms are less than half that amount. There are no better sourcing channels and information for solar PV system related products currently available in Vanuatu. As for pico-/small micro-hydro, the problem of lack of sourcing information is even more severe. So far, only products of unacceptable quality are available in country. As for EE cook stoves, there is a lack of information on best sourcing channels for the materials needed for fabrication. In terms of proof of technical and financial viability, to date, there has not been any successful demonstrations of long-term sustainable village-scale power systems (or household systems deployed across full villages) that are capable to put aside money for future repairs. Further, there is a lack of RE systems of appropriate scale and lay-out to the off-grid population's concentration and layout successfully demonstrated in Vanuatu. (Village populations are relatively small across the country; and, while there is sometimes clustering of villages, many are relatively far apart and thus not suitable for sharing of small-scale village power systems. As for layout within villages, some villages have households that are close together, but others are organized on a family compound basis, with the compounds relatively spread part in relation to one another.) Further, there is a lack of demonstration of EE cook stoves and EE crop driers in rural areas of Vanuatu, such that most rural residents are unaware of such technologies.

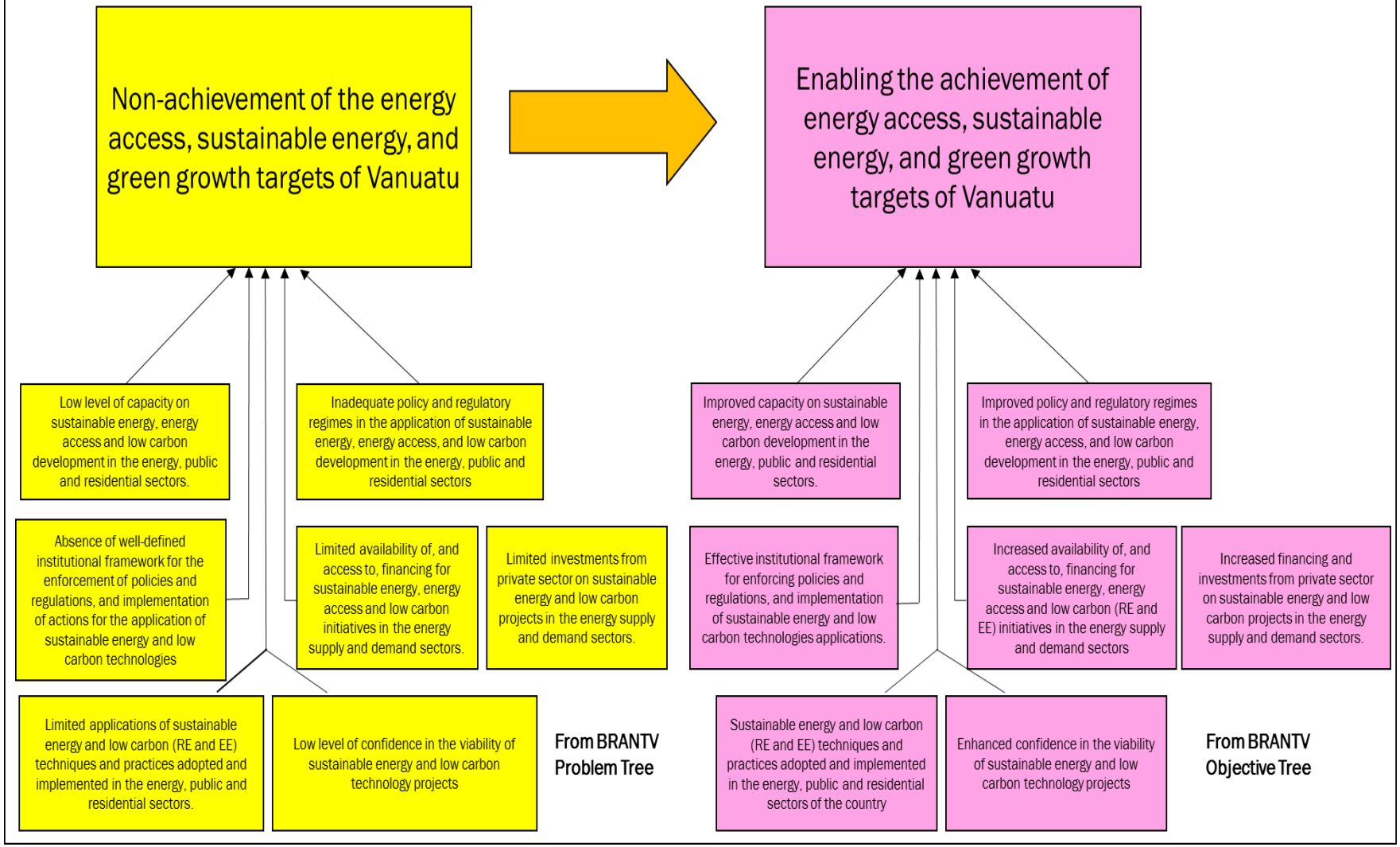
III. STRATEGY

In the case of continuation of the current status quo and implementation of baseline projects only, Vanuatu's NERM targets related to RE and EE for 2020 and 2030 will not be met. Under the project's theory of change, the removal of the immediate causes of the core problem of the non-achievement of the energy access, sustainable energy and green growth targets of the country, will lead to the transitioning of Vanuatu into a situation in which its NERM targets related to EE and RE are on track to be met. Exhibit 2 shows the linkages between the development challenge (core problem) and its immediate causes (on the left in yellow). It also shows that addressing these immediate causes lead to a change in situation in which Vanuatu gets on track for meeting its RE and EE related targets (on the right in purple). As part of its strategy, BRANTV adopts a design in which each major barrier type is addressed in separate project components. However, since some of the barriers are inter-related, the relevant component activities are carried out in an integrated manner. For example, capacity building will address the same RE and EE technology areas that are addressed by the project demos, since the demos are a means of removing not only the technical barriers but also those related to capacity. As another example, the work on addressing institutional barriers also include the development and implementation of the sustainable management mechanism for the operation and maintenance of each project demo. The barrier removal approach and the development and implementation of integrated activities among the major project components have been successfully adopted in other UNDP-GEF projects in the Asia Pacific Region.

The project strategy considers the current *Vanuatu's Off-Grid RE and EE Promotion Program* as the main baseline effort towards achieving the country's NERM targets. This program includes the installation of RE-based (mainly hydro and solar) power generation and distribution systems, as well as some non-power applications of RE such as solar PV freezers for fishermen and solar PV fridges for cooperatives. The current efforts also include the establishment of Vanuatu's National Green Energy Fund (NGEF), a fund that will aim to attract donor financing to be channeled via loans or grants to RE and EE projects in Vanuatu. BRANTV aims to fill in critical gaps in Vanuatu's baseline program, as summarized in the outline below. Currently, despite the program's strengths, with these gaps, the NERM targets are not on-track to be achieved. Yet, with this proposed project that is supported by the GEF, these baseline investments will be more effectively leveraged; and the enhanced program (baseline plus incremental) will be able to transition Vanuatu to be on track to meet its RE and EE targets. The following are some key ways in which the project strategy, combining baseline and incremental efforts, will achieve this transition:

- *Training*: While Vanuatu has substantial baseline program efforts to install RE systems in off-grid areas, training is very limited and generally consists of one-time training upon installation of systems. For larger-scale systems, equipment sourcing and installation capacity is absent; and international experts must be contracted for these functions. For EE cook stoves and driers, there is an absence of personnel to fabricate such systems and no training program to develop such human capacity. To address these capacity gaps in the baseline program, BRANTV will implement an extensive training program covering various hydro, PV, and EE related systems.
- *Policy and planning*: BRANTV design work has identified important policy and planning gaps in the baseline program that it will fill, such as guidelines, standards, and incentive policies, as well as a rural off-grid RE electrification plan.

Exhibit 2. BRANTV Theory of Change



- *Institutional*: BRANTV will address the critical question of how to best manage off-grid RE power systems in Vanuatu, a key gap in the baseline program. This question has generated a lot of discussion and concern so far in Vanuatu, especially given the poor track record in sustainability of past donor off-grid RE projects. Yet no previous project and none of the baseline projects have put substantial effort into the design of management systems. Neither has any project arranged for consensus building work among government officials about such management systems, to be followed by demonstrations of the systems. Further, work to date has not put much attention on bringing DOE together with other departments to promote RE and EE in rural areas and to ensure that relevant policies and plans are implemented. These are institutional areas on which BRANTV will focus and represent relatively innovative incremental aspects of the project. The management system will be a critical feature in the sustainability of rural RE systems and their replication and thus an instrumental contribution towards meeting NERM targets.
- *Financing*: While NGEF is being established, if gaps are not addressed, the fund may not have the intended impact. Incremental work is needed in attracting donor financing and connecting the fund with specific, technically and economically viable projects. BRANTV thus aims to support NGEF in its fundraising and further aims to connect project proponents in the islands with the fund, providing technical assistance to proponents to make applications to the fund. Further, also in the financing realm, PPG work determined that commercial and private sector financing of RE and EE in Vanuatu, aside from some small business loans of National Bank of Vanuatu (NBV) for PV systems, is virtually non-existent. Thus, BRANTV via incremental activities will also work to fill this gap, educating the banks and working with the commercial private sector to set up a loan or equity financing mechanism for off-grid RE projects and productive uses in rural areas.
- *Tools for and proof of economic and financial viability*: A key area of project incremental support that is also quite innovative for Vanuatu will be in sourcing, best price costing, and establishment of local supply of RE and EE parts and equipment. Vanuatu's baseline program is not addressing this area; and, because of that, system costs are excessive and opaque, thus inhibiting financial viability and replication. To provide proof of economic and financial viability, BRANTV adopts a demonstration approach. In this approach, five demonstration programs will be implemented:

    - Comprehensive hydro-based energy generation demo program: This sub-program includes the implementation of different hydro-based power generation technologies in off-grid areas and consists of a mini-hydro system (400 kW Brenwei Mini-hydro), a large micro-hydro system (75 kW Talise Micro-Hydro), and smaller (pico- or small micro-) systems. The last set are incremental and address the gap associated with consideration of the low population of villages and the distances between them, and the need for simple technology that persons in Vanuatu can master on a reasonable timescale, so that replication can be handled domestically. All these RE-based power generation and distribution systems will implement a fee for service system to generate revenues for operational and repair costs, representing an incremental and innovative aspect of the project.
    - Comprehensive commercial rural RE-based energy services business demo program: This includes five PV mini-grids of around 100 kW each, 37 institutional PV systems, and the expansion of a pico-hydro mini-grid to a pico-hydro PV hybrid mini-gird. The last of these is incremental and represents a new and innovative approach in Vanuatu, desirable because it expands a dependable baseline power source to a larger system that can accommodate more productive uses.
    - Comprehensive community-based solar PV energy services business demo program: This is new and incremental, includes ten village-scale community PV systems of 3 to 10 kW each, with or without mini-grids. These demonstrations address the gap associated with consideration of the relatively small scale of many villages in Vanuatu and thus provide much smaller village systems than the 100 kW PV mini-grids in the above sub-program. Strategically, this incremental sub-program also addresses the absence to date of a productive use strategy for increasing system

revenues that can be saved to pay for repairs. This strategy will be a part of the BRANTV fee for service system implemented at these incremental demo sites.

- Comprehensive community based commercial solar PV energy services business demo program: This includes the installation of numerous household-scale PV systems promoted via 33% subsidies and market promotion, and village-wide installation of family-compound scale PV nano-grids at 10 sites. The latter are incremental to the baseline sub-program. The nano-grids, of about 300 W each, will be connected to around five buildings each in family compounds, and will include a fee for service system to generate revenues for operational and repair costs.
- Comprehensive productive use of renewable energy (PURE) demo program: This includes applications of freezers and fridges dedicated PV systems, and incremental productive use activities in village-scale RE initiatives that will diversify productive uses to other areas such as crop drying and sewing. It will further adopt the incremental strategy of stimulating productive uses to generate greater off-grid RE system revenues and thus increase sustainability.
- EE cook stoves production and applications demo program: This new, incremental program will incorporate an extensive road show to introduce EE cook stoves and driers in rural areas across the country. Artisans trained under the project's capacity building and located in both Port Vila and the islands will fabricate and sell stoves to interested households. About 12,000 cook stoves are expected to be adopted among the nation's 55,500 households.

IV. RESULTS AND PARTNERSHIPS

i. Expected Results:

Project Objective: Enabling the achievement of the energy access, sustainable energy, and green growth targets of Vanuatu.

Component 1: Capacity and Awareness Enhancement on Sustainable Energy and Low Carbon Development

Outcome 1: Improved capacity and awareness on sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors.

Output 1.1: Completed technical capacity building programs in off-grid RE technology and EE cook stove applications.

Activity 1.1.1: Design and conduct of training programs in off-grid RE technology applications. For all training programs, a learning-by-doing capacity building strategy will be incorporated either by (i) carrying out training in stages, with each stage followed by work in the field or (ii) having all training take place in the field. A test to assess mastery will be prepared and administered after training is completed.

a) Training program for local operators of pico-/ small micro-hydro (5 to 20 kW) mini-grids in Vanuatu. Training will cover wiring of electrical connections, operation and monitoring of hydro systems and mini-grids, fee collection, and simple maintenance. Around 50 persons will be trained, ensuring adequate number of personnel to support each of the project's 10 pico-/small micro-hydro demos and its one pico-hydro / PV hybrid demo.

b) Training program for high-level designers and installers of pico-/ small micro-hydro mini-grids in Vanuatu. About 5 persons will be trained. Training will also cover pico-hydro/ PV hybrid mini-grids.

c) Training program for local operators of village community PV systems (3 to 10 kW, with or without mini-grids) in Vanuatu[2]. Training will cover wiring of electrical connections; operation and monitoring of PV panels, batteries, and mini-grids; fee collection; and simple maintenance. Around 25 persons will be trained, ensuring adequate number of personnel to support each of the project's 10 village community PV demos. This enhanced training program will provide much more extensive training with emphasis on systems operated and used by village communities as opposed to institutions.

d) Training program for high-level designers and installers of village community PV systems (with or without mini-grid) and of family compound-scale nano-grids in Vanuatu. About 5 persons will be trained.

e) Training program in the installation, troubleshooting, and repair of small SHSs and nano-grids up to 300 W[3]. Around 300 persons will be trained on various islands of the country so that they can serve local markets. Selected persons for the larger group will be trained to serve the project's ten family compound-scale PV nano-grid villages. This improved training program will provide much more extensive training to a group of persons who will them be able to provide repair services to multiple households in their area.

Activity 1.1.2: Design and conduct of a training program in the making of energy efficient cook stoves. Training will cover sourcing of materials, production of stoves, and sales/ distribution approach. About 30 persons will be trained. A test to assess mastery will be prepared and administered after training is completed. Artisans achieving a high level of mastery and showing commitment to promote the stoves will be provided with the necessary tools for making the stoves as a part of Activity 5B.4.2. Artisans will include those from Port Villa and at least one from each of the project's village-scale community PV sites, where power will be available for them to fabricate EE cook stoves to serve the local market on their respective islands.

Activity 1.1.3: Design and conduct of a survey of persons trained in Activity 1.1.1 and Activity 1.1.2 to determine whether these persons since have become actively engaged in the operation, management, repair, design, production, and/or installation of off-grid RE systems or EE cook stoves, using what they have learned in the project capacity building. A survey will also be conducted to check whether they are involved in off-grid RE and/or EE cook stove related work as one of their main sources of income. Such survey will be conducted once towards middle of project lifetime and once towards end of project lifetime.

Output 1.2: Designed, published, and disseminated how-to guidebooks for off-grid RE and EE provided in Bislama, with accompanying MP4/MP5 videos in Bislama and mechanisms to remotely ask questions of experts.

Activity 1.2.1: Design and preparation of "how-to" guidebooks (Bislama) for off-grid RE and EE technology applications. Preparation of accompanying MP4/MP5 videos in Bislama. This involves the setting up and implementation of a mechanism by which those working locally on such applications can remotely ask questions of experts. The foregoing will be carried out for each of the following:

a) Installation, operation, and repair of pico-/small micro-hydro mini-grids. Content will also cover assessing suitability of potential water resources, basic design, and issues such as distance from

[2] This program also includes the baseline one-time training provided to institutions upon installation of their institutional-scale PV systems under the World Bank VREP Phase 2 Project.
[3] This program also includes the baseline one-time training provided to households upon installation of their SHS under the World Bank VREP Phase 2 Project.

village, concentration of households, and need for willingness to pay for power. Pico-hydro/ PV hybrid mini-grids will also be addressed.

b) Installation, operation, and repair of village community PV systems (with or without mini-grid). Content will also cover assessment of suitability/ potential of local solar resource and the need for future demand and willingness to pay for the power.

c) Benefits, production techniques, and sale of energy efficient cook stoves.

d) Installation and repair of small SHSs and family compound-scale nano-grids up to 300 W.

Activity 1.2.2: Design and conduct of survey of recipients of Activity 1.2.1's how-to guidebooks/ MP4 or MP5/ remote consultations by experts – This involves the assessment of whether the recipients have made active use of the materials and services and whether they are involved in off-grid RE and/or EE cook stove related work as one of their main sources of income.

Output 1.3: Completed awareness raising program for the public on off-grid RE technology and EE cook stove applications.

Activity 1.3.1: Promotion of results of off-grid RE technology demonstrations and outreach for identification of new sites via social media and other forms of outreach, such as text messaging and radio. The promotion will also cover productive uses of RE-based energy generation in off-grid areas. Key areas for this outreach will include:

a) Pico-/ small micro-hydro: Villagers will be provided with guidelines for identifying suitable water sources for pico-/ small micro-hydro sites and request proposals/ photos of such potential sites. Pico-hydro/ PV hybrid mini-grids are also included.

b) Village community PV system (with or without mini-grid). Villagers will be apprised of the need for productive uses to ensure success and request proposals of suitable sites.

c) Village-wide family compound-scale PV nano-grids. Proposals for suitable sites for village-wide deployment of family compound-scale PV nano-grids of about 300 W each will be requested.

Activity 1.3.2: Design and conduct of campaign to promote the adoption of energy efficient cook stoves involving social media, such as Facebook, text messages, and other means (to be coordinated with energy efficient cook stove roadshow carried out in Activity 5B.3.1).

Activity 1.3.3: Design and conduct of campaign to educate people on household-scale PV systems. The campaign will promote sourcing information on the most competitive prices and quality in the market (developed via Activities 5A.1.3 and 5A.1.5). It will also educate people on the best ways to maintain household PV systems (including proper and optimal battery use and impact on battery performance and lifetime), how to seek appropriate replacement batteries, and how to dispose of discarded materials. It will make use of social media, such as Facebook, text messages, and other means of outreach.

Activity 1.3.4: Conduct of survey via social media and other means to determine number of communities interested in replicating the project pico-/ small micro-hydro, pico-hydro PV hybrid, village community PV, and village-wide family compound-scale PV nano-grid demos. Survey results will be used in assessing first two indicators for Outcome 5B.

Output 1.4: Established and operational information exchange network for the promotion and dissemination of knowledge on sustainable energy and low carbon development - This is the information exchange network for the sharing of information on RE technology applications (power and non-power) within and outside the country. The following activities are intended to deliver this output:

Activity 1.4.1: Assessment of information needs of the energy sector, particularly in the rural and off-grid areas, and preparation of cost curves. This involves the evaluation of the current stock of information (i.e., type, quality and quantity) about RE and EC&EE/LC technologies available to the public including in the schools. A comprehensive report about the results and recommendations of the assessments will be prepared for purposes of identifying the sort of technical and information support that each region in the country should be provided. Further, two cost curves will be prepared: (1) a "marginal cost abatement curve" (MCAC) that ranks implementation of various RE and EE technologies in Vanuatu in terms of the cost per ton of carbon dioxide equivalent abated and (2) a marginal cost curve for RE power generation technologies that ranks implementation of various such technologies in Vanuatu in terms of cost per kWh of power generated.

Activity 1.4.2: Development, establishment, and operationalization of an energy technology information exchange service - This involves the design and development of the agreed system of RE, EC&EE and LC technology information sharing, including the management and operational arrangements for the system. This system will enable sharing of latest technology and market development information within the energy sector of the country including the technology developers and suppliers in other PICs and SIDS.

Activity 1.4.3: Sustaining and strengthening the information exchange service - This involves the organization and conduct of workshops to strengthen technical and information exchanges within the country's energy sector and in other PICs and SIDS. These will be on the: (a) Review of the operation, performance and impacts of the service to identify potential improvements; and, (b) Sustenance and improvement of the utilization and maintenance of the service.

Output 1.5: Established and operationalized energy (petroleum and electricity) supply and consumption monitoring and reporting and database system – The database shall serve as the repository of all data/information about the energy supply and demand, consumption, and energy utilization performance of the country. The following activities are intended to deliver this output:

Activity 1.5.1: Conduct of research/study on the requirements and procedures for processing, verification, and encoding, as well as data updating. This involves the identification and design of the most feasible, reliable and cost-effective means of data processing, verification, and encoding, and maintenance.

Activity 1.5.2: Design and development of the energy supply and consumption database. The database shall be housed in the DOE, which will be responsible for its operation and upkeep. The database modules will be based on the parameters that are defined in the energy supply and consumption monitoring and reporting system design. Apart from the information from the energy consumption reports of energy producers/suppliers and selected end-use sector entities, results of analyses of the results of the demos/pilots that will be implemented, as well as information of up to date RE, EC&EE and LC technologies development and applications in other countries.

Activity 1.5.3: Capacity development in the use of the database - This involves the design, preparation and conduct of workshops to review the operation, performance of the database; and, training on the utilization and maintenance of the database.

Component 2: Improvement of Energy Policy and Planning Formulation and Implementation

Outcome 2: Improved policy, planning, and regulatory regimes in the application of sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors.

Output 2.1: Adopted and implemented detailed rural electrification plan (*Vanuatu Off-Grid Rural Electrification Roadmap*) covering all 65 inhabited islands of Vanuatu.

Activity 2.1.1: Preparation of detailed off-grid rural electrification plan covering all 65 inhabited islands of Vanuatu. The work will include the following steps: (i) Mapping of off-grid electrification needs across the country covering all 2,000 villages. (ii) Determination of most appropriate system types for each locale. (iii) Prioritization of locales (e.g. which to support in a first phase, etc.). (iv) Determination of the best means of system installation and management for each proposed site. The detailed rural electrification plan will consider findings regarding the project demos (Outcome 5B) and consider institutional work on management systems for mini-grids (Outcome 3). It will also consider (i) the sites identified under the national assessment of pico-hydro/ small micro-hydro potential (Activity 2.1.2A); (ii) identified sites for village-scale community PV (Activity 2.1.3A); (iii) identified sites for deploying family compound-scale PV nano-grids (of around 300 W each) across the full village (Activity 2.1.3A); as well as (iv) relevant institutional work for management of all such systems carried out under Component 3. For household-scale and family compound-scale systems, the *Roadmap* will include aspects of the institutional work of Activities 3.4.1 and 3.4.2 for, respectively, ensuring availability of replacement batteries and repair services and for ensuring proper disposal of batteries, panels, and other parts. For the latter aspect, the *Roadmap* will include the detailed steps for putting into place a "disposal mechanism." For the four islands of Emae, Mataso, Makira, and Aneityum, the *Roadmap* work will build on rural electrification plans already developed for villages on each of these islands under a GIZ project.[4] *Roadmap* work will generally require information on sizes of communities, distances between households, and availability of RE resources. This information may be input into GIS maps if needed to facilitate *Roadmap* design.

Activity 2.1.2a: Identification of promising pico-hydro and small micro-hydro mini-grid (systems roughly in the range of 5 kW to 20 kW) village sites. For initially identified potential villages, work will include assessment of technical and economic viability, and, for priority sites, pre-feasibility work and pico-/ small micro-hydro replication plans. Findings/ sites will be considered in the preparation of the *Vanuatu Off-Grid Rural Electrification Roadmap* (Activity 2.1.1). Identification of initially promising villages will be achieved by a combination of (i) survey work and (ii) screening of proposals received from villages, as result of the outreach under Activity 1.3.1. This activity will also include identification of potential pico-hydro sites that may be suitable for pico-hydro / PV hybrid systems.

Activity 2.1.2b: Preparation of national targets for pico-/ small micro-hydro mini-grids. This will be based on an assessment of potential for pico-hydro and small micro-hydro mini-grids (systems roughly in the range of 5 kW to 20 kW) to play a significant role in Vanuatu's overall rural electrification, extrapolated from the findings of Activity 2.1.2a. This activity may also include targets for pico-hydro/ PV hybrid installations.

[4] Under the GIZ project assignment *Consultancy Services to Develop a Renewable Energy-based Off-grid Electrification Plan for Remote Islands of Vanuatu along the Example of Four Islands*, the document "Report 4: Technical Design of Potential Renewable Energy Projects for Selected Islands" (June 2016) provides rural electrification plans for one village on Mataso, one on Makira, ten villages on Emae, and four villages on Aneityum. Most of the designs call for provision of individual households PV systems (either pico-PV or small SHS) with monthly payments by households for maintenance and parts following such provision, though in some cases PV mini-grids are recommended. The *Vanuatu Off-Grid Rural Electrification Roadmap* may build on these plans, perhaps with some modification if changes over time or learnings from the BRANTV demos, etc., suggest such modification.

Activity 2.1.3a: Identification of villages that are suitable and promising for village-scale community PV systems (systems in the range of 3 to 10 kW, with or without mini-grid) and those that are suitable for deployment across the village of family compound-scale nano-grids (typical scale of 300 W). For initially promising villages, work will include assessment of technical and economic viability, and, for priority sites, pre-feasibility work and replication plans. Findings and recommended sites will be considered in the preparation of *Vanuatu Off-Grid Rural Electrification Roadmap* (Activity 2.1.1). Identification of initially promising villages will be achieved by a combination of (i) survey work and (ii) screening of proposals received from villages as result of the outreach under Activity 1.3.2.

Activity 2.1.3b: Preparation of national targets for (i) village-based community PV systems (with or without mini-grids) and (ii) villages to be served by family compound-scale PV nano-grids (of about 300 W each) to be deployed across the village. In the case of village-based community PV, these targets will be based on an assessment of potential for village community PV (systems roughly in the range of 3 kW to 10 kW) to play a significant role in Vanuatu's overall rural electrification, extrapolated from the findings of Activity 2.1.3a, as well as level of success with the project's village community PV demos. In the case of PV nano-grids, targets will be based on an assessment of the potential for PV nano-grids (of about 300 W each) deployed across a full village to provide the optimal electrification approach in a subset of the nation's villages, also extrapolating from findings of Activity 2.1.3a, as well as level of success of the project's demos of village-wide deployment of family compound-scale PV nano-grids (of about 300 W each).

Activity 2.1.4: Launching of implementation of Phase 1 of the *Vanuatu Off-Grid Rural Electrification Roadmap* via facilitation of financing of replication of the BRANTV demos at priority sites through technical assistance in securing financing, as provided under Component 4.

Output 2.2: Adopted and adhered to national guidelines and adopted and enforced standards to support quality and cost effective development of off-grid RE electrification and EE cook stoves.

Activity 2.2.1: Preparation/ development and promotion of and adherence to national guidelines for design, sourcing, best price costing, installation, safety, and maintenance of:

a) Pico-/small micro-hydro mini-grids - The guidelines will draw from the results of Activities 5A.1.1 and 1.2.1a, and put strong emphasis on safety. The design, installation and operation of the 20 pico-/ small micro-hydro project demos shall adhere to these guidelines. The development of guidelines for hybrid pico-hydro/ PV mini-grids is included in this work.
b) Village community PV systems (with and without mini-grids) - The guidelines will draw from the results of Activities 5A.1.2 and 1.2.1b, and put strong emphasis on safety. The design, installation and operation of the demos for the 10 village/community PV project demos shall adhere to these guidelines.

Activity 2.2.2: Preparation/ development, promotion, and enforcement of national standards for RE-based system mini-grids. The standards preparation work will include review of existing standards in comparable countries that may provide the basis for Vanuatu standards.

a) Pico-/small micro-hydro and associated mini-grids – The adoption of standards is targeted for Year 3 of the BRANTV project implementation period and enforcement for Year 4. These standards will be required to be met at any replication sites pursued via financing work. The preparation of standards for hybrid pico-hydro/ PV mini-grids is included in this work.

b) Village community PV systems (with or without mini-grid) and associated mini-grids and for PV nano-grids (of about 300 W each) - The adoption of standards is targeted for Year 3 of the BRANTV project implementation period and enforcement for Year 4. These standards will be required to be met at any replication sites pursued via financing work.

Activity 2.2.3: Preparation/ development, promotion of, and adherence to national guidelines on energy efficient cook stoves, providing information on parts, quality, and sourcing, as well as information on energy savings of various types of stoves. (Information will be derived from the relevant activities of Outcome 5A, namely Activity 5A.1.4 on sourcing/costing and Activity 5A.4.1 on energy savings). These guidelines will be used in the design and installation of the EE cook stove demos.

Activity 2.2.4: Preparation/ development, promotion of, and adherence to national guidelines for sourcing, best prices for quality systems, installation, safety, operation (that will maximize battery life), and maintenance (including provision of replacement batteries and repair services) of household-scale and family compound-scale PV systems (including small SHSs and PV nano-grids up to 300 W). Information to prepare guidelines will be drawn in part from sourcing/costing work and replacement battery work (Activities 5A.1.3 and 5A.1.5), as well as campaign to educate people on household level and compound level PV (Activity 1.3.3) and how-to household and family compound-scale PV guidebook (Activity 1.2.1d). These guidelines will be used in the design and implementation of the ten project demo villages where compound-scale PV nano-grids are deployed village-wide.

Output 2.3: Adopted and implemented *Off-grid Rural Electrification Policy* that promotes and ensures the quality development of off-grid renewable energy power systems.

Activity 2.3.1: Development and promotion of regulations regarding electricity tariffs for off-grid rural renewable energy power provision (to be incorporated into *Off-Grid Rural Electrification Policy*). The tasks include promotion of the proposed regulations for their adoption/approval and enforcement.

Activity 2.3.2: Development and promotion of regulations regarding the management of (multiple household) off-grid renewable energy systems by owners or contracted managers (to be incorporated into *Off-Grid Rural Electrification Policy*). Such regulations will facilitate owners of systems to either set aside funds or by other means guarantee to have funds available when needed for parts and repairs to ensure system sustainability. These will be adhered to at the 40 relevant project demo sites as a policy pilot and then be adopted and enforced nation-wide as the rural electrification plan is rolled out.

Activity 2.3.3: Formulation of enhancements to existing proposed policy for ensuring PV parts and battery waste are disposed of properly (to be incorporated into *Off-Grid Rural Electrification Policy*). This work will be coordinated with the institutional work related to PV battery waste of Activity 3.4.2. This work will be in cooperation with VREP on its current proposed "Electronic Waste Code of Practice" legislation waiting for review in Parliament and include mechanisms to enable the shipment of battery waste to other countries for recycling. The revised policy will be adopted and implemented.

Activity 2.3.4: Formulation of policy ensuring appropriate batteries and other relevant off-grid RE system parts (for household PV, family compound-scale PV nano-grids, community PV, and pico-/ small micro-hydro, and pico-hydro/ PV hybrid) are available in local markets. For household-scale and family compound-scale PV, this will include a requirement that vendors ensure batteries and other relevant parts are easily replaceable with generic types and that local markets supply these. Relevant items will be incorporated into *Off-Grid Rural Electrification Policy*. This work will be coordinated with the institutional strengthening work related to PV battery replacement in Activity 3.4.1 and with work related to facilitating the local availability of relevant parts for pico-/ micro-hydro, community PV, and family

compound-scale and household-scale PV in Activity 5A.1.1, Activity 5A.1.2, and Activity 5A.1.4, respectively. The proposed policy will be promoted for adoption and implementation.

Activity 2.3.5: Research, drafting, and formulation of recommended preferential policies to encourage private sector investment and financing of off-grid RE. Proposed policies may, for example, extend duty free import status to more products related to off-grid RE power generation. As solar related products are already duty free in Vanuatu, this work will target achieving duty-free status for pico-hydro and small micro-hydro related equipment and target any gaps in duty free status of other solar related products. The preferential policies that will be promoted in this activity will not necessarily be limited to the area of import duties. At least some of the proposed policies will be adopted and implemented.

Component 3: Institutional Framework Enhancement for Sustainable Energy and Low Carbon Development

Outcome 3: Established institutional framework enables the effective enforcement of policies and regulations, and implementation of plans, programs, and projects, on the application of sustainable energy and low carbon technologies.

Output 3.1: Promoted and implemented management models for sustainably running off-grid pico-/ small micro-hydro mini-grids, village community PV systems (with and without mini-grids), and family compound-scale PV nano-grids distributed across full villages.

Activity 3.1.1: Analysis of relevant options and design of preferred model/ models for running pico-/ small micro-hydro mini-grid systems (including pico-hydro/ PV hybrid mini-grids), village community PV systems (with or without mini-grid), and family compound-scale PV nano-grids distributed across full villages. The model/ models will encompass means of assessing and collecting electricity fees, paying local personnel, and funding and carrying out ongoing O&M. A key driver of the model will be the need to collect fees for electricity and save these for when funds are needed for repairs and replacement parts. The work will include identification and confirmation of entities to invest in and run the pico-/small micro-hydro mini-grids (including pico-hydro/ PV hybrid mini-grids), the village community PV systems (with or without mini-grid), and family compound-scale nano-grids (of about 300 W each) distributed across full villages. These entities will likely be local business entities or RESCOs working with a designated national level organization that will monitor their fee collection work and their setting aside of payments for O&M. Multiple signatories will be required to withdraw money from the O&M fund of each village RE power project.

Activity 3.1.2: Outreach to relevant stakeholders and experts to refine and finalize model/ models and build consensus on it/ them. Finalized model/ models will be used in the project's demo pico-/ small micro-hydro mini-grids (including pico-hydro/ PV hybrid), village community PV systems (with or without mini-grid), and family compound-scale PV nano-grids (of around 300 W each) distributed across full villages. Outreach will include one-on-one meetings with decision makers and a workshop to which departments of the productive sectors and other relevant departments will be invited to brainstorm and come up with the refinements needed to ensure the model/ models are practicable.

Output 3.2: Implemented institutional mechanisms for cooperation between DOE and other national level departments to promote off-grid RE power generation and EE cook stoves, as well as their utilization for productive uses.

Activity 3.2.1a: Identification of promising productive uses and design of roadmaps for productive use of electricity at demo sites – This will be carried out in cooperation with departments from the productive sector (especially Department of Cooperatives, Department of Agriculture, Department of Livestock,

Department of Fisheries, and Department of Tourism). The productive use applications will also make use of the electricity production from the pico-/ micro-hydro systems (including the hybrid pico-hydro/PV), community PV systems (with or without mini-grid), and family compound-scale nano-grid systems that will be showcased in the demo sites.

Activity 3.2.1b: Identification of promising village community PV system (with or without mini-grid) sites and promising compound-level PV nano-grid sites for replication of project demos – This will also be carried out via cooperation between DOE and national-level departments from the productive sector (e.g. Department of Cooperatives, Department of Agriculture, Department of Animal Livestock, Department of Fisheries, and Department of Tourism). The results from this activity will feed into Activities 2.1.3a and 2.1.3b and be incorporated into *Vanuatu Off-Grid Rural Electrification Roadmap*. As ability to generate income is important to the sustainability of off-grid systems, the cooperation will emphasize identifying sites known by the departments from the productive sector to have good existing or potential economic activity that may be expanded to additional economic activities/ higher value add once electricity is available.

Activity 3.2.1c: Design of institutional mechanisms for DOE to cooperate with various departments from the productive sector in: (i) promoting productive use of electricity in conjunction with rural off-grid renewable energy based electrification; (ii) identifying new, appropriate sites for village community PV systems (based on high productive use potential); (iii) working together to realize co-development of such systems along with productive uses of the systems; and, (iv) identifying high potential sites for EE cook stove dissemination and working together to disseminate EE cook stoves at such sites. This will include the signing of a new MOU between DOE and Ministry of Agriculture (covering Department of Agriculture, Department of Livestock, and Department of Fishers) and relevant additions to existing MOU between DOE and Ministry of Trades (covering Department of Tourism and Department of Cooperatives). This will be based on experience to-date with cooperation under BRANTV (Activity 3.2.1a and Activity 3.2.1b). Institutional mechanism will be implemented by continuation of cooperation initiated under Activities 3.2.1a and 3.2.1b, now in a more formalized manner.

Activity 3.2.2: Identification of pico-/ small micro-hydro sites based on Water Resources Department (WRD) work on gravity feed water supply via cooperation between DOE and WRD. Results will feed into Activities 2.1.2a and 2.1.2b and the *Vanuatu Off-Grid Rural Electrification Roadmap*. Based on experience with cooperation, the appropriate institutional mechanism will be designed emphasizing a stronger cooperation of DOE with WRD in identifying further sites for pico-/ small micro-hydro and for DOE and WRD to work together to realize co-development of gravity feed water supply and pico/small micro-hydro at appropriate sites. The designed institutional mechanism, which entails the continuation of cooperation, but in a more formalized manner, shall be implemented.

Activity 3.2.3: Conduct of collaborative work between DOE and other relevant national-level departments, especially Department of Forestry, to: (i) identify high priority sites for energy efficient cook stove dissemination; and, (ii) work together to promote energy efficient cook stoves at such sites. High potential sites include those in which deforestation is seriously degrading the environment and those in which villagers may have lack of easy/ close access to firewood. A suitable institutional mechanism will be designed to enable DOE to work with these other departments to identify sites and promote EE cook stoves at such sites. The designed institutional mechanism, which basically is continuation of cooperation, but in a more formalized manner, shall be implemented.

Output 3.3: Implemented institutional mechanisms to facilitate adherence to guidelines and enforcement of standards and regulations related to pico/ micro-hydro, village community PV, family compound-scale PV nano-grids, EE cook stoves, single building SHSs.

Activity 3.3.1: Identification of relevant departments and setting up of cross departmental institutional mechanism to achieve adherence and enforcement (as relevant) to guidelines, standards, and regulations developed under Component 2 to promote and ensure quality of pico-/ micro-hydro mini-grids (including pico-hydro / PV hybrid), village community PV systems, family compound-scale PV nano-grids, and EE cook stoves. The established institutional mechanisms shall be implemented at project demo sites and at proposed replication sites.

Output 3.4: Implemented institutional mechanisms to facilitate the sustainable rollout of household scale PV systems in Vanuatu.

Activity 3.4.1: Development and launch of a system to facilitate the availability and proper repair or replacement of batteries and other parts for SHSs on the islands. The work will include assessment of institutional options for ensuring availability of battery replacement and repair services for household PV systems in rural areas. Best organizations for managing battery provision and service providers will be determined. System developed will be incorporated into the *Vanuatu Off-grid Rural Electrification Roadmap*. This activity also includes the launch of the system implementation.

Activity 3.4.2: Development and launch of a system, in cooperation with VREP, to facilitate the proper disposal of SHS and plug and play system parts, including batteries, panels, etc. The developed system will be incorporated into the *Vanuatu Off-grid Rural Electrification Roadmap*. Department of Environment will be involved in this work. This activity also includes the launch of the system implementation.

Output 3.5: Established and operational *Northern Vanuatu Rural Renewable Energy and Energy Efficiency Promotion Center* of DOE.

Activity 3.5.1: Establishment and operationalization of the DOE *Northern Vanuatu Rural Renewable Energy and Energy Efficiency Promotion Center* in Luganville to increase DOE's capacity and capabilities in the region. The formalization of DOE's ongoing work in Northern Vanuatu under the Center will enable DOE to more effectively carry out this work. The Center will provide support to and monitoring of rural areas of northern islands in rural renewable energy-based power generation, other renewable energy applications, and rural EE applications, especially energy efficient cook stoves. This activity will include development of an action plan for increased site visits by DOE to northern villages to promote rural RE and EE. As a baseline, the number of DOE person-days spent at northern field sites in 2017 will be determined.

Component 4: Sustainable Energy and Low Carbon Initiatives Financing

Outcome 4A: Increased availability of, and access to, financing for sustainable energy, energy access, and low carbon (RE and EE) initiatives in the energy supply and demand sectors.

Output 4A.1: Completed outreach program to identify and secure international funding for Vanuatu's National Green Energy Fund (GNEF).

Activity 4A.1.1: Identification of potential sources of international funding for Vanuatu's NGEF in general, and particularly to enable establishment of sub-fund for replication of the BRANTV demos in pico-/small micro-hydro, pico-hydro/ PV hybrid, village community PV, village-wide deployment of family compound-scale nano-grids (of about 300 W each), and EE cook stoves. This activity also involves the provision of support to NGEF for outreach and application to identified international sources. Outreach will promote NGEF to potential donors/ funding sources and particularly a specific sub-fund to support replication of the BRANTV demos.

Output 4A.2: Implemented program to assist those applying to NGEF for funding for replication of BRANTV demos.

Activity 4A.2.1: Conduct of advisory services and other technical assistance to local project proponents in developing project proposals and preparing applications for loan and/ or grant funding to NGEF for replication of the BRANTV demos, namely pico-/ micro-hydro, pico-hydro/ PV hybrid, village community PV, family compound-scale PV nano-grids deployed across a full village, and EE cook stove dissemination. Technical advising will include preparation of simple financial models for the proposed replication projects.

Output 4A.3: Implemented program to assist those applying to NGEF or other funding source for loan or grant to support their "productive uses" (productive initiatives that will make use of renewable energy based power).

Activity 4A.3.1: Conduct of advisory services and other technical assistance to local entrepreneurs in developing productive use projects and preparing applications to NGEF or other available funding sources for loan or grant funding for rural, small-scale businesses that utilize off-grid RE-based power generation.

Outcome 4B: Increased financing and investments from private sector on sustainable energy and low carbon projects in the energy supply and demand sectors

Output 4B.1: Completed capacity building for the existing banks on financing low carbon development projects.

Activity 4B.1.1: Design and conduct of training program for banks in Vanuatu on the financing of RE and EE, with an emphasis on off-grid RE power generation financing. The training program will emphasize assessment of management models and financial viability of such systems. A test to assess mastery will be prepared and administered after training is completed.

Output 4B.2: Established and operational commercial or private sector financing scheme for low carbon technology (power and non-power applications) projects.

Activity 4B.2.1: Conduct of advisory and design assistance services to banks and/or private sector direct investors in developing and launching a financing scheme (loans or direct, equity investments) for off-grid rural RE power generation and other rural RE and EE applications, as relevant. The financing scheme may expand an existing development loan fund to cover RE and EE applications, as well as associated productive uses. Or it may establish a new loan fund that banks/financial institutions will capitalize and operationalize. In either case, successful loan repayment will be based on revenues generated by either the energy system (e.g. power tariffs) or productive uses (e.g. income generation from kava drying, sewing, etc.) facilitated by the energy system.

Output 4B.3: Completed sustainable EE and RE technologies application projects financed either through the established commercial or private sector financing scheme; or by multiple one-off private sector investments.

Activity 4B.3.1: Assistance to banks or private sector equity investors in sourcing/ connecting with financially viable off-grid rural RE power generation projects (and other rural RE and EE applications projects, as relevant) for either loan or direct, equity investment financing. Facilitation of subsequent exchange between funding source and projects to achieve financial close on transactions. Emphasis will

be on identifying RE and EE projects that generate revenue (such as through power tariffs) and on identifying productive uses associated with RE and EE that generate income (such as through kava drying, sewing, rental of refrigeration space, etc.). As such, the funded projects will be able to make loan repayments in the case of bank loans or provide returns to equity investors in the case of direct equity investment.

Output 4B.4: Completed evaluation of suggested enhanced commercial or private sector financing schemes for supporting initiatives on low carbon development.

Activity 4B.4.1: Evaluation of bank loan or direct, equity investment financing scheme developed and launched under Activity 4B.2.1 and implemented under Activity 4B.3.1. The evaluation will assess funding allocated to the scheme, soundness of mechanism, and actual projects supported by the scheme. Problems encountered and lessons learned will be highlighted. Based on findings, suggestions for enhancement of the financing scheme will be made.

Component 5: Sustainable Energy and Low Carbon (RE and EE) Technology Applications

Outcome 5A: Viable (technical and economic) sustainable energy and low carbon (RE and EE) techniques and practices adopted and implemented in the energy, public, private sector, and residential sectors of the country.

Output 5A.1: Established and operational high quality, low cost sourcing channels and available best cost breakdowns for renewable energy and energy efficiency systems in Vanuatu.

Activity 5A.1.1: Research, liaison, and conduct of technical support to achieve availability of high quality, low cost sourcing of pico-/ small micro-hydro mini-grids and transparent best cost pricing for all aspects of pico-/ small micro-hydro mini-grid development.[5] This activity entails the following tasks:

(1) Sourcing support - *Identification of high quality equipment for pico-/small micro-hydro at good prices for Vanuatu market and liaison work to ensure viability of best sourcing channels.*
(2) Costing guidance and transparency - *Development and documentation of best price break-down of costing for pico-/small micro-hydro mini-grids in Vanuatu (covering various required equipment and parts, civil works, installation, design work, etc.) and widespread dissemination of this costing info. The information disseminated will also include sourcing channels.*
(3) Local supply of parts - *Liaison with and technical and marketing support for commercial outlets in Vanuatu for stocking and supplying, at high quality and low price, needed parts for pico-/ small micro-hydro systems and mini-grids in Vanuatu, resulting in an in-country inventory of replacement parts.*

Activity 5A.1.2: Sourcing, best price costing, and local parts supply work[6] for: (i) village community PV systems (with or without mini-grid); (ii) family compound-scale PV nano-grids of up to 300 W; and, (iii) household-scale SHSs and plug-and-play PV systems. Activity/ sub-activity descriptions are the same as for micro-/mini-hydro mini-grids in Activity 5A.1.1.

Activity 5A.1.3: Conduct of technical assistance to artisans in sourcing of parts (at best price for quality parts) for energy efficient cook stove fabrication. This will involve determination of lowest cost for

[5] While similar work for PV systems is covered in the next activity, this activity should cover any special parts that may be needed to expand pico-hydro systems to hybrid pico-hydro/ PV systems.
[6] The work on household-scale SHSs and plug-and-play systems will aim to address the problem that the prices of such household systems in Vanuatu often surpass international norms by an excessive amount. Work for local supply of parts for the household SHSs and plug-and-play systems will emphasize stocking on the various islands of appropriate battery replacements for SHSs and plug and play PV systems.

quality materials, reasonable margins for artisans, and appropriate selling price for energy efficient cook stoves.

Output 5A.2: Confirmed and secured community support for project demos.[7]

Activity 5A.2.1: Carrying out of liaison with individual families and of full village meetings to confirm ownership and availability of land for demos of RE-based power generation and distribution systems and confirm community interest and willingness to provide labor to set up all the incremental demos.

a) 20 pico-/ small micro-hydro mini-grids demos (including one case on conversion of a pico-hydro mini-grid to hybrid pico-hydro/PV mini-grid with expanded coverage to neighboring village)
b) 10 village community PV system (with or without mini-grid) demos
c) Family compound-scale PV nano-grids (of about 300 W each) deployed across all such compounds in each of 10 villages

Output 5A.3: Completed research and assessment of best energy efficient stove and crop dryer types for Vanuatu market and testing of their associated energy savings.

Activity 5A.3.1: Conduct of research and testing of energy efficient cook stoves and crop dryers appropriate to Vanuatu and that can be made in Vanuatu. This involves: (a) Identification of promising models, including the rocket stove[8];. (b) Carrying out of work on improving energy efficiency of most efficient and appropriate models; (c) Testing of cook stove fuel usage as compared to open hearth fire and testing of their lifetimes/ durability; (d) Testing and refinement of cook stove models adapted to serve as component of crop driers; and, (e) Preparation for DOE of report on stoves researched/ tested and results.

Output 5A.4: Completed and disseminated monitoring and assessment reports on project demos

Activity 5A.4.1: Conduct of periodic monitoring of all key aspects of each BRANTV RE demo, including actual cost breakdown of investment, operation of equipment, technical problems, amounts billed, collection of fees, saving of fees for maintenance and parts, loan repayment, and productive uses (including identification of successful productive uses and revenue generated). This also involves the preparation of report on the monitoring and evaluation of each implemented demonstration. Dissemination of reports.

Activity 5A.4.2: Conduct of periodic monitoring of key aspects of the project energy efficient cook stove dissemination program. Monitoring shall identify which aspects of energy efficient cook stove promotion are most effective. It shall also determine uptake (number and proportion of persons purchasing cook stoves in various villages in which they are promoted), level of usage among purchasing families, problems, feedback from those who purchase the stove and those who choose not to on how they made their decision, and level of satisfaction among those that purchase an energy efficient cook stove.

Output 5A.5: Completed assessment of other applicable low carbon technologies (besides those of the project demos) that can be feasibly implemented in the on-grid and off-grid areas to supplement the planned NAMA and rural electrification projects in Vanuatu.

[7] This is through resolution of land ownership issues and confirmation of village volunteer labor to support the implementation of the demos.
[8] This may alternatively involve documentation of work already conducted in Vanuatu if it is determined such work covers all or part of the desired scope of the foregoing aspect of this activity.

Activity 5A.5.1: Identification of and assessment of the future potential of RE and EE applications not already being pursued by BRANTV or other energy projects in Vanuatu. An analysis of potential economic viability and technical suitability of such RE and EE applications to the situation in Vanuatu will be carried out. Recommendations on next steps for pursuing such technologies will be formulated and proposed, as relevant. Technologies may include, but will not be limited to, high rotation biomass combustion power generation, geothermal at various scales, various forms of ocean energy, solar thermal, and building energy efficiency technologies.

Outcome 5B: Enhanced confidence in the economic and technical viability and long-term sustainability of sustainable energy and low carbon technology projects.

Output 5B.1: Well-managed operational off-grid hydro-based power generation and power distribution systems (mini-grids) with sustainable payment system to support ongoing O&M.

Activity 5B.1.1: Finalization of designs for hydro program demos of Activity 5B.1.3, including business model. Work will also determine the best risk mitigation measures needed to maintain the systems in the face of the various key natural disaster types typically occurring in Vanuatu (cyclone, earthquake, storm/ tsunami).

Activity 5B.1.2: Preparation of the Environmental and Social Management Plan (ESMP) for the 20 off-grid pico- and micro-hydro mini-grids of Activity 5B.1.3. The work will consist of limited environmental and social assessments for each site and include site specific mitigation measures for addressing social and environmental risks as well as demo-wide measures. It will be required that the general mitigation measures and the specific respective mitigation measures be adopted (or included in implementation plans) before the relevant demo can begin. The ESMP work of this activity will be combined with the work of the other ESMP activities to form the project's overall ESMP.

Activity 5B.1.3: Implementation of a comprehensive hydro-based energy generation demo program – This involves the installation, operation, and maintenance of: (a) 600 kW mini-hydro unit (Brenwei Hydro on Malekula); (b) 75 kW micro-hydro unit (Talise Hydro on Maewo); and, (c) 20 pico-/ small micro-hydro mini-grids (including conversion of an existing pico-hydro mini-grid site to hybrid pico-hydro/ PV mini-grid with expanded coverage of neighboring village). The operation of these demos shall include enhancement of any ongoing technical operation as well as collection of fees for electricity use to pay operator and to save in site-specific fund for parts replacement and repairs.

Output 5B.2: Well-managed operational solar PV power grids (around 100 kW), institutional solar PV systems (1.9-5.2 kW), and village community PV systems (3-10 kW) with and without accompanying mini-grids with sustainable payment system to support ongoing O&M.

Activity 5B.2.1: Finalization of designs for village-scale commercial solar PV energy services business demo program of Activity 5B.2.3, analogous to activity description for 5B.1.1.

Activity 5B.2.2: Preparation of ESMP for the 10 village-scale community PV systems of Activity 5B.2.3, analogous to activity description for 5B.1.2.

Activity 5B.2.3: Implementation of a comprehensive village-scale commercial solar PV energy services business demo program – This involves the installation, operation, and maintenance of: (a) 5 PV mini-grids of about 100 kW each; (b) 37 institutional PV systems of 1.9 to 5.2 kW; and, (c) 10 village community PV systems (with or without mini-grid). The operation of these demos shall include enhancement of any ongoing technical operation as well as collection of fees for electricity use to pay

operator and to save in site-specific fund for parts replacement and repairs[9]. The community PV systems will be established keeping in mind plans for supporting artisanal fabrication of EE cook stoves at each of these ten sites.

Output 5B.3: Well-managed and operational household solar PV systems and family compound-scale PV nano-grids, the latter installed across selected villages, with sustainable payment system to support ongoing O&M.

Activity 5B.3.1: Finalization of designs for household and family-scale commercial solar PV energy services business demo program of Activity 5B.3.3, analogous to activity description for 5B.1.1.

Activity 5B.3.2: Preparation of ESMP for the family compound-scale nano-grid PV systems deployed across ten villages of Activity 5B.3.3, analogous to activity description for 5B.1.2.

Activity 5B.3.3: Implementation of a comprehensive household and family scale commercial solar PV energy services business demo program – This involves the installation, operation and maintenance of: (a) household-scale PV systems of 120 W to 1.6 kW SHS[10], with site selection to be driven completely by market demand on a household-by-household basis; (b) family compound-scale PV nano-grids (up to 300 W each) deployed across most if not all such compounds in 10 selected villages. The operation of these demos shall include enhancement of any ongoing technical support as well as collection of fees for electricity use to pay for such support and to save in site-specific fund for battery/ parts replacement.

Output 5B.4: Energy efficient cook stoves disseminated and adopted and used daily by 12,000 households across the country.

Activity 5B.4.1: Finalization of designs and plans for EE cook stove dissemination program of Activity 5B.4.3.

Activity 5B.4.2: Preparation of the environmental and social management plan for the EE cook stove and EE crop dryer demos – This plan will consider safety and environmental impacts during fabrication of stoves and dryers. It will also consider safety and air quality impacts of stove use. Lastly, it will consider disposal of stove/ dryer wastes after the product's useful lifetime. The plan will comprise of mitigation measures for any negative impacts identified. These measures shall be adopted or be incorporated into implementation plans before implementation of the project's EE cook stove and EE crop dryer dissemination work can begin. The ESMP work in this activity will be combined with the ESMP work of other ESMP activities to form the project's overall ESMP document.

Activity 5B.4.3: Implementation of comprehensive EE cook stove demo – This will be carried out in 2 modules: (a) promotion and marketing; and, (b) fabrication, sale and use. The first module involves the planning, organization and conduct of a roadshow to demonstrate energy efficient cook stoves to villagers to promote their sale and use. The planning process will include vetting of villages to determine those most likely to be receptive to energy efficient cook stoves as well as those most important to promote such stoves to due to deforestation/ ecological issues. The second module involves the fabrication and selling of energy efficient cook stoves (to replace open hearth fire cooking) to 12,000 households and use of stoves three meals per day by these households. Those artisans that do well in mastering EE cook stove

[9] Based on layout of the specific potential village and needs, a decision may be made to separate the installation into multiple installations within one village or across multiple nearby villages. For example, a village, or group of small villages, requiring a 4 kW system may get this installed as four 1 kW systems if this makes more sense in terms of village layout than a centrally located 4 kW system. Further, the project's grant funding will not support set up of the mini-grid, but villages may decide to self-finance the associated mini-grids.

[10] This is conjunction with SHS sales promotion with 33.3% grant subsidy from World Bank VREP Phase 2.

fabrication capacity building content of Activity 1.1.5 and show seriousness of purpose in continuing to fabricate cook stoves for sale will be provided with a set of basic tools to fabricate their cook stoves.

Output 5B.5: Operational and revenue-generating productive uses of renewable energy to support rural economic development in the on-, and off-grid areas.

Activity 5B.5.1: Conduct of relevant consultations and information gathering to prepare the detailed design of productive use initiatives at the various demo sites to be implemented under Activity 5B.5.2. The detailed design of the productive use showcases will be based on the results of Activity 3.2.1, which identifies promising productive uses by demo locale.

Activity 5B.5.2: Implementation of a comprehensive productive use of renewable energy (PURE) program – This involves the installation and optimized operation of: (1) solar freezers for use by fishermen; (2) solar fridges for fishing industry cooperatives; and (3) productive use activities within the communities and villages at the demo sites, including appropriately modified (for crop drying) EE cook stove sites.[11] This involves the introduction of the combination of daily needs power provision with productive use power provision via village-scale systems and a broader range of productive uses.

ii. Partnerships:

Project partners, their current and planned activities, and how BRANTV will work with them are described below:

Exhibit 3. Project Partners

Project Partner	Relevant Initiatives	How Project Will Work with the Partner
1. DOE, MCCND	Most of DOE's work will be relevant to the project	DOE permanent staff will work closely with full-time project staff across all components of BRANTV. The project will be based in DOE offices in Port Vila and Luganville. As the Implementing Partner, DOE will also take a leadership role, along with the MCCND, in providing direction to the project.
2. World Bank's VREP Project	Phase 2 of VREP will establish PV mini-grids, institutional PV systems, and household PV systems	BRANTV will provide technical assistance to support the success of VREP Phase 2 including: high level training in PV system design and installation, extensive training on the islands in PV repair, cost-effective sourcing of PV system parts, and management system for fee-for-service RE systems. It will further complement the selected PV configurations of VREP Phase 2 with other configurations that fill the gaps vis-à-vis the small scale of villages and the spatial distribution of villages and households typically found in Vanuatu.
3. ADB's Energy Access Project	Project will include 400 kW Brenwei Hydro Mini-Grid System	BRANTV will provide technical assistance to support the success of Brenwei Hydro particularly in developing a management system for fee-for-service RE systems. It will further complement Brenwei with the introduction of smaller scale hydro systems (pico- and small micro-hydro) that will fill the gaps vis-à-vis the small village scale and the spatial distribution of villages found in Vanuatu, as well as the need for

[11] Among the productive uses, utilization of modified EE cook stoves in combination with RE powered fans for crop drying applications will be promoted. (The PV powered fan draws hot air from the modified cook stove to dry crops.) In addition, productive uses may be promoted at family compound-scale PV nano-grid demos if suitable options for the roughly 300 W systems are identified.

		technologies that Vanuatu nationals can master on a short time-scale for ease of maintenance and replication.
4. IUCN Talise Hydro Project	Phase 3 of the project will complete the Talise 75 kW micro-hydro mini-grid so that it can become operational	*Same as for Brenwei Hydro in above cell*
5. EU-GIZ ASCE Project	Component of project that provides solar DC freezers for fishermen	BRANTV will complement ASCE Project's productive use work by demonstrating village-based freezers/ ice-makers and other productive uses, such as crop-drying.
6. SPC Solar Fridge Project	This project provides solar DC fridges to cooperatives	*Same as for ASCE Project in above cell*
7. National Green Energy Fund (NGEF) and GGGI	This fund, developed in cooperation with GGGI, is raising funds and developing financial mechanisms to support RE and EE projects in Vanuatu.	BRANTV will provide direct support to NGEF in the areas of: international fund raising, connecting NGEF with local proponents of off-grid RE power projects (and assisting those proponents in applying for NGEF funds), connecting NGEF with local proponents of productive use of RE ("PURE") initiatives (and assisting those proponents in applying for NGEF funds).
8. Department of Water Resources (DWR), New Zealand High Commission, UNICEF	These organizations are cooperating on water supply projects across Vanuatu.	BRANTV will facilitate coordination between DOE and DWR in identifying potential combined gravity drop water supply – pico-hydro projects and developing such projects. This project will be based on the water supply development work DWR is doing with the New Zealand High Commission and UNICEF.
9. National government departments in the productive sectors (including Departments of Agriculture, Livestock, Fisheries, Cooperatives, and Tourism)	These organizations are carrying out rural development projects in various areas, such as fisheries, cattle breeding, etc.	BRANTV will facilitate cooperation between DOE and departments in the productive sectors to identify high-potential productive uses of renewable energy ("PURE" applications) and to identify sites for promoting RE power generation in conjunction with such applications.
10. Department of Forestry	This organization carries out various projects to protect the nation's forests.	BRANTV will engage Department of Forestry to cooperate with DOE in identifying priority sites for EE cook stove and EE crop dryer dissemination, as well as in actual promotion of these technologies once the sites are identified.
11. Department of Environment	This organization is carrying out various projects related to environmental protection in Vanuatu.	BRANTV will engage Department of Environment in discussion regarding policy, institutional mechanism, and implementation for a plan to ensure that PV related wastes are disposed of nationwide in a way that does not endanger the health of the natural environment.

iii. Stakeholder engagement:

Key project stakeholders and strategies for engaging them are given below. Please also see project partners in the sub-section above. Each project partner is also considered an important stakeholder of the project, but, to avoid repetition, is not listed again here.

- **Private sector technical and equipment companies:** Such firms will be invited to be involved in the project both as learners and as bidders for demo project calls for procurement. The project will offer high level trainings in both the pico-/small micro-hydro area and the PV area. The project will be conducting work in identifying best cost channels for sourcing quality projects and providing expected cost breakdowns for overall systems (including parts and labor). Local suppliers will be welcome to leverage this information to improve their sourcing of products and thus can offer products in Vanuatu at a lower price. For products not already supplied in Vanuatu, such as quality pico-hydro equipment, the project will be conducting outreach to potential suppliers about carrying inventory. Finally, the project will work with suppliers on developing means of ensuring that PV replacement parts (especially batteries) are available on the islands and that means of collecting PV related waste are also in place.
- **Commercial banks:** The project will invite commercial banks to attend its capacity building program for the banks on the financing of RE and EE technologies. The project will further reach out to the banks regarding the development of financing mechanisms for loans to RE and EE projects – either by extending existing loan funds/ loan lines of business that they have or setting up new loan funds/ lines of business.
- **Private sector equity investors:** Project will reach out to private sector entities that are potential equity investors in RE and EE projects. The project will discuss with such entities the potential of setting up an equity fund for direct investments in RE and EE projects in Vanuatu.
- **Local business persons on the islands and in villages:** The project will reach out to such persons about forming a local "RESCO" to manage one or more village-scale RE power systems in its area. The project will also reach out to such persons about pursuing businesses in the areas of productive use of the RE and EE. Further, the project will later contact such persons about the potential to develop replication projects and apply to NGEF and/ or to the private sector financing mechanism facilitated by the project for funding of such initiatives.
- **Engineers / high level technical persons:** The project will invite such person to participate in its high-level trainings on (i) the design and installation pico-/ small micro-hydro mini-grids and pico-hydro PV hybrid mini-grids and (ii) the design and installation of village-scale community PV systems.
- **Rural electricians:** The project will identify two to three such rural electricians on each of four islands: Pentecost, Santo, Gaua, and Tanna. The project will provide training for such persons both through its training programs and through special certified electrician training. The project will further retain these persons to carry out project activities at the demo sites and teach courses on the islands on household-scale SHS and compound-scale PV nano-grid repair.
- **Artisans/ potential artisans:** The project will train 30 such persons in the fabrication of EE cook stoves. Those that pass the mastery test and show strong interest in taking up this trade will be provided by the project with the necessary tools and equipment for EE cook stove fabrication.
- **Operators/ potential operators:** The project will select and train a few operators from each village at which there is an incremental project demo. The operators will be paid for their part-time work, which will consist of: operating an off-grid village RE system, preparing bills and collecting payment, transferring funds to required account, troubleshooting basic technical problems, and notifying relevant parties of more significant technical problems.
- **Local villagers and indigenous people:** The project will put special emphasis on engagement of local villagers, many of whom are indigenous peoples. The project has already (during the PPG phase) consulted extensively with local people in the demo villages regarding their interest in RE and EE systems, their willingness to volunteer labor and land as needed, and their ideas for productive uses

and will continue to do so during full project implementation. The project will, during its early stages, conduct limited environmental and social impact assessments at each of the 40 incremental demo sites as part of its ESMP. The assessments will include in-depth consultation with local people. The work will include FPIC for indigenous peoples.

- **Women:** The project will put special emphasis on the involvement of women in village community meetings with the project, ensuring that 50% of participants (or at least decision making participants) at such meetings are women. The project will also proactively seek the involvement of women in productive use initiatives, assuring that 50% of project funds for productive uses go to initiatives mainly involving women.
- **Other marginalized groups in the villages:** The project will put special emphasis on ensuring such groups are involved in community decision making meetings and are prioritized for opportunities with project productive use funds and, if viable, opportunities for operator roles.
- **Local NGOs:** The project will invite various NGOs to the project inception workshop and from there determine their interest in participation in various project activities. The project will reach out to Vanwods in association with financing-related activities to see if there is a possibility of developing a financing mechanism with Vanwods for rural RE, EE, and/or productive use.
- **Other Countries:** Learnings of BRANTV will be disseminated to other countries in the South Pacific region that may benefit via UNDP offices in the region.

iv. Mainstreaming Gender:

BRANTV recognizes the strong need to promote improvement of the situation of women in Vanuatu. This includes both the need for women's voices to be heard in decision-making and the need to ensure that women benefit from project activities. As such, a gender strategy has been designed for the project. This strategy will promote the mainstreaming of gender and associated enhancement of the situation of women with the following measures:

- BRANTV will ensure that women play a key role in village/ community decision-making associated with the project. It will be required that at least 50% of those involved in relevant meetings and relevant decision making will be women. As pointed out by one group of village women during the PPG Phase, the women are usually the ones who end up contributing most in Vanuatu to the volunteer labor required to carry out development project. As such, they should play a key role in decision-making on such projects and on how the village will be involved. Further, suggests this group, a decision-making role for women could also alleviate the current sustainability problems associated with system management vis-à-vis the inability to set aside funds for repairs.
- Women will be given priority for project funds provided for productive use initiatives. It will be required that at least 50% of such funds go to productive use initiatives mainly involving women.
- A priority will be put on ensuring that women participate in the project's training and capacity building program with strong representation. A target of 30% women among those who master program materials has been set. This will be achieved by requiring that 30% of persons receiving high level technical training and operator training are women and that 50% of those involved in the nation-wide PV repair and installation program are women.
- A priority will be put on ensuring that women benefit from contract opportunities associated with project implementation, such that 30% of total person-days in individual consulting contracts are carried out by women.

Further, the project will aim to go beyond simply meeting the targets outlined above and instead achieve a "gender responsive" status, with results that address the differential needs of men and women and equitable distribution of benefits, resources, status, and rights. As such, the project will also ensure that

productive use initiatives are tailored to those special endeavors preferred by and suitable to women. In addition, a strong focus on women's involvement in productive uses will enable women to increase their incomes and thus increase their resources and status in the household and village.

v. South-South and Triangular Cooperation (SSTrC):

Because Vanuatu shares similar conditions with some other South Pacific Island nations, the results of BRANTV may be highly beneficial to such nations. As such, BRANTV results will be shared with these countries. In general, South Pacific island nations have less experience than places elsewhere in the world with RE and EE. Further, as in the case with Vanuatu, they may struggle with achieving a sustainable management model for off-grid RE systems; and their populations may be mostly unfamiliar with EE cook stoves and crop driers. As such, the UNDP Pacific Office (UNDP PO) will spearhead liaison work to ensure BRANTV results are circulated among relevant parties in the region. An important project tool for sharing information will be the project's information exchange network for the promotion and dissemination of knowledge on sustainable energy and low carbon development. Links for the associated website will be shared with relevant parties in South Pacific island nations. Among the available materials, information on sourcing and best cost pricing for RE parts and equipment will be highlighted to these nations, which all face similar challenges in terms of overpriced RE equipment and lack of transparency on reasonable pricing. The results of the project demos and, particularly, the management system developed for the off-grid RE demos will also be highlighted in communications with these nations.

V. FEASIBILITY

i. Cost efficiency and effectiveness:

Aspects of the project's strategy that will promote cost efficiency are as follows:

- *Stimulation of replication of the project demos:* The project will invest in RE and EE demos, which will be critical in providing proof of concept and proof of costing, so that others will be willing to replicate them, thus leveraging in project funds far beyond the project demos. The project will further provide technical assistance (TA) support in multiple areas to stimulate replication of the project demos. These areas include awareness raising that encourages local people to submit proposals of suitable sites, site identification work by government departments, preparation of a village-by-village *Vanuatu Off-Grid Rural Electrification Plan*, and liaison work for local project proponents, NGEF, and private/ commercial finance sector entities to facilitate replication of the project demos.
- *Work in sourcing and costing of RE equipment and design/ installation services:* The project will carry out technical assistance in sourcing and costing with an aim of identifying good quality equipment for the least cost. This will increase the cost efficiency of the project demos, as well as the overall cost efficiency of the project.
- *Savings in the long-run as compared to diesel generation:* Over the long run, with the sourcing and best cost pricing work, RE will provide greater cost efficiency for local communities than would the alternative of diesel generators.
- *Leveraging of TA funds to promote investment by other parties in RE and EE in Vanuatu*: The project will invest a large proportion of GEF funds in TA in the capacity, awareness, policy, institutional, and financing areas, which are relatively low in cost, to leverage funding from other sources for actual installations of RE and EE equipment, which is relatively high in cost. There are a range of ways the project does this. The project includes activities that involve TA support to the commercial / private sector in designing EE and RE financing mechanisms, but looks to other parties to set up the actual

funds for realization of these mechanisms. As another example, the project will use TA funds to support NGEF in fundraising from international parties for the financing of RE and EE in Vanuatu.

- *Provision of TA support to ensure co-financed investments are sustainable:* With limited TA funds, BRANTV addresses the gaps that may otherwise jeopardize the sustainability of a large amount of donor financing for RE installations in the PV and hydro areas. This BRANTV work includes support of extensive training in the islands for PV repairs, support to develop local supplies of replacement PV system parts (especially batteries), and development of village-scale RE power management systems that can achieve the sustainability that has been so elusive to such installations thus far.

Aspects of the project's strategy that will promote cost effectiveness are as follows:

- *Multi-pronged barrier removal approach:* The project addresses barriers in multiple areas, rather than in one single areas, such as policy. Further, initiatives within each barrier removal category (e.g. capacity building and demonstration) are mutually reinforcing. Experience in the past shows that such approaches in the design of UNDP-GEF projects are effective.
- *Vanuatu-specific design:* The project design carefully considers the specific challenges Vanuatu has been facing in achieving dissemination and sustainability of its RE and EE installations. As such, for example, it puts much emphasis on management systems for off-grid systems, the need for a roadshow to familiarize villagers with EE cook stoves, the need for smaller off-grid RE power systems given small population clusters, and the need to address dispersed, family-compound style villages differently from villages with a more concentrated clustering of households.
- *Combination of productive uses/ income generation with RE and EE:* The project puts a strong emphasis on addressing the need for income generation activities and combines this with RE and EE to ensure that installations generate revenues, in turn leading to higher potential for sustainability.
- *Extensive consultation and involvement of communities in community-scale projects:* The project design calls for extensive liaison with communities and their involvement in implementation of demos in their village. Land issues can be a problem that stymies progress of RE installations. The project adopts a strategy of community-scale systems which have an easier time achieving buy-in about land issues, as compared to larger systems that spread benefits over a much larger area than that of the community providing the land alone.
- *Close involvement of DOE*: The project design was carried out with close involvement of DOE so that main project elements reflect DOE priorities. Implementation plans call for continued close involvement of DOE and integration of activities with the work of DOE permanent staff. Further, the project's full-time team will be based in DOE offices.

ii. Risk Management:

As per standard UNDP requirements, the Project Manager will monitor risks quarterly and report on the status of risks to the UNDP Country Office. The UNDP Country Office will record progress in the UNDP ATLAS risk log. Risks will be reported as critical when the impact and probability are high (i.e. when impact is rated as 5, and when impact is rated as 4 and probability is rated at 3 or higher). Management responses to critical risks will also be reported to the GEF in the annual PIR.

Project Risks					
Description	**Type**	**Impact & Probability**	**Mitigation Measures**	**Owner**	**Status**
Natural disasters, frequent in Vanuatu, will destroy the installed off-grid	Environ -mental	Project will fail to achieve critical aim of demonstrating long-term sustainability of off-grid RE power systems in	Requirements for project's off-grid RE power demo design work will explicitly include incorporation of natural disaster risk	PMU	Reducing (due to incorporation of mitigation into design)

RE power system demos of the project.		Vanuatu. P=1, I=4, significance= moderate	mitigation measures.		
Diversion of water for pico-/small micro-hydro demos will negatively impact ecosystem and/or will impact other uses.	Environ-mental and Social	Local ecosystem will be disturbed and/or social friction will ensue due to loss of availability of water for other economic uses, such as irrigation. P=1, I=3, significance= low	Limited social and environmental assessments will be conducted for these small systems to ensure such problems do not occur. If the assessments identify needed mitigation measures, the project will require such measure to be implemented before construction can occur.	PMU	Reducing (due to requirement of social and environ-mental assessment)
PV system parts and cook stove parts will be abandoned after their useful lifetime.	Environ-mental	Toxic wastes from lithium ion and lead acid batteries and PV panels will get into water systems and affect aquatic life. Cook stove parts will liter the environment and not be recycled. P=2, I=3, significance= moderate	Project will devise institutional system and policies for dealing with PV waste, not only from the project but for the entire nation. Project will support implementation of these. Limited environmental and social assessment for cook stove demos will assess how to deal with cook stove waste disposal/ recycling once a product's useful lifetime ends.	PMU, Dept. of Environ nment, DOE	Reducing (due to plans for dealing with PV system waste and due to requirement of social and environ-mental assessment)
Project will reinforce ongoing problems in Vanuatu of lack of opportunity for women and other marginalized groups.	Social	Project opportunities and benefits will flow mainly to men and to households which are relatively well off, this falling short of UN priority to empower the marginalized. P=2, I=3, significance= moderate	Project will require that certain targets are met in terms of the participation of women and marginalized groups in decision-making and will also require that at least half of funds for productive uses are allocated to initiatives mainly involving women.	PMU, DOE	Reducing (due to plans to address issue by project targets for involving these groups)
Demos will be established on lands of indigenous people against their will.	Social	Project demos are likely to be destroyed/ vandalized due to indigenous people having been deprived of their rights. P=1, I=4, significance= moderate	Project will carry out FPIC (Free Prior and Informed Consent) processes to ensure that proper consultation and agreement of indigenous people occurs before any demos are established. Further, project, working with DOE, will institute a process for reporting grievances.	PMU, DOE	Reducing (due to plans for FPIC and grievance reporting mechanism)
Off-grid RE power systems supported by project will lack the funds to carry out repairs and	Financi al	Project demos will be left inoperable and in disrepair and project will not achieve one of its central priorities of	Project will design management mechanism for village off-grid RE systems and build consensus among officials for the system,	PMU, DOE	Reducing (due to plans for introducing effective off-

purchase new parts as needed.		overcoming historical lack of sustainability of village power systems in Vanuatu. P=3, I=4, significance= high	which will prioritize fee collection and saving of a portion of revenues for repairs and parts. Successful demonstration of the sustainable management mechanism will encourage previously discouraged stakeholders to promote replication of the BRANTV demos.		grid village RE power management system)
High cost of transport between islands will not allow regular access to project sites for project monitoring purposes.	Financial	The project's large number of small demos will not be realizable due to lack of visits by the project team and relevant consultants. P=1, I=4, significance=moderate	Project will address the transport cost issue in two ways: First, DOE will co-finance a northern office and the project team and some DOE staff will be based there much of the time, cutting costs for visits to northern sites, which predominate among demo sites. Second, the project will train and engage two to three local, rural electricians on four key islands where there are demos to assist in monitoring the demos and guiding their development, as a means both of cutting travel costs and raising local capacity to promote sustainability.	PMU, DOE	Reducing (due to plans for northern office and trained local electricians on four main islands of the project)
Inadequate local capacity will result in lack of national experts to fill national roles, lack of personnel to operate demos, and lack of effective project management.	Operational	The project's demos and other activities will not be implemented due to lack of project management capacity, lack of national consultants, and lack of technical skills on the islands. P-1, I=4, significance= moderate	Project will engage a project team of three full-time staff, two of which will be actively engaged in national consultant roles much of the time (engaged in roll-out of the project demos, etc.), thus addressing the challenge of recruiting qualified national consultants in Vanuatu. This substantial project team, which will be led by a highly experienced project manager, will also ensure that project management is strong. Lastly, the project will provide training to a select group of local persons on the islands so that they can serve as operators for the off-grid village RE power systems.	UNDP, DOE	Reducing (due to strategy of developing a strong team of three full-time PMO staff and strategy of training local operators)
Lack of political	Political	Without policy and	Project has specific	DOE	No change

will and coordination among government departments will result in RE and EE policies, plans, standards, and guidelines either not being adopted or not being effectively implemented.	, Organizational, Regulatory	planning support going into the future, project results will be less likely to replicated and, if replicated, less likely to be successful due to lack of standards and guidelines. P=4, I=2, significance= moderate	activities to promote institutional coordination. Further, project combines demonstration of financial, technical, and management system viability with such policy work, so that decision-makers will be encouraged by the positive results they see to continue promoting RE and EE.	UNDP	
Lack of capacity in marketing and promotion will result in lack of knowledge across the country about fair prices and preferred sourcing channels for RE systems, successes with the RE demos, and the availability and benefits of EE cook stoves.	Strategic	Without strong marketing and promotion on costing of systems and success of demos, "demand pull" for such systems will remain limited so that replication will be weak. P=2, I=4, significance= moderate	Project allocates specific funds for awareness raising to mitigate this risk. For the EE cook stoves, the project also allocates substantial funding for a "road show," so that the EE cook stoves can be taken from village to village for demonstration.	PMU	Reducing (due to the design of specific awareness raising and road show activities)
Unsuccessful productive use initiatives will result in lack expected of income generation.	Financial	Without strong income generation from productive uses, project's intended "business model" for RE power generation will fail. That is, productive uses will not generate strong revenues for the RE power systems that can in turn be used to ensure their sustainability through funds set aside for maintenance and repairs. P=3, I=3, significance= moderate	Project will develop coordination between DOE and departments in the productive sectors to identify promising productive uses in various locations. Further, project will have specific activities to design the productive uses, which will be selected via consultation with local communities and business advising by the project. Business advising will ensure that products have a good potential market and that business plans are viable.	PMU	Reducing (due to the design of coordination between DOE and departments in the productive sectors and plans for advising of communities on markets and business plan viability)

iii. Social and Environmental Safeguards:

Project design work included conduct of a Social Environmental Screening Procedure (SESP), which is provided as Annex 8. The SESP rated the project to be of moderate risk. As such, as Environmental and Social Management Plan (ESMP) will be prepared early in the project implementation. Because of this, none of the associated project activities (i.e., mainly the demos) will commence until the ESMP is completed and approved by the Project Board. The ESMP will be based on limited environmental and social impact assessments (ESIAs) at each of the project's 40 incremental demo sites. In addition to assessing environmental issues, the ESIAs will assess impact on women, indigenous people, and other

marginalized groups. The project will apply FPIC (Free Prior and Informed Consent) for/during all activities that involve indigenous peoples. The project, working with DOE, will institute a grievance redress mechanism for the reporting of environmental and social grievances associated with the implementation. DOE will take the lead in addressing such grievances.

PPG work has taken the first key steps in addressing social and environmental risks. Particularly, consultations have been carried out at demo sites to ensure community buy-in and a gender assessment has been conducted to ensure at least half of overall project benefits flow to women.

The key risks identified as a part of the SESP involve the following key areas, with all risks being directly associated with the project demos rather than other aspects of the project:

- Environmental
  - Potential adverse impacts on habitats and ecosystems
  - Generation of waste that enters environment
- Social
  - Potential adverse impacts on the human rights and/or livelihoods of affected populations, particularly indigenous people and marginalized groups
  - Health and safety risks to local communities due to construction, operation, decommissioning, and disposal of wastes

Environmental and social grievances will be reported to the GEF in the annual PIR.

iv. Sustainability and Scaling Up:

Sustainability and scaling up have been central considerations in project design. The project adopts several central features to ensure sustainability. First, it puts strong emphasis on the design of, consensus building on, and adoption/ implementation of a sustainable management system for off-grid RE systems. Under such a management system, end users will pay for power and funds will be responsibly managed to pay the system operator and set aside funds for future repair and parts needs. Local management systems will in turn report to a central body to ensure best practice with funds. Second, the project will carry out several training programs to ensure there are qualified persons to install and repair off-grid RE systems and qualified persons to fabricate EE cook stoves on the scale needed for widespread dissemination. Further, the project emphasizes smaller RE system at scales suitable to Vanuatu's population layout and, in the case of hydro, small enough that "plug-and-play" systems that can be handled by national staff without requiring international experts for installation are used. Finally, sustainability is supported by a strong emphasis on policy, regulatory, and planning work.

Project design promotes scaling up primarily by promoting replication of the incremental project demos. The demos will build confidence by proving the technical and financial viability of systems. TA support for sourcing and costing of such systems will further ensure that replication is attractive. Site selection for replication will be promoted through the project-promoted awareness building and through its support of cooperation between DOE and other relevant departments. Project TA support for financing mechanisms in the commercial /private sector, fund-raising for the public sector (NGEF), and liaison work between project proponents and both public and commercial sector funds will also stimulate replication of the demos and, thus, scale-up. To ensure that knowledge generated by the project and lessons learned are incorporated into broader stakeholder initiatives, the project, via its information exchange network for the promotion and dissemination of knowledge on sustainable energy and low carbon development, will make all project related documents available online. The UNDP PO will also endeavor to share key project results with other South Pacific island nations.

v. Financial Analysis:

Annex 18 provides the details of the financial model and indicators used to assess the financial viability of the BRANTV incremental RE power generation demos. Demos assessed include (1) the pico-/ small micro-hydro demos, (2) the village-scale community PV demos, and (3) the family compound-scale PV nano-grids deployed across villages (with each nano-grid being 300 W on average in scale and connected to five buildings on average). Assessments were conducted for each of the different scales of such demos planned (i.e. 5 kW, 7.5 kW, 10 kW, and 15 kW for the hydro demos; 5 kW and 7.5 kW for the village-scale community PV demos; and 2.4 kW and 3.3 kW for the total per village of family-compound scale PV nano-grid installation). Up-front costs (including equipment and installation, design, and social and environmental assessment), system revenues over time, and operator salaries over time, along with inflation and discount rates, are key elements incorporated into the model.

Exhibit 4 summarizes results of the financial analysis. In all cases, results show positive NPVs and IRRs greater than the discount rate of 10%, confirming that the investments (assuming assumptions are met) are good ones. For the hydro systems, the IRR goes up somewhat as scale increases, a result of assumptions that system costs per kW go down as size increases. The PV-battery systems have a somewhat lower IRR than the hydro systems due to somewhat lower utilization rate and generally higher cost per kW. The PV nano-grids have a lower IRR than the village-scale community PV systems, partly due to the smaller scale and partly because the nano-grids include grid costs while the community PV systems do not.

Exhibit 4. Summary of Results of Financial Analysis (USD, unless indicated as %)

Indicator	Pico- and Small Micro-Hydro Mini-Grid				Village-Scale Community PV		Family Compound-Scale PV Nano-Grid Installed across Village	
	5 kW	7.5 kW	10 kW	15 kW	5 kW	7.5 kW	2.4 kW	3.3 kW
Up-front cost	24,368	29,251	34,235	43,903	21,148	31,722	13,258	18,230
DCF	35,145	52,717	70,290	105,435	29,422	44,133	13,881	19,086
NPV	10,777	23,466	36,054	61,532	8,274	12,411	623	856
IRR	15%	18%	21%	24%	15%	15%	11%	11%
Parameters used								
Discount rate: 10%; Inflation rate: 2.5%								

VI. PROJECT RESULTS FRAMEWORK

This project will contribute to the following Sustainable Development Goal (s): SDG7 - Ensure access to affordable, reliable, sustainable and modern energy for all					
This project will contribute to the following country outcome included in the UNDAF/Country Programme Document: *UN Pacific Strategy 2018-2022*: Outcome 1 – Climate Change, Disaster Resilience and Environmental Protection; *UNDP Sub-Regional Programme Document 2018-2022*: Outcome 1 – By year 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.					
This project will be linked to the following output of the UNDP Strategic Plan: *Output 1.4*: Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented. *Output 1.5*. Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy)					
Strategy	**Objective and Outcome Indicators**	**Baseline**	**Mid-term**	**End of Project**	**Assumptions**
Project Objective: Enabling the achievement of the energy access, sustainable energy, and green growth targets of Vanuatu	Cumulative tons of incremental GHG emissions reduced from business as usual (tons CO_2)[12]	0	6,080.9	45,016.1	Commitment of the government to RE&EE targets, irrespective of the party in power, will not change
	Incremental number of households (with at least 20% woman-headed) in rural areas whose level of energy access is increased via village-scale off-grid RE or that benefit from newly adopting EE cook stoves[13]	0	8,400[14]	14,000[15]	
	Total new, incremental reductions in or newly avoided amounts of annual diesel consumption achieved (liters DFO)[16]	0	67,238[17]	272,212	
	Incremental fuel wood saved annually by use of energy efficient cook stoves, million kgs[18]	0	3.9	15.6	Households find that benefit of reduced smoke and reduced needs for fuel wood outweigh any

[12]Direct greenhouse gas emission reductions that are attributable to the incremental activities of the project, e.g., from adoption of village-scale off-grid rural RE (pico-/ small micro-hydro mini-grids, village community PV with or without mini-grid, family compound-scale PV nano-grids installed across a village), and EE cook stoves

[13] Number of households will be computed based on the sum of the number of households with an EE cook stove that did not have one before launch of project and the number of households that, after launch of project, get access to village RE power (hydro, village-scale community PV, or family compound-scale nano-grid PV) that exceeds their previous potential level of access to power in kWh per day by at least 50%. (The level of access to power is based on the amount of power they could use daily, not their actual use.)

[14] Consisting of 7,200 households (25% of total target in year one and 35% in year two) acquiring EE stoves and 1,200 households gaining access to village-scale power systems or to family compound-scale nano-grids installed in all compounds in a village. For the village-scale power or the village-wide "sets" of nano-grids, each "system" (where a village-wide set of nano-grids is also considered a single virtual system) is assumed to provide power to an average of 50 households, so that 24 systems (25% of total in year one and 35% in year two) mid-way through project could reach 1,200 households.

[15] Consisting of 12,000 households acquiring EE cook stoves and 2,000 households gaining access to village-scale power or to nano-grids installed in all compounds in a village. For the village-scale power or the village-wide "sets" of nano-grids, each "system" (where a village-wide set of nano-grids is also considered a single virtual system) is assumed to provide power to an average of 50 households, so that 40 systems by end of project will reach 2,000 households.

[16] Diesel Fuel Oils (DFO's) HHV (higher heat value), which is the same as the GCV (gross calorific value) and assumes the water from combustion is entirely condensed, is 44,800 kJ/ kg (source www.eisco.co).

[17] Targets are based on diesel fuel use avoided by incremental demos: pico-/small micro-hydro, village-scale community PV, and PV nano-grids across villages. The scale of the demos, capacity factors, and the roll-out over the lifetime of the project are given in Annexes 1 and 2 (covering demo descriptions and GHG emission reductions, respectively).

[18] Savings is from use of EE cook stoves that replace open hearth cooking. Targets based on annual rural household fuel wood use of 2,600 kg per year being reduced by half when family uses EE cook stove instead of open hearth fire. The HHV (see footnote 5 above for explanation of HHV) of dry wood is estimated to be the range of 14,400 - 17,400 kJ/kg (source www.eisco.co). Rollout of EE cook stoves given in Annex 2 (covering GHG emission reductions).

					reluctance to give up traditional open hearth cooking practices
Outcome 1. Improved capacity and awareness on sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	Number of individuals (with at least 30% being women) in Vanuatu that are newly (as of start of project) involved in operating, maintaining, repairing, designing, and/or installing off-grid rural RE power systems as one of their main sources of income.	0	150[19]	300	Individuals have the needed capacity to utilize available information to carry out installation, maintenance, repair operation, design, etc. of systems
	Number of artisans in Vanuatu fabricating EE cook stoves as their main source of income	0	10	20	
Outcome 2. Improved policy, planning, and regulatory regimes in the application of sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	Portion of nation's off-grid villages for which a comprehensive electrification plan has been determined[20], %	0	50	100	---
	Number of regulations under the *Off-Grid Rural Electrification Policy* that are enforced	0	0	5	Other relevant agencies have the will to support DOE in getting the guidelines and standards officially issued and enforced or adhered to, as relevant
Outcome 3. Established institutional framework enables the effective enforcement of policies and regulations, and implementation of plans, programs, and projects, on the application of sustainable energy and low carbon technologies	Number of pico-/ small micro-hydro, village community PV, and village sets of family compound-scale nano-grid sites at which management model enables fee collection, savings for repairs/ parts, and payment of operator	0	10	40	• National level entity interested and willing to oversee process and funds for off-grid RE system management • Local level entities are interested and willing to manage the off-grid RE systems and invest efforts or funds in the process • Villagers willing to accept outside management of their village RE systems
	Number of villages at which DOE has cooperated with other national-level departments to implement rural electrification or EE cook stoves, as well as productive uses of RE/EE applications, if relevant	0	0	60	• Productive departments interested and willing to cooperate • Water Resources Department (WRD) interested and willing to cooperate • Department of Forestry interested

[19] Targets include persons with capabilities in all listed system types, though the greatest number of persons will have capabilities in the individual SHS area, with lesser numbers in each of pico-/ micro-hydro, village-scale community PV, and family compound-scale PV nano-grids.

[20] Plan for each village should indicate type of RE technology to be used and type of management system for fee collection, repairs, and sustainability. Total of 2,000 off-grid villages assumed, so that ¼ would be 500 villages and 100% would be 2,000 villages.

					and willing to cooperate
Outcome 4A. Increased availability of, and access to, financing for sustainable energy, energy access, and low carbon initiatives in the energy supply and demand sectors	Amount of new international funding confirmed with funding entities for infusion into NGEF because of BRANTV efforts, US$ million	0	2	10	International sources of funding receptive to idea of supporting replication of project demos and of supporting NGEF generally
Outcome 4B. Increased financing and investments from private sector on sustainable energy and low carbon projects in the energy supply and demand sectors	Amount of funding represented by financial closes reached for loans or direct equity investments to RE and EE projects under commercial or private sector financing scheme for low carbon projects, US$ million	0	0	4	Local entities pursuing low-carbon projects find terms and conditions of financing scheme loans or equity acceptable and attractive
Outcome 5A. Sustainable energy and low carbon (RE and EE) techniques and practices adopted and implemented with both cost and technical viability in the energy, public, private sector, and residential sectors.	Number of types of key off-grid RE power generation and mini-grid related equipment/ parts newly available or available at 25% or more less than cost at start of project [21]	0	8	8	---
Outcome 5B. Enhanced confidence in the economic and technical viability and long-term sustainability of sustainable energy and low carbon technology projects	No. of communities and private sector entities, and households in both on-grid and off-grid areas that are interested in replicating the RE-based power generation system, and EE cook stoves and RE-powered freezer demos: • Pico-/ small micro-hydro • Hybrid pico-hydro & PV • Village community PV (with or without mini-grid) • Village-wide family compound-scale PV nano-grids • EE cook stoves • RE-powered freezers	• 0 • 0 • 0 • 0 • 0 • 0	• 0 • 0 • 0 • 0 • 0 • 0	• 38 • 2 • 20 • 20 • 12,000 • 60	Villagers willing to pay for electricity services.

[21] One point for each of: (i) quality pico-/ small micro-hydro turbine/ generator set with ELC, (ii) key parts for repair of quality turbine/ generator set, (iii) solar panels for community PV, family compound-scale PV nano-grids, or small household-scale SHS, (iv) batteries for community PV, family compound-scale PV nano-grid, or small SHS, (v) inverters, (vi) plug and play PV system, (vii) meters to monitor household power usage, and (viii) other mini-grid parts, such as cabling, etc.

VII. MONITORING AND EVALUATION (M&E) PLAN

The project results as outlined in the project results framework will be monitored annually and evaluated periodically during project implementation to ensure the project effectively achieves these results.

Project-level monitoring and evaluation will be undertaken in compliance with UNDP requirements as outlined in the UNDP POPP and UNDP Evaluation Policy. While these UNDP requirements are not outlined in this project document, the UNDP Country Office will work with the relevant project stakeholders to ensure UNDP M&E requirements are met in a timely fashion and to high quality standards. Additional mandatory GEF-specific M&E requirements (as outlined below) will be undertaken in accordance with the GEF M&E policy and other relevant GEF policies.

In addition to these mandatory UNDP and GEF M&E requirements, other M&E activities deemed necessary to support project-level adaptive management will be agreed during the Project Inception Workshop and will be detailed in the Inception Report. This will include the exact role of project target groups and other stakeholders in project M&E activities including the GEF Operational Focal Point and national/regional institutes assigned to undertake project monitoring. The GEF Operational Focal Point will strive to ensure consistency in the approach taken to the GEF-specific M&E requirements (notably the GEF Tracking Tools) across all GEF-financed projects in the country. This could be achieved for example by using one national institute to complete the GEF Tracking Tools for all GEF-financed projects in the country, including projects supported by other GEF Agencies.

M&E Oversight and Monitoring Responsibilities

Project Manager: The Project Manager is responsible for day-to-day project management and regular monitoring of project results and risks, including social and environmental risks. The Project Manager will ensure that all project staff maintain a high level of transparency, responsibility and accountability in M&E and reporting of project results. The Project Manager will inform the Project Board, the UNDP Country Office and the UNDP-GEF RTA of any delays or difficulties as they arise during implementation so that appropriate support and corrective measures can be adopted.

The Project Manager will develop annual work plans based on the multi-year work plan included in Annex 3, including annual output targets to support the efficient implementation of the project. The Project Manager will ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality. This includes, but is not limited to, ensuring the results framework indicators are monitored annually in time for evidence-based reporting in the GEF PIR, and that the monitoring of risks and the various plans/strategies developed to support project implementation (e.g. gender strategy, KM strategy, etc.) occur on a regular basis.

Project Board: The Project Board will take corrective action as needed to ensure the project achieves the desired results. The Project Board will hold project reviews to assess the performance of the project and appraise the Annual Work Plan for the following year. In the project's final year, the Project Board will hold an end-of-project review to capture lessons learned and discuss opportunities for scaling up and to highlight project results and lessons learned with relevant audiences. This final review meeting will also discuss the findings outlined in the project terminal evaluation report and the management response.

Project Implementing Partner: The Implementing Partner is responsible for providing all required information and data necessary for timely, comprehensive, and evidence-based project reporting, including results and financial data, as necessary and appropriate. The Implementing Partner will strive to ensure project-level M&E is undertaken by national institutes, and is aligned with national systems so that the data used by and generated by the project supports national systems.

UNDP Country Office: The UNDP Country Office will support the Project Manager as needed, including through annual supervision missions. The annual supervision missions will take place based on the schedule outlined in the annual work plan. Supervision mission reports will be circulated to the project team and Project Board within one month of the mission. The UNDP Country Office will initiate and organize key GEF M&E activities including the annual GEF PIR, the independent mid-term review and the independent terminal evaluation. The UNDP Country Office will also ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality.

The UNDP Country Office is responsible for complying with all UNDP project-level M&E requirements as outlined in the UNDP POPP. This includes ensuring the UNDP Quality Assurance Assessment during implementation is undertaken annually; that annual targets at the output level are developed, and monitored and reported using UNDP corporate systems; the regular updating of the ATLAS risk log; and, the updating of the UNDP gender marker on an annual basis based on gender mainstreaming progress reported in the GEF PIR and the UNDP ROAR. Any quality concerns flagged during these M&E activities (e.g. annual GEF PIR quality assessment ratings) must be addressed by the UNDP Country Office and the Project Manager.

The UNDP Country Office will retain all M&E records for this project for up to seven years after project financial closure to support ex-post evaluations undertaken by the UNDP Independent Evaluation Office (IEO) and/or the GEF Independent Evaluation Office (IEO).

UNDP-GEF Unit: Additional M&E and implementation quality assurance and troubleshooting support will be provided by the UNDP-GEF Regional Technical Advisor and the UNDP-GEF Directorate as needed.

Audit

The project will be audited based on UNDP Financial Regulations and Rules and applicable audit policies on NIM implemented projects.[22]

Additional GEF Monitoring and Reporting Requirements

Inception Workshop and Report: A project inception workshop will be held within two months after the project document has been signed by all relevant parties to, amongst others:

a) Re-orient project stakeholders to the project strategy and discuss any changes in the overall context that influence project implementation;
b) Discuss the roles and responsibilities of the project team, including reporting and communication lines and conflict resolution mechanisms;
c) Review the results framework and finalize the indicators, means of verification and monitoring plan;
d) Discuss reporting, monitoring and evaluation roles and responsibilities and finalize the M&E budget; identify national/regional institutes to be involved in project-level M&E; discuss the role of the GEF OFP in M&E;
e) Update and review responsibilities for monitoring the various project plans and strategies, including the risk log; Environmental and Social Management Plan and other safeguard requirements; the gender strategy; the knowledge management strategy, and other relevant strategies;

[22] See guidance here: https://info.undp.org/global/popp/frm/pages/financial-management-and-execution-modalities.aspx

f) Review financial reporting procedures and mandatory requirements, and agree on the arrangements for the annual audit; and
g) Plan and schedule Project Board meetings and finalize the first-year annual work plan.

The Project Manager will prepare the inception report no later than one month after the inception workshop. The inception report will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser, and will be approved by the Project Board.

GEF Project Implementation Report (PIR): The Project Manager, the UNDP Country Office, and the UNDP-GEF Regional Technical Advisor will provide objective input to the annual GEF PIR covering the reporting period July (previous year) to June (current year) for each year of project implementation. The Project Manager will ensure that the indicators included in the project results framework are monitored annually in advance of the PIR submission deadline so that progress can be reported in the PIR. Any environmental and social risks and related management plans will be monitored regularly, and progress will be reported in the PIR.

The PIR submitted to the GEF will be shared with the Project Board. The UNDP Country Office will coordinate the input of the GEF Operational Focal Point and other stakeholders to the PIR as appropriate. The quality rating of the previous year's PIR will be used to inform the preparation of the subsequent PIR.

Lessons learned and knowledge generation: Results from the project will be disseminated within and beyond the project intervention area through existing information sharing networks and forums. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to the project. The project will identify, analyze and share lessons learned that might be beneficial to the design and implementation of similar projects and disseminate these lessons widely. There will be continuous information exchange between this project and other projects of similar focus in the same country, region, and globally.

GEF Focal Area Tracking Tools: The following GEF Tracking Tool(s) will be used to monitor global environmental benefit results:

The baseline/CEO Endorsement GEF Focal Area Tracking Tool(s) – submitted in Annex 6 to this project document – will be updated by the Project Manager/Team and shared with the mid-term review consultants and terminal evaluation consultants (not the evaluation consultants hired to undertake the MTR or the TE) before the required review/evaluation missions take place. The updated GEF Tracking Tool(s) will be submitted to the GEF along with the completed Mid-term Review report and Terminal Evaluation report.

Independent Mid-term Review (MTR): An independent mid-term review process will begin after the second PIR has been submitted to the GEF, and the MTR report will be submitted to the GEF in the same year as the 3rd PIR. The MTR findings and responses outlined in the management response will be incorporated as recommendations for enhanced implementation during the final half of the project's duration. The terms of reference, the review process and the MTR report will follow the standard templates and guidance prepared by the UNDP IEO for GEF-financed projects available on the UNDP Evaluation Resource Center (ERC). As noted in this guidance, the evaluation will be 'independent, impartial and rigorous'. The consultants that will be hired to undertake the assignment will be independent from organizations that were involved in designing, executing or advising on the project to be evaluated. The GEF Operational Focal Point and other stakeholders will be involved and consulted during the terminal evaluation process. Additional quality assurance support is available from the UNDP-

GEF Directorate. The final MTR report will be available in English and will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser, and approved by the Project Board.

Terminal Evaluation (TE): An independent terminal evaluation (TE) will take place upon completion of all major project outputs and activities. The terminal evaluation process will begin three months before operational closure of the project allowing the evaluation mission to proceed while the project team is still in place, yet ensuring the project is close enough to completion for the evaluation team to reach conclusions on key aspects such as project sustainability. The Project Manager will remain on contract until the TE report and management response have been finalized. The terms of reference, the evaluation process and the final TE report will follow the standard templates and guidance prepared by the UNDP IEO for GEF-financed projects available on the UNDP Evaluation Resource Center. As noted in this guidance, the evaluation will be 'independent, impartial and rigorous'. The consultants that will be hired to undertake the assignment will be independent from organizations that were involved in designing, executing or advising on the project to be evaluated. The GEF Operational Focal Point and other stakeholders will be involved and consulted during the terminal evaluation process. Additional quality assurance support is available from the UNDP-GEF Directorate. The final TE report will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser, and will be approved by the Project Board. The TE report will be publicly available in English on the UNDP ERC.

The UNDP Country Office will include the planned project terminal evaluation in the UNDP Country Office evaluation plan, and will upload the final terminal evaluation report in English and the corresponding management response to the UNDP Evaluation Resource Centre (ERC). Once uploaded to the ERC, the UNDP IEO will undertake a quality assessment and validate the findings and ratings in the TE report, and rate the quality of the TE report. The UNDP IEO assessment report will be sent to the GEF IEO along with the project terminal evaluation report.

Final Report: The project's terminal PIR along with the terminal evaluation (TE) report and corresponding management response will serve as the final project report package. The final project report package shall be discussed with the Project Board during an end-of-project review meeting to discuss lesson learned and opportunities for scaling up.

Mandatory GEF M&E Requirements and M&E Budget

GEF M&E Requirements	Primary Responsibility	Indicative Costs to be Charged to the Project Budget[23] (US$)		Time Frame
		GEF Grant	Co-financing	
Inception Workshop	UNDP Pacific Office	3,092	10,000	Within two months of project document signature
Inception Report	Project Manager	None	5,000	Within two weeks of inception workshop
Standard UNDP monitoring and reporting requirements as outlined in the UNDP POPP	UNDP Pacific Office	None	None	Quarterly, annually
Monitoring of indicators in project results framework	Project Manager and Project M&E Officer	None - handled by M&E officer	16,000	Annually

[23] Excluding project team staff time and UNDP staff time and travel expenses.

GEF M&E Requirements	Primary Responsibility	Indicative Costs to be Charged to the Project Budget[23] (US$)		Time Frame
		GEF Grant	Co-financing	
GEF Project Implementation Report (PIR)	Project Manager and UNDP Pacific Office and UNDP-GEF team	None	None	Annually
NIM Audit as per UNDP audit policies	UNDP Pacific Office	16,000 (4,000 per year)	16,000	Annually or other frequency as per UNDP Audit policies
Lessons learned and knowledge generation	Project Manager	None	10,000	Annually
Monitoring of environmental and social risks, and corresponding management plans as relevant	Project Manager UNDP CO	None	5,000	On-going
ESMP monitoring & evaluation	Project Manager UNDP Pacific Office	10,000	10,000	Annually
Addressing environmental and social grievances	Project Manager UNDP Pacific Office BPPS as needed	None for time of project manager, and UNDP CO	20,000	
Project Board meetings	Project Board UNDP Pacific Office Project Manager	None	8,000	At minimum annually
Supervision missions	UNDP Pacific Office	None[24]	4,000	Annually
Oversight missions	UNDP-GEF team	None[24]	4,000	Troubleshooting as needed
GEF Secretariat learning missions/site visits	UNDP Pacific Office and Project Manager and UNDP-GEF team	None	4,000	To be determined.
Mid-term GEF Tracking Tool to be updated by a local institution	Project Manager	3,000	None	Before mid-term review mission takes place.
Independent Mid-term Review (MTR) and management response	UNDP Pacific Office and Project team and UNDP-GEF team	27,050	3,000	Between 2nd and 3rd PIR.
Terminal GEF Tracking Tool to be updated by a local institution	Project Manager	3,000	None	Before terminal evaluation mission takes place
Independent Terminal Evaluation (TE) included in UNDP evaluation plan, and management response	UNDP Pacific Office and Project team and UNDP-GEF team	27,050	3,000	At least three months before operational closure
TOTAL indicative COST Excluding project team staff time, and UNDP staff and travel expenses		**89,193** (3% of GEF grant)	**118,000**	

[24] The costs of UNDP Country Office and UNDP-GEF Unit's participation and time are charged to the GEF Agency Fee.

VIII. GOVERNANCE AND MANAGEMENT ARRANGEMENTS

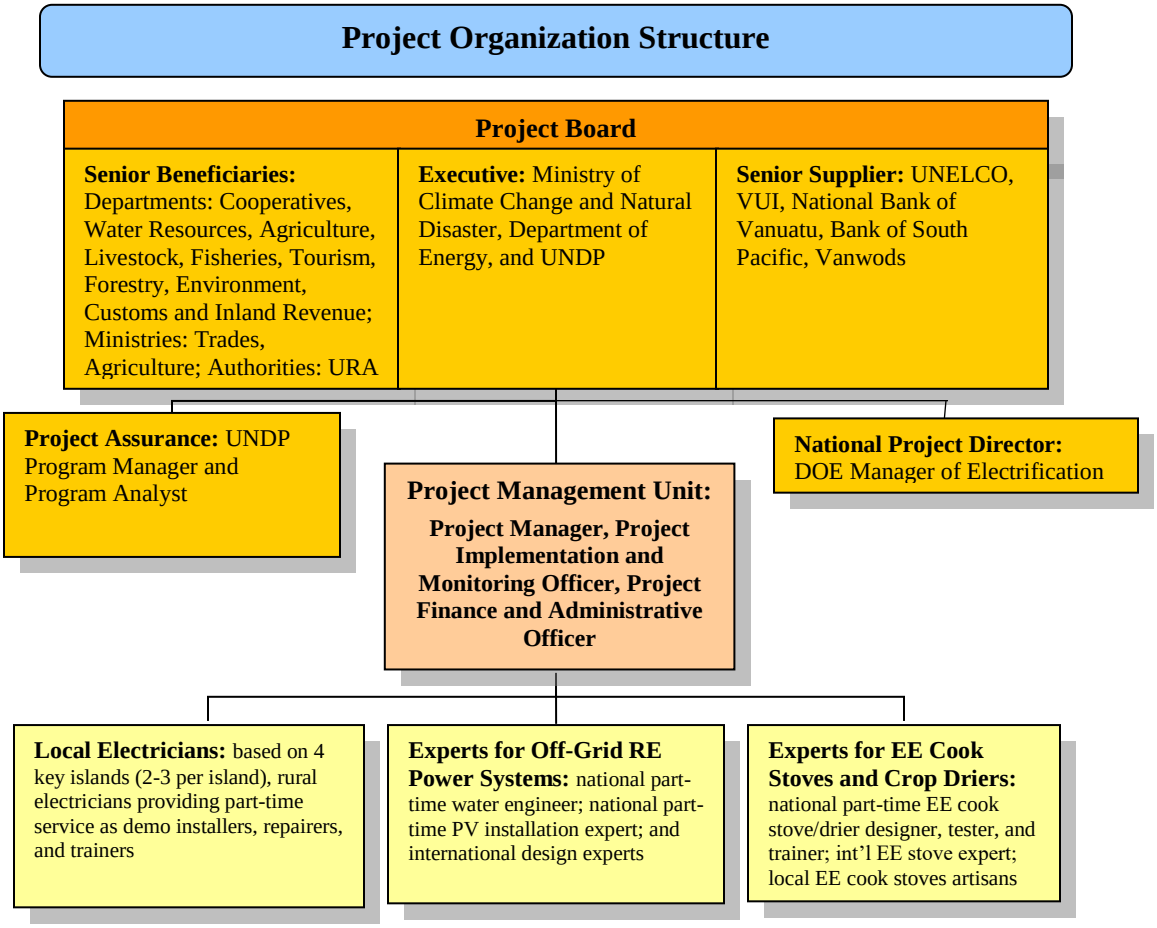
Roles and Responsibilities of the Project's Governance Mechanism

The project will be implemented following UNDP's national implementation modality, per the Standard Basic Assistance Agreement between UNDP and the Government of Vanuatu, and the Country Programme.

The **Implementing Partner** for this project is Department of Energy, Ministry of Climate Change & Natural Disaster (DOE-MCCND). The Implementing Partner is responsible and accountable for managing this project, including the monitoring and evaluation of project interventions, achieving project outcomes, and for the effective use of UNDP and GEF resources.

The project organization structure is shown in Exhibit 5

Exhibit 5. Project Organizational Chart



The **Project Board** is responsible for making by consensus, management decisions when guidance is required by the Project Manager, including recommendation for UNDP/Implementing Partner approval of project plans and revisions. To ensure UNDP's ultimate accountability, Project Board decisions should be made in accordance with standards that shall ensure management for development results, best value money, fairness, integrity, transparency and effective international competition. In case a consensus cannot be reached within the Board, final decision shall rest with the UNDP Programme Manager. The

terms of reference for the Project Board are contained in Annex 7. The Project Board will be chaired by the Director General of the Ministry of Climate Change and Natural Disaster (MCCND). Individuals from the following organizations will comprise the other members of the Project Board: Department of Energy, Department of Cooperatives, Department of Water Resources, Department of Agriculture, Department of Livestock, Department of Fisheries, Department of Tourism, Department of Forestry, Department of Environment, Department of Customs and Inland Revenue, Ministry of Trades, Ministry of Agriculture, Utility Regulatory Authority, UNELCO, VUI, National Bank of Vanuatu, Bank of South Pacific, and Vanwods. The Project Board will meet two times a year, for an aggregate eight times in total, to review the progress of the project.

The **National Project Director** (NPD), will be the Director, Electrification, DOE, as delegated by the Director of DOE. The NPD will be responsible for weekly oversight of the Project Management Unit (PMU), including strategic oversight and guidance to project implementation in close collaboration with UNDP. The NPD will not be paid from the project funds, but will represent a government in-kind contribution to the project. The NPD may sign and approve the project financial reports and the financial requests for advances or any contracts issued under NIM component of the project. The NPD may delegate this financial responsibility to the Project Manager. The NPD will be responsible for provision of technical and institutional coordination of the project with other government departments.

The **Project Manager** will run the project on a day-to-day basis on behalf of the Implementing Partner within the constraints laid down by the Board. The Project Manager function will end when the final project terminal evaluation report, and other documentation required by the GEF and UNDP, has been completed and submitted to UNDP (including operational closure of the project).

The **project assurance** role will be provided by the UNDP Pacific Office, specifically the relevant Program Manager and the relevant Program Analyst.

Additional quality assurance will be provided by the UNDP Regional Technical Advisor as needed.

Project Management

A Project Management Unit (PMU) will be established jointly by UNDP and DOE. The PMU will consist of three full-time personnel hired by and paid for by the project, as well as various DOE permanent staff making part-time contributions to the project as needed. The PMU's three full-time personnel will be: (1) the Project Manager, (2) the Implementation and Monitoring Officer, and (3) The Finance and Administration Officer. The Project Manager will be a mid-career person with an engineering background and extensive experience in the energy / power sector, both technically and regarding policy and regulations. In addition to handling overall day-to-day management of the project, the Project Manager will contribute technical expertise as needed for implementation of the project demos, sourcing and costing work, capacity building, policy and planning work, institutional work, and financing work. The Implementation and Monitoring Officer will be a more junior person, with an electrical engineering background, who will support the project in implementation across all the main activity areas. In addition, the Implementation and Monitoring Officer will be responsible for monitoring project progress and keeping updated records of the status of the project indicators. The Finance and Administrative Officer, who will have a cross-cutting background in project administration, will support the project in all financial and administrative aspects of the project, including the handling of all procurement efforts.

The full-time PMU team will be located within DOE's Port Vila Office and its proposed Luganville Office. DOE's Luganville Office, which will serve as the Northern Vanuatu RE and EE Promotion Center, will be established by the project with co-financing to enhance DOE's institutional effectiveness in promoting RE and EE in the nation's northern areas. As most the BRANTV demos will be in the

northern part of the country, the project team will most time use the northern office as their base, but will also work out of the main DOE office in Port Vila for support of southern demos and activities carried out in Port Vila. In addition, permanent DOE staff supporting BRANTV on a part-time basis will mostly be based in the Port Vila Office, that at least one experienced DOE person supporting the project on a part-time basis will be based in Luganville.

The PMU will achieve BRANTV's ambitious targets with the support of several part-time consultants working under the direction of the Project Manager. Key among these will be a national water engineering expert, a national PV installation expert, a national EE cook stove and EE crop drying expert, local rural electricians, and local cook stove artisans. The water engineering expert, who may be retained up to half-time during the first three years of the project, will be responsible for design of the water works aspects of the pico- and small micro-hydro aspects of the project, as well as related training, site selection, and coordination with Department of Water Resources. The national PV installation expert will be responsible for design and installation of the project's PV demos, as well as support in related training and site selection. Rural local electricians, of which there will be two or three on each of the four main demo islands of the project, will be trained by the project and work for the project on a part-time, on-demand basis. They will support the project in installation of off-grid power projects (leading volunteer villagers in this work), training of local people, and monitoring, maintenance, and repair of installed RE power systems. The national EE cook stove and crop drying expert will support the project extensively with technical research, testing of stove efficiency, training of artisans, and development of optimal EE crop drier design. This expert will train several artisans in EE cook stove fabrication, some of which will be based in Port Vila and others of which will be based in the islands. The artisans will be provided with equipment by the project and will be responsible for fabricating and promoting the EE cook stoves in their local area and beyond, if possible. International consultants, with more limited time input, will provide expert input on RE power system design and EE cook stove/ EE crop drying technologies.

On the administrative side, the PMU will be responsible for preparing an Annual Work Plan (AWP) and Annual Budget Plan (ABP) for each year. These documents will be reviewed by the Project Board and provide the basis for allocating resources to planned activities. The AWP will need to be approved and signed by UNDP. The PMU will also prepare quarterly operational reports and Annual Progress Reports (APRs) and any other necessary reports. The PMU should monitor the project indicators, including both the objective and outcome-level indicators in this document as well as internal output-level indicators, providing updates on an annual basis in the PIR. These various reports (quarterly operational reports, APRs, and PIRs) will summarize the progress made by the project versus the expected results, explain any significant variances, detail the necessary adjustments, and be the main reporting mechanism for monitoring project activities.

Governance Role for Project Target Groups:

The project will involve a range of target groups in decision making, both at the national level and at the local level. At the national level, the Project Board has very broad composition (see above for Project Board membership). It includes many national departments or other national-level government organizations that the project aims to involve in policy, planning, and other aspects of RE and EE development in Vanuatu. Involvement of a high-level official from these organizations in the decision-making of the Project Board will facilitate engagement at the working level in relevant project activities. Also, at the level of the Project Board, the project involves the utilities and financial institutions that the project aims to involve in financing replication of project demos. At the local level, the project adopts several strategies to engage target groups in decision making. By involving local electricians (RE power) and local artisans (EE cook stoves) in demo implementation and training, the project ensures that local technical/ business persons have an influence on how the project is implemented. Most importantly, in each of the demo villages, the project has involved and will continue to involve local villagers in

decisions of how their systems will be managed and of what type of productive uses will be pursued. For this village-level input into project decision making, it will be ensured that one-half of local participants are women.

UNDP Direct Project Services as Requested by Government (if any):

The UNDP, as GEF Agency for this project, will provide project management cycle services for the project as defined by the GEF Council. In addition, the Government of Vanuatu may request UNDP direct services for specific projects, based on its policies and convenience. The UNDP and Government of Vanuatu acknowledge and agree that those services are not mandatory, and will be provided only upon Government request. If requested, the services would follow the UNDP policies on the recovery of direct costs. These services (and their costs) are specified in the Letter of Agreement (Annex 12). As is determined by the GEF Council requirements, these service costs will be assigned as Project Management Cost, duly identified in the project budget as Direct Project Costs. Eligible Direct Project Costs should not be charged as a flat percentage. They should be calculated based on estimated actual or transaction based costs and should be charged to the direct project costs account codes: "64397- Services to projects – CO staff" and "74596 – Services to projects – GOE for CO".

Agreement on intellectual property rights and use of logo on the project's deliverables and disclosure of information:

To accord proper acknowledgement to the GEF for providing grant funding, the GEF logo will appear together with the UNDP logo on all promotional materials, other written materials like publications developed by the project, and project hardware. Any citation on publications regarding projects funded by the GEF will also accord proper acknowledgement to the GEF. Information will be disclosed in accordance with relevant policies notably the UNDP Disclosure Policy[25] and the GEF policy on public involvement[26].

IX. FINANCIAL PLANNING AND MANAGEMENT

The total cost of the project is USD 20,802,170. This is financed through a GEF grant of USD 2,639,726 and USD 18,162,444 in parallel co-financing. UNDP, as the GEF Implementing Agency, is responsible for the execution of the GEF resources and the cash co-financing transferred to UNDP bank account only.

Parallel co-financing: The actual realization of project co-financing will be monitored during the mid-term review and terminal evaluation process and will be reported to the GEF. The planned parallel co-financing will be used as follows:

Co-financing source	Co-financing type	Co-financing amount	Planned Activities/Outputs	Risks	Risk Mitigation Measures
MCCND-DOE	Grant	16,348,000	400 kW mini-hydro demo, 170 kW micro-hydro demo, 5 PV mini-grids, 37 institutional PV systems, numerous household-scale PV systems, one-time	-Delays in progress of baseline activities leads to delays in release of	-Establishment of DOE Northern Vanuatu RE and EE Promotion Office will lead to increased effectiveness in implementing projects in

[25] See http://www.undp.org/content/undp/en/home/operations/transparency/information_disclosurepolicy/

[26] See https://www.thegef.org/gef/policies_guidelines

			training with various PV systems, solar freezers for fishermen	funds	northern areas; -BRANTV promotion of PV and extensive PV repair training will lead to faster uptake of household-scale PV systems in the market
MCCND-DOE	In-kind	714,444	Capacity building, policy and planning, establishment and operation of DOE Northern Vanuatu RE and EE Promotion Center, operation and investment of NGEF, support for incremental demos (pico-/ micro-hydro, pico-hydro PV hybrid, village-scale community PV, village-wide PV nano-grids, EE cook stoves, and productive uses of RE), project management	-Government diverts funds to other uses	-Demos and "seeing is believing" phenomenon will maintain enthusiasm of government for project -More effective approach to RE systems management to overcome key problem of lack of sustainability of systems will attract great interest from government
Ministry of Tourism, Trade, Commerce and Ni-Vanuatu Business	Grant	1,000,000	Solar fridges for cooperatives	-Delays in progress of baseline activities leads to delays in release of funds	-Establishment of BRANTV institutional coordination mechanism between DOE and Department of Cooperatives will enhance progress, with DOE being able to provide support to Dept. of Cooperatives on the relevant demos
UNDP	Grant	100,000	Project management	-Slow rollout of funds	-Ensuring project roll-out is timely and GEF funds are spent in a timely fashion will ensure UNDP funds are also made available in a timely fashion

Budget Revision and Tolerance: As per UNDP requirements outlined in the UNDP POPP, the project board will agree on a budget tolerance level for each plan under the overall annual work plan allowing the project manager to expend up to the tolerance level beyond the approved project budget amount for the year without requiring a revision from the Project Board. Should the following deviations occur, the Project Manager and UNDP Country Office will seek the approval of the UNDP-GEF team as these are considered major amendments by the GEF:

a) Budget re-allocations among components in the project with amounts involving 10% of the total project grant or more;
b) Introduction of new budget items/or components that exceed 5% of original GEF allocation.

Any over expenditure incurred beyond the available GEF grant amount will be absorbed by non-GEF resources (e.g. UNDP TRAC or cash co-financing).

Refund to Donor: Should a refund of unspent funds to the GEF be necessary, this will be managed directly by the UNDP-GEF Unit in New York.

Project Closure: Project closure will be conducted as per UNDP requirements outlined in the UNDP POPP. On an exceptional basis, only, a no-cost extension beyond the initial duration of the project will be sought from in-country UNDP colleagues and then the UNDP-GEF Executive Coordinator.

Operational completion: The project will be operationally completed when the last UNDP-financed inputs have been provided and the related activities have been completed. This includes the final clearance of the Terminal Evaluation Report (that will be available in English) and the corresponding management response, and the end-of-project review Project Board meeting. The Implementing Partner through a Project Board decision will notify the UNDP Country Office when operational closure has been completed. By this time, the relevant parties will have already agreed and confirmed in writing on the arrangements for the disposal of any equipment that is still the property of UNDP.

Financial completion: The project will be financially closed when the following conditions have been met:

a) The project is operationally completed or has been cancelled;
b) The Implementing Partner has reported all financial transactions to UNDP;
c) UNDP has closed the accounts for the project;
d) UNDP and the Implementing Partner have certified a final Combined Delivery Report (which serves as final budget revision).

The project will be financially completed within 12 months of operational closure or after the date of cancellation. Between operational and financial closure, the implementing partner will identify and settle all financial obligations and prepare a final expenditure report. The UNDP Country Office will send the final signed closure documents including confirmation of final cumulative expenditure and unspent balance to the UNDP-GEF Unit for confirmation before the project will be financially closed in Atlas by the UNDP Country Office.

X. TOTAL BUDGET AND WORK PLAN

Total Budget and Work Plan			
Atlas Proposal or Award ID:	00099978	Atlas Primary Output Project ID:	00103158
Atlas Proposal or Award Title:	Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV)		
Atlas Business Unit	FJI10		
Atlas Primary Output Project Title	Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV)		
UNDP-GEF PIMS No.	5926		
Implementing Partner	Department of Energy – Ministry of Climate Change & Natural Disaster (DOE-MCCND)		

GEF Component/Atlas Activity	Responsible Party (Atlas Implementing Agent)	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	Note
OUTCOME 1: Improved capacity and awareness on sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	**DOE-MCCND**	**62000**	**GEF**	71200	International Consultants	42,000	42,000	0	0	84,000	1
				71300	Local Consultants	40,625	40,625	40,625	40,625	162,500	2
				71600	Travel	28,945	4,135	4,135	4,135	41,350	3
				72200	Equipment and Furniture	9,800	4,200	0	0	14,000	4
				74200	Audio Visual & Print Prod Costs	368	53	52	52	525	5
				74500	Miscellaneous	0	200	0	200	400	6
				Total Outcome 1		**121,738**	**91,213**	**44,812**	**45,012**	**302,775**	
OUTCOME 2: Improved policy, planning, and regulatory regimes in the application of sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	**DOE-MCCND**	**62000**	**GEF**	71200	International Consultants	0	21,000	21,000	0	42,000	7
				71300	Local Consultants	23,075	46,150	23,075	0	92,300	8
				71600	Travel	0	4,964	9,636	0	14,600	9
				Total Outcome 2		**23,075**	**72,114**	**53,711**	**0**	**148,900**	
OUTCOME 3: Established institutional framework enables the effective enforcement of policies and	**DOE-MCCND**	**62000**	**GEF**	71200	International Consultants	0	0	21,000	0	21,000	10
				71300	Local Consultants	24,800	12,400	12,400	12,400	62,000	11
				71600	Travel	6,300	4,200	6,300	4,200	21,000	12

regulations, and implementation of plans, programs, and projects, on the application of sustainable energy and low carbon technologies				74200	Audio Visual & Print Prod Costs	150	0	50	0	200	13
				Total Outcome 3		**31,250**	**16,600**	**39,750**	**16,600**	**104,200**	
OUTCOME 4A: Increased availability of, and access to, financing for sustainable energy, energy access, and low carbon (RE and EE) initiatives in the energy supply and demand sectors	**DOE-MCCND**	**62000**	**GEF**	71200	International Consultants	0	7,140	6,930	6,930	21,000	14
				71300	Local Consultants	0	6,000	12,000	12,000	30,000	15
				71600	Travel	0	0	3,500	3,500	7,000	16
				Total Outcome 4A		**0**	**13,140**	**22,430**	**22,430**	**58,000**	
OUTCOME 4B: Increased financing and investments from private sector on sustainable energy and low carbon projects in the energy supply and demand sectors	**DOE-MCCND**	**62000**	**GEF**	71200	International Consultants	14,700	19,600	0	14,700	49,000	17
				71300	Local Consultants	5,200	5,200	5,200	10,400	26,000	18
				71600	Travel	4,125	4,125	3,300	4,950	16,500	19
				74200	Audio Visual & Print Prod Costs	25	0	0	0	25	20
				Total Outcome 4B		**24,050**	**28,925**	**8,500**	**30,050**	**91,525**	
OUTCOME 5A: Sustainable energy and low carbon (RE and EE) techniques and practices adopted and implemented with both cost and technical viability in the energy, public, private sector, and residential sectors of the country	**DOE-MCCND**			71200	International Consultants	33,250	19,950	13,300	0	66,500	21
				71300	Local Consultants	29,100	29,100	19,400	19,400	97,000	22
				71600	Travel	11,880	11,880	7,920	7,920	39,600	23
				74200	Audio Visual & Print Prod Costs	85	84	84	84	337	24
				Total Outcome 5A		**74,315**	**61,014**	**40,704**	**27,404**	**203,437**	
OUTCOME 5B: Enhanced confidence in the economic and technical viability and long-term sustainability of sustainable energy and low carbon technology projects	**DOE-MCCND**	**62000**	**GEF**	71200	International Consultants	70,000	0	0	0	0	25
				71300	Local Consultants	52,800	17,600	8,800	8,800	88,000	26
				71600	Travel	17,080	8,540	8,540	8,540	42,700	27
				72200	Equipment and Furniture	351,122	491,571	561,795	0	1,404,488	28
				Total Outcome 5B		**491,002**	**517,711**	**579,135**	**17,340**	**1,605,188**	
PROJECT MANAGEMENT	**PMO & UNDP**	**62000**	**GEF**	71200	International Consultants	0	0	17,500	17,500	35,000	29

				71300	Local Consultants	7,920	7,920	11,880	11,880	39,600	30
				71600	Travel	0	0	5,850	5,850	11,700	31
				72100	Contractual Services-Companies	0	0	3,000	3,000	6,000	32
				74100	Professional services	4,000	4,000	4,000	4,000	16,000	33
				74200	Audio Visual & Print Prod Costs	15	15	15	14	59	34
				74500	Miscellaneous	1,342	0	0	0	1,342	35
				74596	Services to project/DPC	3,750	3,750	3,750	3,750	15,000	36
				75700	Training & workshop	1,000	0	0	0	1,000	37
				Total Management		**18,027**	**15,685**	**45,995**	**45,994**	**125,701**	
PROJECT TOTAL						**783,457**	**816,402**	**835,037**	**204,830**	**2,639,726**	

Summary of Funds:

Sources of Funds	Amount Year 1	Amount Year 2	Amount Year 3	Amount Year 4	Total
GEF	783,457	816,402	835,037	204,830	2,639,726
UNDP	25,000	25,000	25,000	25,000	100,000
DOE-MCCND	4,554,216	4,129,216	4,202,216	4,176,796	17,062,444
Ministry of Tourism, Trade, Commerce and Ni-Vanuatu Business	1,000,000	0	0	0	1,000,000
TOTAL	6,362,673	4,970,618	5,062,253	4,406,626	20,802,170

Budget Notes:

Outcome 1

1. International consultants: USD 84,000 for 120 days at USD 700 per day, including: training program for high-level designers and installers of pico-/small micro-hydro mini-grids (30 days), training program for high-level designers and installers of village-scale community PV (with or without mini-grid) and family-compound scale PV nano-grids (30 days), support of content for how-to guide and MP4/5s on pico-/small micro-hydro (20 days), support of content for how-to guide and MP4/5s on village-scale community PV systems (20 days), and support of content for how-to guide and MP4/5s on family-compound scale PV nano-grids and households-scale SHSs.
2. National consultants: USD 162,500 for 30 days at USD 150 per day and 790 days at USD 200 per day. The former includes 15 days for surveys of persons trained in the project's capacity building programs and 15 days for surveys of persons receiving the project's how-to guidebooks. The latter include: training

of local operators of pico-/ small micro-hydro mini-grids (60 days), training of local operators of village community-scale PV systems (60 days), training program in repair of household-scale SHSs and family-compound scale PV nano-grids (100 days), training program in the fabrication of EE cook stoves (100 days), how-to guidebook MP4/5s on pico-/small micro-hydro mini-grids (including pico-hydro PV hybrid mini-grids) (40 days), how-to guidebook MP4/5s on village-scale community PV (40 days), how-to guidebook MP4/5s on EE cook stoves and crop dryers (60 days), how-to guidebook MP4/5s on household-scale PV and family-compound scale PV nano-grids (40 days), promotion of results of pico-/ small micro-hydro demos and outreach for identification of additional sites (30 days), promotion of results of village-scale community PV demos and outreach for identification of additional sites (30 days), campaign to promote EE cook stoves (60 days), campaign to educate people on household-scale SHSs and family compound-scale PV nano-grids (60 days), assessment of info needs of energy sector as relates to low-carbon technologies (20 days), development/ operationalization of energy information exchange service focused on low carbon technologies (30 days), workshops to strengthen energy information exchange focused on low-carbon technologies (5 days), research on requirements for an energy supply and consumption database (20 days), design of an energy supply and consumption database (30 days), and workshops to develop capacity in use and maintenance of energy supply and consumption database (5 days).

3. Travel: USD 41,350 in total, spread across six of the outcome's 24 activities or sub-activities. Benchmarks are USD 2,000 for roundtrip international airfare, USD 150 for per diems in Port Vila, USD 200 for roundtrip domestic airfare, and USD 50 for per diems in the field. There are two international roundtrip airfares (2,000) and 40 days of per diem in Port Vila (USD 6,000) split equally between travel for the international consultant providing the high-level pico-/ small micro-hydro training and the one providing the high-level village-scale community PV training. There are 80 domestic round-trip air flights (USD 16,000), 255 days of per diem in the field (USD 12,750), and USD 2,600 of ground transport. These are spread across the following activities: training for local operators of pico-/ small micro-hydro, high-level training on pico-/ small micro-hydro, training for local operators of village-scale community PV, high-level training for village-scale community PV and family compound-scale PV nano-grids, training program in repair of household-scale SHSs and compound-scale PV nano-grids, and training program in the fabrication of EE cook stoves.
4. Equipment: USD 14,000 in total consists of: USD 10,000 in equipment for artisans that will fabricate EE cook stoves, USD 2,000 in equipment for energy information exchange service and USD 2,000 in equipment for energy supply and consumption database
5. Printing: USD 525 in total spread across the six training programs of the outcome (training for pico-/ small micro-hydro operators, training for high-level pico-/ small micro-hydro designers and installers, training for community PV operators, training for high-level community PV designers and installers, training for repairers of household-scale SHSs and compound-scale PV nano-grids, and training for EE cook stove fabricators)
6. Miscellaneous: USD 400 in total, spread across the two surveys, for telecom and other communication costs associated with the surveys.

Outcome 2

7. International consultants: USD 42,000 for 60 days at USD 700 per day including: 20 days for design of detailed off-grid rural RE electrification plan for Vanuatu, 10 days for developing standards for pico-/small micro-hydro and associated mini-grids, 10 days for developing standards for village-scale community PV and family-compound scale nano-grids, 10 days for design of policy to ensure that PV wastes are disposed of properly, and 10 days for design of policy to ensure that batteries and other replacement parts are available for PV systems on the islands.
8. National consultants: USD 92,300 in total comprised of 130 days at USD 150 per day and 364 days at USD 200 per day. The former includes: 70 days in the design of the detailed off-grid rural RE electrification plan for Vanuatu, 30 days in identifying promising pico-/small micro-hydro sites across Vanuatu and preparing preliminary plans, and 30 days for identifying promising sites for village-scale community PV and family compound scale PV nano-grids and development of associated plans. The latter include: 7 days for developing national targets for pico-/small micro-hydro, 7 days for developing national targets for village-scale community PV and family-compound scale PV nano-grids, 20 days for launching implementation of Phase 1 of the rural electrification plan, 30 days for developing national guidelines on pico-/ small micro-hydro, 30 days for developing national standards for pico-/small micro-hydro, 30 days for developing national guidelines for village-scale community PV, 30 days for developing national standards for village-scale community PV and compound-scale PV nano-grids, 30 days for developing national guidelines for EE cook stoves, 30 days for developing national guidelines for

household-scale PV systems, 30 days for developing regulations regarding tariffs for village-scale off-grid RE systems, 30 days for developing regulations regarding management of multi-household off-grid RE power generation systems, 30 days for developing policy to ensure that PV system parts are disposed of properly, and 30 days for developing policy to ensure that batteries and other PV system replacement parts are available on the islands.

9. Travel: USD 14,600 in total for travel. This is allocated among three of the 17 activities or sub-activities of the outcome. Benchmarks are USD 2,000 for roundtrip international airfare, USD 150 for per diems in Port Vila, USD 200 for roundtrip domestic airfare, and USD 50 for per diems in the field. There is one international round-trip flight (USD 2,000) and 10 days of per diem in Port Vila (1,500) for assessment and design of sustainable management model for village-scale off-grid RE power systems. The other travel costs are 20 domestic roundtrip airfares (USD 4,000), 90 per diems in the field (USD 4,500), and USD 2,600 in ground transport. These other travel costs are spread across the three following activities: design of detailed off-grid rural RE electrification plan (accounting for 60 of the 90 per diem in the field days and USD 2,000 of the USD 2,500 in ground transport), identification of and planning for promising/ priority pico-/small micro-hydro sites, and identification of and planning for promising/ priority village-scale community PV sites and family compound-scale PV nano-grid sites.

Outcome 3

10. International consultants: USD 21,000 for 30 days at USD 700 per day, including: 20 days to develop institutional system to ensure that batteries and other replacement parts for SHSs are available on the islands in Vanuatu and 10 days to develop institutional system to ensure that various wastes from PV systems are properly disposed of.
11. National consultants: USD 62,000 for 310 days at USD 200 per day, including: 70 days in the assessment and design of preferred systems for managing off-grid village RE power systems sustainably, 30 days for revising and building consensus on such systems, 20 days supporting cooperation between DOE and productive sector departments for identifying types of productive uses and relevant roadmap, 20 days for supporting cooperation between DOE and productive sector departments in identifying promising sites for village-scale community PV vis-à-vis foregoing work on productive uses, 20 days for designing ongoing mechanism for cooperation between DOE and productive sector departments for identifying productive uses and relevant sites, 30 days for supporting cooperation between DOE and Water Resources Department on identifying combined pico-hydro/ gravity drop water supply sites, 30 days supporting cooperation between DOE and other departments (such as Forestry Department) to identify priority sites for promoting EE cook stoves and EE crop dryers and to implement such joint promotion, 30 days to support the setting up and implementation of a cross-institutional mechanisms for ensuring that RE and EE policies, standards, and guidelines are enforced/ adhered to, 30 days to develop and launch institutional system to ensure that batteries and other replacement parts for SHSs are available on the islands in Vanuatu, and 30 days to develop and launch institutional system to ensure that various wastes from PV systems are properly disposed of.
12. Travel: USD 21,000: Travel allocations are included for six of the outcome's 11 activities or sub-activities. Benchmarks are USD 2,000 for roundtrip international airfare, USD 150 for per diem in Port Vila, USD 200 for roundtrip domestic airfare, and USD 50 for per diems in the field. There is one international roundtrip airfare (USD 2,000) with 10 days of per diem in Port Vila (USD 1,500) for the consulting activities indicated under note 10. There are 44 domestic roundtrip flights (USD 8,800), 174 per diems in the field (USD 8,700), and USD 1,200 of ground transport spread across the following six activities: design and assessment of model for managing off-grid village RE power systems sustainably, support of cooperation between DOE and departments in the productive sectors to identify promising sites for village-scale community PV power systems, support of cooperation between DOE and WRD to identify combined pico-hydro/ gravity drop water supply sites, support of cooperation between DOE and other departments to identify high priority EE cook stove dissemination sites and promote EE cook stoves at those sites, design and launching of institutional system to ensure that batteries and other replacement parts for SHSs are available on the islands, and developing and launching system to ensure that various wastes from PV systems are properly disposed of.

13. Printing: USD 200 will support printing costs for two activities: revising and building consensus on mechanism for sustainable management of village-scale off-grid RE power systems and setting up cross-institutional mechanism to ensure enforcement of/ adherence to RE and EE policies, standards, and guidelines.

Outcome 4A

14. International consultants: USD 21,000, consisting of 30 days at USD 700 per day for work in identification and outreach to international sources of funding for NGEF for BRANTV demo replication.
15. National consultants: USD 30,000, consisting of 150 days at USD 200 per day for: identification and outreach to international sources of funding for NGEF for BRANTV demo replication (30days), assistance and advising to local proponents to apply to NGEF for funding (loan or grant) for BRANTV RE power generation replication projects (60 days), and assistance and advising to local proponents to design productive use of RE and EE projects and apply to NGEF for funding (loan or grant) of those projects (60 days).
16. Travel: USD 7,000, including USD 3,500 for the national consultant advising local BRANTV RE power generation replication project proponents on applying to NGEF for loans or grants and USD 3,500 for the national consultant advising local proponents on designing productive use of RE and EE projects and applying to NGEF for loans or grants for such projects. Each of these USD 3,500 amounts consist of 10 round-trip airfares at USD 200 each and 30 days of per diems at USD 50 per day.

Outcome 4B

17. International consultants: USD 49,000 in total for 70 days at USD 700 per day, consisting of: 20 days for training of banks, 30 days for advising on design of a private sector financing scheme, and 20 days for evaluating and making recommendations on such a scheme.
18. National consultants: USD 26,000 in total for 130 days at USD 200 per day, consisting of: 20 days for training of banks, 30 days for advising on design of a private sector financing scheme, 60 days in assisting banks or equity investors in connecting with RE and EE projects and reaching financial close on those projects, and 20 days in evaluating and making recommendations on private sector financing scheme.
19. Travel: USD 16,500 with benchmarks of USD 2,000 for international roundtrip airfare, USD 150 per day for per diems in Port Vila, USD 200 for roundtrip domestic airfare, and USD 50 per day for per diems in the field. The total includes three international roundtrip airfares (USD 6,000), one for each of the three international consulting assignments listed under note 17. It includes 35 days of per diem in Port Vila (USD 7,000) across those three trips. It includes ten domestic round trips (USD 2,000) for the work in connecting banks and equity investors with RE and EE projects (to be conducted by a national consultant) and 30 per diems in the field (for USD 1,500) and USD 200 in ground transport, both for the activity of connecting banks and investors with projects.
20. Printing: USD 25 in total for materials for training program for the banks.

Outcome 5A

21. International consultants: USD 66,500 for a total of 95 person days at USD 700 per day, consisting of: 30 days for pico-/ small micro-hydro sourcing work, system best costing work, and work to achieve local supply of parts; 45 days for sourcing work, system best costing work, and work to achieve local supply of parts for PV systems including village-scale community PV, family compound-scale PV nano-grids, household-scale SHSs, and pico-PV ("plug-and-play") systems; and 20 days for research on the most effective and appropriate EE cook stove and EE crop drying technology for fabrication within Vanuatu.
22. National consultants: USD 97,000, consisting of 440 person days at USD 200 per day and 60 person days at USD 150 per day. The latter are for community liaison work, including 30 days confirming land availability and volunteer work support for the 19 pico-/ small micro-hydro systems and the 1 pico-hydro

PV hybrid system, 15 days for the 10 village-scale community PV systems, and 15 days for the 10 villages in which family compound-scale nano-grids will be deployed. The 440 days at USD 200 per day are comprised of: 60 days for the sourcing, best cost system pricing, and facilitating availability of local parts for pico-/small micro-hydro; 90 days for sourcing, best cost system pricing, and facilitating availability of local parts for PV, including village-scale community PV, family compound-scale PV nano-grids, household-scale SHSs, and pico-PV/"plug-and-play" systems; 30 days for assisting EE cook stove artisans in securing parts/ supplies; 60 days for assessing EE cook stove models; 50 days for periodic monitoring and reporting on the 20 pico-/small micro-hydro demos (including the pico-hydro PV hybrid demo); 25 days for periodic monitoring and reporting on the 10 village-scale community PV demos; 25 days for periodic monitoring and reporting on the 10 village demos with family compound-scale PV deployed throughout; 50 days for periodic monitoring and reporting on the EE cook stove and EE crop dryer demos; and 50 days for identifying and assessing the potential for Vanuatu RE and EE applications not already being pursued by BRANTV or other energy projects in Vanuatu.

23. Travel: USD 39,600 in total. All except one of the outcome's 12 activities or sub-activities include travel. Benchmarks are USD 2,000 for international roundtrip airfare, USD 200 for domestic round trip airfare, USD 150 for per diems in Port Vila, and USD 50 for per diems in the field. In some cases, ground transport is also included. There are 3 international roundtrip airfares (totaling USD 6,000), one for each of the international pico-hydro sourcing consultant, the international PV sourcing consultant, and the EE cook stove research consultant, with 45 per diems in Port Vila (totaling USD 6,750) allocated across such consultants. There is a total of 71 round-trip domestic airfares allocated (totaling USD 11,800), involving all but one of the outcome's 12 activities. There is a total of 193 days of per diem in the field allocated across the same 11 activities for a total of USD 9,650. Finally, USD 3,000 is allocated across the outcome for ground transport in the field.
24. Printing: USD 337 in total, spread across the pico-/small micro-hydro sourcing and costing work, the PV sourcing and costing work, the pico-/small micro-hydro monitoring and reporting, the village-scale PV monitoring and reporting, the family compound-scale PV nano-grid monitoring and reporting, and the EE cook stove/ crop dryer monitoring and reporting. The range in printing allocation for each of these six activities is USD 40 to USD 80 per activity.

Outcome 5B

25. International consultants: US70,000 for a total of 100 person days at USD70 per day, including 60 days for design of pico-hydro demos; 30 days for design of the pico-hydro PV hybrid demo; and 10 days for support in preparing the RE portion of the ESMP (5 days for village hydro; 3 days for community scale PV; and 2 days for compound-scale PV nano-grids).
26. National consultants: 490 national consultant days including USD 30,000 for 200 days at USD 150 per day for nationwide EE cook stove and EE crop dryer road show, including preparations and time on the roadshow. The other 290 days are at USD200 per day and include: 60 days for village hydro design; 30 days for pico-hydro PV hybrid design, 30 days for hydro ESMP, 30 days for village-scale community PV design, 15 days for village-scale community PV ESMP, 30 days for design of compound-scale PV nano-grids across 10 villages, 15 days for ESMP of compound-scale PV nano-grids, 20 days for EE cook stove ESMP, and 60 days for design of productive use demos.
27. Travel: Total travel is USD42,700. Of this, USD 18,800 is for nationwide EE cook stove and EE crop dryer road show, including 24 domestic round trip airfares at USD 200 each, 160 days of per diem at USD 50 per day, and USD 6,000 for ground transport. Other travel includes 3 international airfares at USD2,000 each, one for each of village hydro demo design, pico-hydro PV hybrid demo design, and hydro ESMP. There are 44 domestic roundtrip airfares at USD200 each, for design work ESMP work, and installation work. There are 135 per diems in the field at USD50 per day for this same work, as well as USD2,350 for ground transport.
28. Equipment: USD 1,404,488 for equipment for the incremental project demos including USD 524,400 for the 19 pico-hydro mini-grid demos and the 1 pico-hydro PV hybrid mini-grid demo, USD 262,700 for the ten village-scale community PV demos, USD 262,700 for the 10 village demos for which family compound-scale nano-grids will be deployed across the villages, and USD 354,688 for productive use-related equipment to be deployed across many of the 40 demo sites.

Project Management

29. International consultants: The allocation is for 25 days for the MTR and 25 days for the terminal evaluation (TE), totaling USD 35,000 for 50 work days at USD 700 per day.
30. National consultants: A total of USD 39,600 for 264 days at USD 150 per day, consisting of: 25 days for MTR, 25 days for TE, 5 days for inception workshop, and 214 days to cover some of the costs of project management team (while the remaining costs are covered by co-financing).
31. Travel: A total of USD 11,700 is for travel for the MTR and the TE, each consisting of: one roundtrip international airfare (at USD 2,000), 8 person round-trip airfares at USD 200 each, 12 per diems at USD 150 per day, and 9 per diems at USD 50 per day.
32. Contractual services: USD 6,000 total consists of USD 3,000 for updating of CCM Tracking Tool at mid-term of project and USD 3,000 for updating it at end of project.
33. Professional services: USD 16,000 total consists of USD 4,000 each year for the four years of the project for the annual audit.
34. Printing: USD 59 for various printing costs, such as materials for inception workshop.
35. Miscellaneous: USD 1,342 for food for various project management events, especially inception workshop.
36. DPC: USD 15,000 is for "direct project costs" paid to UNDP on as needed basis for UNDP support services, such as recruiting consultants and handling procurement of equipment and payroll of project team. Refer to Annex 12 for details.
37. Training & workshops: USD 1,000 is for rental of conference hall for inception workshop.

XI. LEGAL CONTEXT

This document together with the UN Pacific Strategy 2018 - 2022, and the UNDP Sub-Regional Programme Document (SRPD) for the Pacific 2018 - 2022 agreed to by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA and all UNPS and UNDP SRPD provisions apply to this document.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.
The implementing partner shall:

a) Put in place an appropriate security plan and maintain the security plan, considering the security situation in the country where the project is being carried;
b) Assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary and with approval from the Project Board. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered under this Project Document.

Any designations on maps or other references employed in this project document do not imply the expression of any opinion whatsoever on the part of UNDP concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

XII. ANNEXES

Annex 1. BRANTV Demonstrations

This annex provides summaries of plans for the demos that will be implemented under the BRANTV project. These demos are presented here by technology type and scale. The different demos that will be covered under the project are the following: (1) hydropower demos including (a) 1 mini-hydro mini-grid, (b) 1 large micro-hydro mini-grid, and (c) 19 pico and small micro-hydro mini-grids; (2) one pico-hydro PV hybrid mini-grid; (3) village-scale PV system demos including (a) 5 large PV mini-grids, (b) 37 institutional-scale PV systems, and (c) 10 village-scale community PV systems (with or without mini-grid); (4) family compound and household-scale PV systems including (a) family compound-scale PV systems (typically each 300 W and including five buildings) deployed across 10 villages and (b) household-scale PV systems promoted nationwide; (5) 12,000 energy efficient cook stoves; and (6) productive uses including (a) solar PV freezers for fishermen (with dedicated PV system), (b) solar PV fridges for cooperatives (with dedicated PV systems); and (c) broad range of productive uses across 30 to 40 or more villages integrated with general use RE power systems and EE cook stoves. The implementation plans were worked out during two extensive missions/ field trips in selected islands in November and December 2018. Reports prepared based on these missions/ field trips are *BRANTV PPG Mission 2 – Scoping Site Visits (Tanna, Pentecost, Santo, Gaua, and Efate) – November 2017* and *BRANTV Detailed Technical Study Report – Dec. 4 – 28, 2017*.

1. Hydro-based Power Generation Demos

BRANTV Hydro-based Power Generation Demos	
Baseline hydropower demos	**Incremental hydropower demos**
• Brenwei Hydro, 400 kW (mini-hydro mini-grid) • Talise Hydro, 75 kW (large micro-hydro mini-grid)	• 19 pico or small micro-hydro mini-grids (5 – 20 kW each)

Brenwei Hydro Demo: Brenwei Hydro is a 400 kW mini-hydro project with mini-grid on Malekula. The project is fully co-financed. The project will be the first mini-hydro in the nation in recent decades and will demonstrate Vanuatu's ability to organize international contractors to carry out the work, as well as demonstrate how a mini-hydro system can provide power for multiple villages and thus bring improved energy access to the rural population. Because management systems and operational costs have been a major challenge in Vanuatu regarding off-grid village power, the Brenwei Hydro Baseline Demo will benefit from BRANTV's incremental work in developing a management systems for off-grid systems (to include billing for electricity, with revenues partly used to pay system operators and partly set aside for future repair and part needs). Brenwei Hydro Baseline Demo will also benefit from BRANTV's incremental work in productive uses that will provide examples (carried out at incremental demo sites) as well as from relevant government coordination that will encourage productive uses at Brenwei Hydro. Productive uses, in turn, can help raise Brenwei's utilization rate and, thus, its revenues and, ultimately, its sustainability. Brenwei will provide both global benefits (GHG emission reduction[27] as compared to a diesel mini-grid, which might have been used instead) and national and local benefits (increased energy access, potential for increased incomes from productive uses, and reduced local air pollution as compared to the alternative of diesel power

[27] See Annex 2 for GHG emission reduction of baseline demos.

generation, which might have been used instead). Further, over the long run, Brenwei is expected to bring substantial savings in avoiding the high costs of importing fuel to Vanuatu and transporting it to the site, though the up-front costs of Brenwei will be relatively high due to the need to have work carried out by international contractors. For implementation, a project management team within DOE will organize bidding for international contractors, which will, in turn, carry out implementation of Brenwei on a turnkey basis.

Talise Hydro Demo: Talise Hydro is a 75 kW micro-hydro project with mini-grid on Maewo. The project is fully co-financed. Compared to the incremental project demos that will be on the small end of the micro-hydro range, Talise is on the "large" end of the micro-hydro range (the range being from over 5 kW to 100 kW). Talise will be the first "large" micro-hydro to be deployed in Vanuatu for decades. It will demonstrate Vanuatu's ability to organize international contractors to carry out the work, as well as how a large micro-hydro system can provide power for multiple villages and thus bring improved energy access to the rural population. Talise will benefit from incremental BRANTV work in the same way as described above for Brenwei and will provide similar global and national benefits as described above for Brenwei. For implementation, a project management team within DOE will organize bidding for international contractors, which will, in turn, carry out implementation of Talise's mini-grid on a turnkey basis. Talise Hydro and mini-grid is a project that has been carried out in phases. While the micro-hydro station was completed some time ago, funds were not sufficient to develop a mini-grid, so the power has gone unused. Now that funds have been secured, the mini-grid will be installed and enable commissioning of the project.

Pico- or small micro-hydro mini-grid demos: BRANTV will have a total of 19 pico- /small micro-hydro mini-grid demos (not including the one hybrid system covered in the next section). The hardware for these demos will be fully incremental – fully financed by GEF funds --- and thus these demos are considered "incremental demos." Yet, they will receive some in-kind co-financing support, including volunteer labor from villagers and ongoing support from DOE full-time staff time to manage and monitor implementation, and some government cash co-financing support for travel to demo sites. The capacity of the systems will be 5 to 15 or 20 kW each. The maximum capacity possible will depend on availability of "plug-and-play" type equipment at the higher capacities so that in-country talent can master system design and installation in the near-term and carry out installation and maintenance. The number of 19 (or roughly 20) such demos was selected as the number of demos that would provide enough experience for in-country talent to master system design and installation, while at the same time being a good number to prove repeatability and thus better stimulate replication throughout appropriate locales nation-wide. The identified sites all have a water source with sufficient flow and sufficient elevation drop to turn the turbine and generate power suitable to the targeted capacity. The identified sites are also close enough to the targeted population to make the transmission of power generated economically viable. As such, they are generally within 1 km of the turbine/generator site at the bottom of the elevation drop. In some cases, the water source will be the same one used for water supply – either already or to be implemented along with the power system. The BRANTV team identified a strong need for demonstrating the pico- and small micro-hydro mini-grid demos for the following reasons: (1) the scale is more appropriate to Vanuatu (where villages are often far from one another and where the population of individual villages are relatively small) than larger systems; (2) the small scale and "single village" approach ensure that land issues, often a stumbling block, will be much more easily resolved than with larger systems; (3) hydro provides the most cost-effective form of power provision to off-grid villages that have a good pico- or small micro-hydro resource; (4) Vanuatu currently lacks the expertise to design and install quality systems, but has a substantial number of villages with the appropriate water resource for pico-/ small micro-hydro; and (5) Vanuatu only has a few of hydro systems of this scale already installed nationwide and most are not working or not working well. Cost effectiveness will be a critical aspect of the pico-/ small micro-hydro demos. Given that equipment in general is often much more expensive

in Vanuatu than elsewhere in the world and that costs are not transparent, a key aim of BRANTV will be to provide sourcing support for pico-/ small micro-hydro plug-and-play systems and to develop a transparent costing model. Preliminary estimates show that pico-/small micro-hydro has the potential to be highly cost effective compared to other options and compared to people's willingness to pay for power over the lifetime of the systems. These incremental demos will be designed by consultants retained by the project (an international consultant guiding design work and a national water consultant leading the civil works), by the project team (two of which will have electrical engineering backgrounds), and full time DOE staff. It will be implemented under the leadership of these parties in conjunction with local electricians trained by the project and retained to lead implementation. Villagers will provide volunteer labor. Local operators will be hired and paid from electricity revenues. Long-term sustainability will be ensured by implementation of a management mechanism (also to be designed by BRANTV) whereby payments for electricity will not only cover the operator's salary, but also provide a savings for future repairs and parts. Successful demonstration of this management system will be a critical part of what these demos will achieve. These incremental demos will provide global benefits of GHG emission reduction as compared to the business-as-usual case in which it is likely that diesel generators would eventually have been installed instead. On the national and local levels, benefits include increased energy access, less local pollution than the business-as-usual case, a cost-effective means of electrifying off-grid villages in Vanuatu that have suitable water resources, and the potential for income generation via productive uses of RE based power.

Equipment and civil works: The incremental pico- and small micro-hydro systems will include the following main components:

- Catchment - a cement container with steel rod reinforcement to catch and collect the water as it exits or is diverted from the water source. Local volunteer labor will be used to construct the catchment.
- Dam (for low head sites) - water channel designed to increase the pressure or flow rate of water/ head at low head sites.
- Penstock – pipe that transports water from the catchment, down through the elevation drop, and to the turbine/generator
- Turbine/generator/ ELC – piece of equipment combining the turbine, generator, and electronic load controller (ELC) components of the pico- or small micro-hydro system. The turbine/generator converts the mechanical energy of the descending water flow to electricity. The ELC allows the system to deal with variable loads from the village, so that the generator does not burn out appliances when the load is low. This combined piece of equipment should, if possible, also have dummy loads, safety mechanism, pressure gauges, and voltage, current and power indicators.
- Generator/ equipment house – small structure built to contain the piece of equipment combining the turbine/generator/ELC and to contain the main circuit control board.
- Main cable – large cable transmitting electricity from the turbine-generator-ELC combo to the village or villages served. The diameter of this cable (which will influence the cost per unit length) is usually determined based on the amount of current that will be flowing through it.
- Subsidiary cabling – cables distributing electricity from the main cable to households in the village, with circuit boxes with meters for every four households or so. This cable will have 2.5 mm diameter for leading from the main cable into households and power outlets and 1.5 mm diameter leading to lighting.

Contributions of labor, land, and capital goods: Local villagers will contribute labor to the set-up of the catchment, equipment house, and cabling/ mini-grid. Cabling will be buried underground to the extent possible as a mitigation measure for natural disaster. Design and supervision of construction will be led by DOE and recruited consultants. Recruited consultants will include international and national consultants for the design, a national water expert for the civil works design, and local electricians (resident on the relevant island and trained by the project) to lead villagers in their work. The land will be contributed by local villagers. Equipment will be purchased by the project (either via full grant, or partial grant/ partial loan).

Management system: A key to the demo project design will be payments for electricity used that is channeled into a secure fund to save for operation, maintenance, and replacement parts needed. The systems will employ operators to handle day-to-day needs and collect payments. A renewable energy service company (RESCO) will oversee operation and fee collection and savings in a designated account that requires multiple signatures for withdrawal. Work of the RESCO will be overseen by a national-level organization (e.g., Ministry of Cooperatives) to ensure compliance.

Incremental pico- and small micro-hydro demo sites and preliminary scale: The demo sites and their preliminary scale, type of resource, and village/ villages and population served are shown in Exhibit A1-1.

Exhibit A1-1. BRANTV's 19 Pico-Hydro/ Small Micro-Hydro Mini-Grid Demos*

Location	Proposed Capacity[28]	Water Source	Villages/ Population Served
1. Rangusuksuk, Pentecost	7.5 kW	Hydro-power will be integrated with water supply associated with Pangbo River. Proposed head 1 km away from village, terminus 800 m away from village.	1 village of 61 households and over 300 people (also for consideration for inclusion: 2 nearby smaller villages within 1 km, each with 100 people or so). Village well-off due to kava. Could use power to dry kava, refrigerate fish, operate sewing machines, etc.
2. Melsisi, Pentecost	10 kW	Strong stream nearby, with up to 54 kW or more capacity. Some water being diverted for irrigation.	1 mission with school, hospital, and village; 80 households with 400 to 500 people. Could use power for hospital equipment, kava and tarot processing, freezing fish, etc.
3. Bwatnapni,[29] Pentecost	5 kW	River has a year-round flow 1 km from village, where generator would be placed; potential estimated at 44 kW max	Population of 100 villagers (40 households), 200 boarding students, 45 villagers in nearby villages, 40 monks for total of 385 people. Possible uses of power: kava

[28] Exhibit A1-4 may be referred to for projected annual power generation of various sized systems.
[29] Note: Due to land issues, discussion currently underway whether instead to pursue solar PV nano-grids at this site. If pico-/small micro-hydro is not pursued at Bwatnapni, an alternative pico-/small micro-hydro site will be selected elsewhere on Pentecost.

			processing, fishing, photocopying for school, kava bar being built, government offices expected to be set up, etc.
4. Nambwarangiut, Pentecost	5 kW	Mountain spring emerging from rocks; already being used for water supply and some for fish farming. Generator to be set up about 150 m from village, water source another 100 m from generator.	1 village with 31 households, primary school with 173 students. Possible uses of power: kava grinding and packaging; freezing of fish caught in ocean and tilapia (for which fish farming is just getting started), weaving, sewing, etc.
5. Waterfall, Pentecost	7.5 kW	Two rivers near village: the one with waterfall tourist attraction has two potential sites for hydro installation. Has potential of up to 42 kW.	2 - 4 villages, each with about 100 persons - 72 households and 400 persons in total. Could use power to process kava, for lights for cooking businesses, and for sewing and weaving businesses.
6. Laringmat, Pentecost	5 kW	*to be determined*	*to be determined*
7. Falambil, Santo	5 kW	Small waterfall of Wafook River, <1 km from village; excellent, very strong water source close to village	1 village of 12 households - 100 people; growing quickly as people move back to the village; good potential for fisheries and raising prawns; potential power uses: freezing fish/ prawns, kava processing, etc.
8. Vussvongo, Santo	5 kW	Tong'en Stream, which flows into Lape River	30 households in 3 nearby villages, with 150 people total (tbc)
9. Village near Wasat River, Santo	5 kW	Wasat River	*to be determined*
10. Siriti/ Nemen/ Santa Maria, Gaua	15 kW	Stream with small waterfall 150 m from Sirti, which is 200 from Nemen, which is 150 from Santa Maria (44.1 kW potential)	3 villages with 70 households and 552 people in total; possible uses of power: copra (main crop) and kava processing, refrigeration for fish and meat (villagers have cattle)
11. Barvet/ Aworor, Gaua	7.5 kW	River near coast is 150 m from first village and 1 km from second village (9.8 kW available at proposed site)	2 villages with 35 households and 225 people in total; also, in daytime, primary school with 105 students. Main economy copra, kava, and cattle; power may be used for processing and/or refrigeration
12. Lawa Village, Malekula	10 kW	upgrade 2 existing systems that are not working and integrate with water supply	102 households
13. Lambugu Village,[30] Malkeula	5 kW	upgrade existing system that is not working	*to be determined*

[30] Note: Discussion currently underway whether to pursue Lambugu Village site due to low population. If pico-hydro not pursued at this site, an alternative pico-hydro site will be selected elsewhere in Malekula.

14. Big Water, Maewo	7.5 kW	Water source is large river, which comes from deep inland and has very big catchment area; has 70 meters drop 200 m from village edge with a potential of 28 kW	1 village of over 50 households and 2 schools (kindergarten and primary school); economic activity includes raising prawns and fishing; potential power uses: freezing fish/ prawns, kava processing, power tools, etc.
15. Isaka, Tanna	7.5 kW	Stream 100-150 m from village – about 100 m of elevation drop possible down to that location	35 to 50 households. Possible uses of power: site near volcano - 4 tourist bungalows, more planned; baking; sewing; etc.
16. Site near village on Mt. Malin, Tanna	5 kW	*Villages on Mount Malin above Iquaramanu Villages have water sources/ streams nearby to them; further investigation for suitable site needed*	*to be determined*
17. Tanna site 3, Tanna	5 kW	*to be determined*	*to be determined*
18. Siri Falls, Erramongo	5 kW	*to be determined*	*to be determined*
19. Village near site in DOE hydro study, Aneityum	5 kW	*to be determined*	*to be determined*

*Notes: BRANTV's one pico-hydro PV hybrid mini-grid system demo is covered in the next section. For all 19 of the systems included in this table, the mini-grid will include a main cable from the turbine/gen set to the village and small cables branching off to small groups of households, each small group also having a circuit breaker box. In this way, power will be delivered to all households in the village as well as relevant productive use applications. Meters will track use by each household and by businesses/ productive uses. An operator will manage the system and collect payments for power every month.

Costs of incremental pico- and small micro-hydro demos: Equipment/ part costs are broken down in Exhibit A1-2. Based on preliminary discussions with pertinent stakeholders during the PPG stage, land and majority of labor will be donated by the village. Final discussions and confirmation will be carried out as part of demo project implementation. Design and oversight of local work will be handled by DOE working in conjunction with experts and local electricians hired and trained by the project. Including local cabling, costs per village pico-/ small micro-hydro mini-grid range would range from USD 21,500 to USD 35,300 each, depending on the size of the system and $2,353 to $4,300 per kW installed. This is considered a reasonable target, as internationally costs for hydro systems of 5 kW to 1 MW range from USD 2,000 to USD 10,000 per kW. Developing countries have cost advantages in labor, so should be able to achieve costs closer to the low end of the international range. BRANTV will benefit from free labor, thus enabling a lower per kW all-in installation cost. At the same time, cost per kW installed tends to be higher the smaller the system; and the BRANTV incremental systems are at the low end of the range for which the range of international cost estimates have been provided.

Exhibit A1-2. Equipment Costs for Pico- / Micro-Hydro systems

Item	Cost per unit (for 5 kW system)	Units for 5 kW system	Cost for 5 kW system	Cost for 7.5 kW system	Cost for 10 kW system	Cost for 15 kW system
Main cable (6 mm to 10 mm diameter)	$3 per meter	1,000	$3,000	$3,200	$3,400	$3,800
Distribution cable	$240 per 100 m or 4 households	10 (for 40 households)	$2,400	$3,600	$4,800	$7,200
Circuit breaker boxes	$30 per box (4 households per box)	10 (for 40 households)	$300	$450	$600	$900
Cabling subtotal	--	---	***$5,700***	***$7,250***	***$8,800***	***$11,900***
Civil works (catchment basin)	$2,000 for steel rods, $1,000 for cement	1 of each	$3,000	$3,900	$4,700	$6,200
Turbine/generator/ ELC	$11,000	1	$11,000	$12,000	$13,000	$15,000
PVC pipe for penstock	$1,800	1	$1,800	$1,800	$2,000	$2,200
Subtotal for civil works, turbine/ generator/ ELC, and penstock	---	---	***$15,800***	***$17,700***	***$19,700***	***$23,400***
Grand total	---	---	**$21,500**	**$24,950**	**$28,500**	**$35,300**
Cost per kW (including secondary cabling)	---	---	**$4,300 per kW**	**$3,327 per kW**	**$2,850 per kW**	**$2,353 per kW**

Benefits: The pico-/ small micro-hydro mini-grid has several key benefits for Vanuatu. Benefits as compared to larger scale hydro systems include: (1) Plug-and-play nature of pico- /small micro-hydro systems, allowing Vanuatu to quickly build up local capacity to install and operate systems, without undergoing the slow and expensive international procurement processes required for larger systems; (2) More appropriate scale to Vanuatu, given the dispersed, sparse populations in Vanuatu -- pico-/small micro-hydro (compared to larger systems) can serve a small cluster of villages and keep transmission costs low; and, (3) Land and use of system only at the local level, so that land issues are easier to resolve. In the past Pacific Island Countries, including Vanuatu, have faced a lot of problems with hydro power projects (even at the mini-hydro scale) due to

land issues. Land owners are hesitant to give up their land for such projects when they benefit a relatively wide population. Yet, as the group of beneficiaries becomes smaller and personally known by the land owner or land owning group, land issues become much easier to resolve.

Benefits as compared to other types of village power options include: (1) Lower up-front costs as compared to other renewable energy power options, such as solar PV, and lower costs over time as compared to diesel generator mini-grids; (2) Better local air quality than diesel generator mini-grids; (3) GHG emission reductions as compared to diesel generator mini-grids; (4) Longer potential lifetime than other types of systems if well maintained; and, (5) Potential to integrate village RE power projects with water supply projects in some cases.

Economics: While the up-front capital costs of the systems will be covered by project grants and possibly loans, the payback on this upfront investment can still be calculated by revenues generated from electricity sales. In practice, revenues will be put into a fund to cover maintenance and parts and pay back any loans taken out to build the system. Exhibit A1-3 shows the calculation of revenues and payback period. Annex 18 provides the more complex discounted cash flow (DCF) analysis and net present value (NPV) of the investment. Typically, these systems are operated at 70% capacity; 75% of each 24-hour period with 95% system up time. In that case, the typical net capacity factor (NCF) is 50%. If power is sold for USD0.20 per kWh, the payback periods for the systems, considering equipment only and including costs of feeder cables, range from about 3 to 5 years. In practice, cost of the operator and any spare parts/ repairs needed will need to be taken from revenues. Yet, as these incremental systems will be funded in large parts by grant, revenues will more than cover these costs. The DCF/ NPV analysis provided in Annex 18 also suggests favorable returns to the investment.

Exhibit A1-3. Economics of Pico-/ Micro-Hydro Systems[31]

System Size	Capacity Factor	kWh per day	Revenues per year (@ USD0.20/kWh)	Lifetime, years	Revenues per Lifetime	Payback Period in Years (including feeder cables from cost)
5 kW	0.50	60	4,380	25	109,500	4.9
7.5 kW	0.50	90	6,570	25	164,250	3.8
10 kW	0.50	120	8,760	25	219,000	3.3
15 kW	0.50	180	13,140	25	328,500	2.7

GHG Emission Reductions: GHG emission reduction ("ER") calculations for the pico-/ small micro-hydro mini-grids are based on comparison to diesel generator mini-grids that might have been installed instead and are shown in Exhibit A1-4. In addition to the 19 systems, the 2 kW hydro expansion of the hybrid system (discussed in the next section of this annex) is also included in the calculations. It is assumed that the diesel generator has a specific fuel consumption (SFC) of about 0.3 liter diesel per kWh and that the emissions factor for diesel is 2.68 kg CO2 per liter. Total GHG ERs over all 19 systems plus the one expansion, assuming 25 year lifetimes, are 11,372.4 tons CO2.

[31] DCF/ NPV analysis available in Annex 18.

Exhibit A1-4. GHG ERs of Pico-/ Micro-Hydro Systems[32]

System Size	kWh per year per system[33]	Liters diesel saved per year (@0.3 liter per kWh)	GHG ERs per year (kg CO2) (@2.68 kg CO2/ liter diesel)	Number of Systems	GHG ERs per year for all systems (kg CO2)	GHG ERs per lifetime for all systems (tons CO2)
5 kW	21,845	6,554	17,564	11	193,688	4,830.0
7.5 kW	32,768	9,830	26,345	5	132,055	3,293.2
10 kW	43,691	13,107	35,127	2	70,430	1,756.4
15 kW	65,534	19,661	52,691	1	52,823	1,317.3
2 kW (expansion)	8,738	2,621	7,025.4	1	7,025	175.6
TOTAL	**---**	**---**	**---**	**20**	**448,996**	**11,372.4**

2. Pico-Hydro PV Hybrid Demo

BRANTV Pico-Hydro PV Hybrid Demos	
Baseline pico-hydro PV hybrid demos	**Incremental pico-hydro hybrid demos**
N/A	• 1 pico-hydro PV hybrid demo mini-grid (5 kW pico-hydro, 5 kW PV)

Pico-hydro PV hybrid demo: The pico-hydro PV hybrid mini-grid demo will be implemented at Loltong, Pentecost, a site that has an existing 3 kW pico-hydro system and mini-grid. The demo will include the following elements: (1) upgrade of the 3 kW generator-turbine system at Loltong to a 5 kW generator-turbine-ELC system;[34] (2) addition of 5 kW of PV to the mini-grid; (3) extension of the mini-grid to include households in a large, neighboring village and mission. Loltong is already benefiting from its 3 kW pico-hydro system, but because the generator is not of high quality and does not have an ELC, there are problems, such as light bulbs and other items getting burned out when the load is too low. Further, if the village wishes to extend the mini-grid to the adjacent village and carry out productive uses, more power will be needed and thus the proposal to add PV and extend the mini-grid. The pico-hydro PV hybrid mini-grid will be the first of its kind to operate in Vanuatu. This type of system is particularly interesting to Vanuatu as there are sites that have limited hydropower potential that may need to be complemented by PV to achieve needed capacity. A pico-hydro PV hybrid system is more attractive than a PV-battery only system, because the hydro system will continue to

[32] The GHG ERs are computed based on comparison to a diesel gen set that might have been installed instead.
[33] Lifetime kWh for all the hydro systems are computed by multiplying the annual kWh for each system type by the number of systems of that type and then multiplying all by the estimate 25-year lifetime per system. The result us 14,144.73 MWh.
[34] Note: Currently under discussion as to whether to replace existing system with 3 kW system or expand to 5 kW. May depend on funding availability during implementation.

provide a certain minimum of power in longer rainy periods, when a PV-battery only system may have already used up its reserve power and thus provide no power at all. Also, the hydro portion of the system will generally have a lower per kW cost than the PV-battery system. In the pico-hydro PV hybrid system, little or no batteries can be used to further keep costs down. In this configuration (little or no batteries), the PV system is leveraged as extra power to be used for productive uses when the sun is shining. Because this pico-hydro PV hybrid system is completely new to Vanuatu, an international consultant who can guide domestic experts in the design of the system will be retained. For implementation, a local electrician on Pentecost (to be trained under the BRANTV Project) will lead local people in work needed to extend the grid and install the system, with guidance from DOE and project consultants. The PMU team and permanent DOE staff will also support implementation of the demo. The global benefit of the demo will be GHG emission reductions as compared to the business as usual case where a diesel generator might have in the future been adopted to cover the shortfall of the existing pico-hydro system. National and local benefits include increased energy access to residents, the potential for increased income with productive uses of the additional power, better air quality as compared to the case in which a diesel generator is adopted to fill the gap, and a first model for further systems of this type.

Demo site and targeted scale: The system at Loltong, Pentecost, will be expanded/ improved from a 3 kW pico-hydro mini-grid system with no ELC that serves one large and one small village with a total of 85-90 households (350 people) to a 5 kW pico-hydro and PV mini-grid system with ELC that serves two large villages, a mission, and one small village with a combined total of 180 households (800 people). In addition to expanding the population served, productive uses of the power can be expanded. Loltong currently has a workshop that is not on the pico-hydro mini-grid that may be added to it. The hydropower site at Loltong has as its source water coming out of the rocks on the hill above the village. This water is also piped down to the village for daily use. Potential uses of the expanded power capacity are not only the daily uses of the additional village (which has 90 households and a mission), but also productive uses of the power. For example, Loltong has a workshop that currently uses a diesel generator that might shift its use to the mini-grid if enough power is available for welding and other applications. And, about 5 shops with cold storage could power refrigeration. Sewing machines and ironing are other potential uses, as are processing of various crops, such as kava, taro, and manioc.

As with the 19 pico-/ small micro-hydro systems above, a payment system will be implemented for this hybrid system; and fees collected will be used to pay the operator and to save for repairs and parts.

Costs: Estimated costs for improvement of the hydro system, addition of PV panels, and expansion of the mini-grid are as follows: new 5 kW turbine-generator with ELC – USD 11,000, extension of main cable 1 km – USD3,000, distribution lines to households in the added village USD1,680, circuit boxes USD 210, 5 kW PV panels and inverters USD10,000 The total cost of equipment and parts is USD 25,890, including the lines to the households in the newly added village.

Benefits: The improved system will expand the potential productive uses (and thus incomes) and more than double the population served. It will also increase the reliability of the current hydro system, which to date has had multiple problems and is disliked by some as it blows out lights at times. It will result in better air quality than the diesel generator alternative currently being used by the workshop and potentially used by others, were local power capacity to be expanded by diesel generator. It will also result in GHG ERs as compared to the diesel alternative that might have been adopted instead.

Economics: Currently, no revenues are being collected at the Loltong pico-hydro mini-grid. Thus, while some of the system already exists, we can estimate the payback period based on the ratio of costs of the new equipment to the new revenues collected. The net capacity factor of the pico-hydro is typically 0.5 (as above) while that of the PV is assumed to be 70% use during 5/12 of the day with 85% up time, resulting in a net capacity factor of 25%. The hydro has a lifetime of 25 years, while the PV has a lifetime of 20 years. Average kWh per day for the combined system is (60 kWh + 30 kWh) = 90 kWh. Revenues per year (at USD0.20 per kWh) are USD6,570. Lifetime revenues are (USD 109,500 + USD 43,800) = USD 153,300. Payback period in years is 3.9 years, assuming the lines to households are included. This does not consider costs of paying the operator and of repairs/ parts, though since the system will largely be covered by grant funding, O&M funds should be quite sufficient. DCF and NPV analysis is provided in Annex 18.

GHG Emission Reduction: Because Loltong already has a 3 kW pico-hydro system (although it is not operating that well), to be conservative, it is assumed that incremental ERs are only for the additional 2 kW of the new pico-hydro system and for the 5 kW of the PV system. In kWh per year, this will be 8,738 kWh annually for the pico-hydro over 25 years. For the PV, the power used is 10,867.4 kWh annually over 20 years.[35] Thus, avoided incremental emissions are achieved over system lifetimes for (218,450 kWh + 217,349 kWh) = 435,45799 kWh. Using the same parameters as above for the pico-/ small micro-hydro section, this yields GHG ERs of 350.4 tons CO2 for the hybrid system over its lifetime. It should be noted that for ease of comparison to Annex 2, the increment of 2 kW for the pico-hydro is included in the calculations for all hydro systems. Thus, the net GHG ERs for the PV of the hybrid system alone is 174.8 tons CO2.

3. Village-Scale PV System Demos

BRANTV Village-Scale PV System Demos	
Baseline village-scale PV system demos	**Incremental village-scale PV system demos**
• 5 large PV mini-grids (about 100 kW each) • 37 institutional PV systems (1.9 – 5.2 kW each)	• 10 village-scale community PV systems (with or without mini-grid, 3 to 15 kW each)

Large PV mini-grids: There will be 5 large PV mini-grid demos of about 100 kW each which will be financed entirely through co-financing. These will demonstrate PV mini-grids of a scale not before demonstrated in Vanuatu and will show how RE power can be provided to some of Vanuatu's large off-grid communities. The mini-grids will include a central locale with panels and batteries. Smaller cables branching off a main cable will transmit electricity to households and businesses. While most communities in Vanuatu will not be appropriate to this relatively large scale of mini-grid, there is still a need in Vanuatu to demonstrate such systems as a means of electrifying the nation's largest and most economically vibrant rural communities. The demo will be implemented by a contractor on a turnkey basis. Because there are local firms in Vanuatu that sell PV products and carry out installation, it is quite possible one of these firms will win the bid. They may cooperate with

[35] This is 217.35 MWh over the PV system's lifetime.

international firms in their bidding, given that experience on such large mini-grids is lacking in Vanuatu. At the global level, the mini-grids will provide GHG ERs as compared to the business as usual case in which the locality may have adopted a diesel mini-grid instead of a PV mini-grid. National and local benefits include increased energy access and better local air quality than in the business as usual scenario. In addition, because the baseline project will benefit from interaction with the productive use work at BRANTV incremental demos and BRANTV institutional work related to productive uses, this is likely to stimulate productive use work at these baseline mini-grids, which will, in turn, raise local incomes. The large mini-grid demos will also adopt the management system developed by the project and thus assist in the testing, refinement, and popularization of off-grid systems that charge for power and use fees collected to pay an operator and save for future repair and parts needs. This increased sustainability achieved via the management system will, in turn, increase the cost effectiveness of the investment. Because BRANTV will also support incremental activities in sourcing and cost of PV system parts, the cost of these large PV mini-grids will be reduced as compared to the situation in which there is no BRANTV project.

Institutional PV demos: There will be 37 institutional PV systems of 1.9 to 5.2 kW each. These systems will expressly serve the institutional market, including schools, hospitals, government buildings, etc. They will be paid for entirely through co-financing (67% by the purchasing institutions and 33% by government subsidies). They will demonstrate the effectiveness of institutional PV systems for Vanuatu's institutional organizations and show how the systems can be an effective option for institutions. They will further demonstrate the market demand approach, in which these systems are promoted in the market and then sold to those organizations that come forward with interest. There is a need for dissemination of a better quality of institutional PV system in Vanuatu. While there are several such institutional systems already in use in the country, experience shows the quality may not be very good. For example, the PPG team visited one such system at the hospital in Melsissi, Pentecost. If was found that the panels were not placed at an advantageous angle to the sun. The institutional-scale PV demo program will further demonstrate a model of up-front payment for systems by institutions and their responsibility for ongoing repairs and parts beyond the warrantee period. This will contrast with most of the other BRANTV RE power demos (both baseline and incremental) that will institute a management model in which end users pay for power monthly with some revenues set aside for repairs and parts, rather than making a large one-tine up-front payment. The household PV demo program (described below) will be the one other segment of the demos to demonstrate the up-front payment model with end user responsibility for repair and parts costs. The global benefit will be GHG ERs as compared to the case in which the institution may have adopted a diesel power system instead of a PV system. The national and local benefits include increased energy access for rural institutions and thus better quality of services for the populace. Another benefit will be better air quality as compared to the business as usual scenario, when a diesel generator might have been adopted. At present, there is a challenge with cost effectiveness of PV systems in Vanuatu, with prices for systems much higher than international norms. Thus, BRANTV design includes incremental sourcing and best price costing work that will help ensure the institutional-scale PV systems promoted are cost effective, with the best possible prices achieved for high quality systems. For carrying out the demos, the Government of Vanuatu will select approved system vendors based on their ability to provide systems of certified quality and to provide required warrantees. The vendors will promote the systems and can sell then at a 33% discount, which will then be reimbursed to the vendors by the government. Installation will include a one-time training on use of the systems. In addition, BRANTV incremental activities will provide extensive training across the nation in PV repair that will greatly enhance the sustainability of systems.

Village-scale community PV demos: BRANTV will have a total of 10 village-scale community PV systems of 3 to 10 kW each. These systems, including PV panels and batteries, will be installed in a central location in the village and available for village community members to use for a fee.

The main system hardware of these incremental demos will be paid for with GEF funds, though co-financing will be manifested through labor provided by villagers and supervision support from DOE. Design and implementation will be carried out by the project team, project consultants, and local electricians trained by the project, working together with the DOE team. Mini-grids may be added to the systems to extend power to households, but the mini-grids will be paid for by the village and/ or households. For villages that are relatively spread out, the system may be divided into multiple systems, such as three systems of 1 kW or up to five systems of 5 kW each. Vanuatu's PV experience to date has been focused on small, plug and play ("pico-PV") systems and individual SHSs used on a household-by-household basis. The rationale for pursing village-scale community PV systems is to achieve sustainability of village power systems (often lacking in Vanuatu) by providing enough power to support income-generating productive uses and thus creating the potential for revenues for the power system. The revenues will be used for maintenance and repairs in addition to paying the operator. The central location of the systems will also enable more focused operation and maintenance support. The ten sites for village-scale community PV will also be leveraged as sites for fabrication of EE cook stoves, which requires a strong power source. Distributing EE cook stove production beyond Port Vila/ Efate will allow for lower cost and more effective distribution of the cook stoves. Overall, then, the purpose of these village-scale community PV demos will be to demonstrate a type of off-grid RE system focused mainly on facilitating productive uses and a system serving a village rather than serving an institution or a specific household. Strong cost effectiveness is expected, as BRANTV will provide technical support in sourcing and costing of PV system parts and as best price costing targets will be set clearly in advance. As with the other demos, the global benefit will be GHG ERs as compared to the business-as-usual situation in which a diesel generator is adopted instead to provide such village power. National and local benefits include increase energy access, increased local incomes through productive uses, and clear demonstration of best price costing of such systems.

Equipment: Equipment will include: PV panels, inverter, cabling (both main cable and narrower cable to hook up households if mini-grid is implemented), meters, and battery (battery will require replacement during 20-year lifetime of system).

Contribution of land, labor, and capital goods: As with the pico- / small micro-hydro systems, land for the village community PV systems will be contributed by the village and labor for installation will be volunteered. Design and management of installation will be handled by consultants and local electricians recruited and paid for by the project, working in conjunction with DOE staff. Capital goods (equipment and parts) for this incremental demo will be paid for by the project, by grant and, possibly, partial loan.

Management system: As with the pico-/ small micro-hydro systems, key to the demonstration will be the management system, which will include hiring of an operator to collect fees and take care of technical issues. A RESCO will be the system owner and will be responsible for saving a good portion of fees collected for future maintenance and parts. The battery system will be one of the key costs associated with the system and it will need to be replaced at least once (for lithium ion batteries) or perhaps up to three or four times (for lead acid batteries) during the 20-year lifetime of the system. The fees collected will thus be important in financing replacement battery costs.

Demo sites and preliminary scale: The village-scale community PV demo sites and their preliminary scale, village/ villages and population served, and potential productive uses are shown in Exhibit A1-5. While four sites have been confirmed, the specifics of the other six sites, for which islands have been selected but sites not yet designated, will be determined during implementation.

Exhibit A1-5. BRANTV's 10 Village-scale Community PV Demos*

Location	Proposed Capacity[36]	Villages/ Population Served	Potential Productive Uses
1. Kori, Santo	5 kW	1 village of 35 households; dimensions of 1 km by 200 m, so may be suitable to mini-grid	Refrigeration for meat products, EE cook stove fabrication
2. Bodmas, Santo	5 kW	1 village of 72 households and school; village is 200 by 250 m, so suitable to mini-grid with large number of households in compact area	Agricultural processing such as of kava and other cash crops, refrigeration, EE cook stove fabrication
3. Laone, Pentecost	5 kW	2 villages of 74 households; long dimension of less than 1 km; population of approx. 370; may be suitable for mini-grid some years later or now if community wishes to invest.	Ice making for fishing, refrigeration for fish and other meat products, kava processing (both raw and dry), phone charging, provision of sufficient power for heavy tools, i.e. electric grinder, saw etc., EE cook stove fabrication
4. Luli, Paama	5 kW	1 village of 42 households; long dimension of just over 1 km; population of approx. 210; may be suitable for mini-grid	" "
5. Tahal Nesa, Paama	5 kW	*to be determined*	" "
6. Uri Island, Malekula	5 kW	*to be determined*	" "
7. Epi Island 1	5 kW	*to be determined*	" "
8. Ambrym 1	5 kW	*to be determined*	" "
9. Port Resolution, Tanna	7.5 kW	Central Village Yatokuri and possibly four neighboring villages as users of community system; strong women's group; estimated 300 people or 60 households in Yatokuri	Agricultural processing, such as fruit juice; bungalows; restaurants; EE cook stove fabrication
10. Sulfur Bay, Tanna	7.5 kW	Central Village of Ibigal and possibly four neighboring villages as users of community system; 300 people in Ibigal (500 including other villages)	Agricultural processing; EE cook stove fabrication

*Systems will consist of a ground-based or rooftop based array of solar panels connected to a battery bank, with the latter stored in protective housing. The villagers may or may not add a mini-grid to transmit the power to homes in the village.

[36] The 5 kW systems achieve 20,586 kWh per year or power consumed; and the 7.5 kW systems achieve 30,879 kWh per year of power consumed.

Costs: Based on preliminary estimates, the equipment cost of the PV systems (including panels, inverters, and batteries, but not including cabling for distribution to households) will be USD 4,000 per kW, or USD 20,000 for smaller systems (5 kW) and USD 30,000 (7.5 kW) for larger systems, not including battery replacement over the 20-year lifetime. BRANTV sourcing efforts will aim to provide best cost sourcing, while still achieving good quality levels. Total costs of equipment over all ten systems will be (8 x USD 20,000 + 2 x USD 30,000) = USD 220,000.

Benefits: The village community PV systems will introduce a new model to Vanuatu, different from the mainstay of household-scale PV systems used to date. This new model will have a focus on productive uses and have the potential for raising local incomes. This income generation, in turn, will enable systems to charge and collect revenues for power use, which will contribute to sustainability of the systems, as funds collected can be reinvested in parts and repairs the systems need over time. The PV systems will provide better local air quality than the diesel generator alternative which might have been adopted instead, as well as GHG ERs and cost savings over the system lifetimes, as compared to what would have been the situation with diesel generation.

Economics: Because these village-scale community PV systems have substantial batteries, they have a relatively high utilization capacity. It is assumed that they achieve 70% utilization capacity over 75% of each 24-hour period and are up 90% of the time, for an overall utilization rate of 47%. Thus, 5 kW systems achieve 20,586 kWh per year and 7.5 kW systems achieve 30,879 kWh per year.[37] Assuming electricity tariffs are USD 0.20 per kWh, the 5 kW systems will bring in revenues of USD 4,117 per year and the 7.5 kW systems bring in revenues of USD 6,176 per year. Thus, the payback of both systems is achieved after 4.9 years. As much of the initial systems costs of these incremental demos will be covered by grant, revenues will be ample to cover operation and maintenance, as well as battery replacement, which were not included in the payback calculations. Annex 18 shows DCF and NPV analysis of the financial returns of the investment on these systems.

GHG Emission Reduction: Using parameters of 0.3 liters of diesel per kWh and 2.68 kg CO2 per liter diesel used for a diesel system that might have been installed had the PV system not been installed, the 5 kW systems achieve GHG ERs of 16,639 kg CO2 per year and the 7.5 kW systems achieve 24,959 kg CO2 per year. Over a 20-year lifetime, that will be 332.8 tons CO2 for each of the 5 kW systems and 499.2 tons CO2 for each of the 7.5 kW systems. Because there are eight of the former and two of the later, the grand total CO2 ERs for these ten village community PV systems will be 3,660.8 tons CO2.

4. Household-/ Family Compound-Scale PV Demos

BRANTV Family Compound-Scale and Household-Scale PV System Demos	
Baseline household-scale PV system demos	**Incremental family compound-scale PV demos**
• Household-scale SHSs (120 W to 1.6 kW) promoted nationwide	• Family-compound scale PV systems (of around 300 W and covering around 5 buildings each) deployed across all family compounds in each of 10 villages

[37] Total kWh generated over the lifetime of this set of systems is computed as follows: The per year total is (20,586 kW/year x 8 systems) + (30,879 kW/year x 2 systems) = 226,246 kWh/ year. Over 20 years, the total is 4,528.92 MWh.

Household-scale PV demos: The household-scale PV demos will be systems of 120 W to 1.6 kW each installed on the roof tops of individual households. The systems will be completely co-financed, with 33% government subsidy and the remainder paid for by the individual household on an upfront basis. There will be no ongoing fees, but households will be responsible for any repairs or parts not covered under system warranty. The systems will be promoted nationwide and sold to interested parties with the main qualification for subsidy being household location in a long-term off-grid area (i.e. area that is not a part of the concessions of the two utilities in Vanuatu, UNELCO and VUI). The installations will demonstrate the scale-up of deployment of household systems in Vanuatu and stimulation of the market via a combined subsidy and market promotion approach. The household-scale PV demo program will further demonstrate a model of up-front payment for systems by households and individual responsibility for ongoing repairs and parts beyond the warrantee period. This will contrast with most of the other BRANTV RE power demos (both baseline and incremental) that will institute a management model in which households pay for power monthly with some revenues set aside for repairs and parts. The institutional PV demo program (described above) will be the one other segment of the demos to demonstrate the up-front payment model with individual (in this case, the institution) responsibility for repair and parts costs. The global benefits of the household-scale PV demos will be reduction in GHG ERs in comparison to diesel power generation, which might have been used instead had no PV system been installed. National and local benefits include increased energy access in rural areas and better air quality than had diesel generators been adopted instead. At present, there is a challenge with cost effectiveness of household-scale PV systems in Vanuatu. A previous program (now in progress) is promoting pico-scale PV systems (10 to 50 W); and the market prices (before subsidy, which is 50%) are over double that of best international prices. Thus, BRANTV design includes incremental sourcing and best price costing work to ensure that the household-scale PV systems promoted via this newer baseline program are cost effective, with the best possible prices achieved for high quality systems. For carrying out the demos, the Government of Vanuatu will select approved system vendors based on their ability to provide systems of certified quality and to provide required warrantees. The vendors will promote the systems and can sell them at a 33% discount which will then be reimbursed to the vendors by the government. Installation will include a one-time training on use. BRANTV incremental activities will provide extensive training across the nation in PV repair that will greatly enhance the sustainability of systems.

Family compound-scale PV deployed across full villages: The BRANTV Project will have a total of 10 villages across which suitable family compound-scale nano-grids will be deployed. These “nano-grids” will typically be 300 W each in capacity and be connected to roughly five buildings within a family compound. The roughly 300 W household PV system will likely sit on one rooftop in the compound and be connected to the other four or so buildings by wiring. This is a new model in Vanuatu, though some family compounds may have informally developed such systems in the past. The rationale for pursuing this type of configuration is that some villages in Vanuatu have a relatively dispersed layout, in which family compounds are relatively far apart, making a village-wide mini-grid uneconomic. Yet, by creating nano-grids, instead of individual household/building systems, the nano-grid model allows a high-power level that may facilitate some productive uses not possible with smaller household systems. It also allows more focus on a central compound system for maintenance and repairs. The hardware for these incremental demos will be fully supported by GEF financing. Families will provide volunteer labor to support installation, with design and installation led by project consultants, the project team, and permanent DOE staff. Families/ involved households will pay monthly fees, which will be set aside for repairs and parts. Global benefits will be GHG ERs as compared to the baseline case in which diesel generators may have been adopted by the families instead. National and local benefits include increased energy access, potential for productive uses (and associated income generation), and better air quality than if diesel generators had been adopted.

Equipment: Equipment for each nano-grid will include: PV panels (300 W), inverter, cabling to go from the SHS to the roughly four other buildings of the family compound, a meter, and a battery system (battery will require replacement during 20-year lifetime of system).

Contribution of land/ rooftop, labor, and capital goods: Land/ rooftop will be contributed by the family whose compound is being served, as will labor for installation. Design and management of installation will be handled by consultants and local electricians recruited and paid for by the project, working in conjunction with DOE staff, whose time will be co-financed. Capital goods (equipment and parts) for these incremental demos will be paid for by the project, by grant and, possibly, partial loan.

Management system: These systems will have a different management systems from the baseline household PV system demos, for which a partial, 33% subsidy will be provided and an up-front cash payment required for the rest of the system. In the implementation of the installation and operation of the nano-grid demos, the participating households (families) will not have to make any up-front payments, but instead will be required to make monthly payments for power based on usage level. Fees will be used to cover a village operator who collects fees and ensures standard maintenance and repairs and to cover costs of parts and eventual battery replacement.

Demo sites and preliminary scale: The demo villages and preliminary scale of systems, village/ villages and population served, and potential productive uses are shown in Exhibit A1-6. While four sites on Santo have been confirmed, the specifics of the other six sites, for which islands have been selected but sites not yet designated, will be determined during implementation.

Exhibit A1-6. BRANTV's 10 Villages with Family-Scale PV-Nano-grids (of 300 W) Deployed Across them

Location	Proposed Capacity[38]	Villages/ Population Served	Potential Productive Uses
1. Lelek, Santo	8 systems x average of 300 W per system = 2.4 kW	Lele, Luri, and La Point; 35 households, population of 175	Copra processing (virgin oil, oil extraction), refrigeration, raw kava processing, phone charging
2. Lathi, Santo	11 systems x average of 300 W per system = 3.3 kW	1 village, 50 households, 250 people	" "
3. Kole, Santo	8 systems x average of 300 W per system = 2.4 kW	35 households and 175 people estimated	" "
4. Sara, Santo	8 systems x average of 300 W per system = 2.4 kW	*to be determined*	" "
5. Emae 1	8 systems x average of 300 W per system = 2.4 kW	*to be determined*	Refrigeration for fish and other meat products, phone charging

[38] In terms of annual power generation, villages with 2.4 kW installed (8 x 300 W) achieve 9,881 kWh of utilized power generation per year; and the village with 3.3 kW installed (11 x 300W) will achieve 13,587 kWh of utilized power generation per year.

6. Emae 2	8 systems x average of 300 W per system = 2.4 kW	*to be determined*	" "
7. Tongwa 1	8 systems x average of 300 W per system = 2.4 kW	*to be determined*	" "
8. Tongwa 2	8 systems x average of 300 W per system = 2.4 kW	*to be determined*	" "
9. Makira 1	8 systems x average of 300 W per system = 2.4 kW	*to be determined*	" "
10. Makira 2	8 systems x average of 300 W per system = 2.4 kW	*to be determined*	" "

Costs: Based on preliminary estimates, the equipment cost of the PV systems (including panels, inverters, batteries, and cabling) will be USD 500 per 100 W, or USD 1,500 for the 300 watt systems, not including battery replacement that will be required over the 20-year lifetime of the system. BRANTV sourcing efforts will aim to provide best cost sourcing, while still achieving good quality levels. Preliminary estimates of total costs of equipment for those villages with 8 family compounds are USD 12,000 per village and for the village with 11 systems, USD 16,500. Total cost of equipment for the ten systems will be USD 124,500. DOE staff will work with consultants retained by the project, who will design the systems and manage installation. Among these consultants will be local electricians trained by the project. Equipment for these incremental demos will be purchased with grant from the project and, possibly, partial loan.

Benefits: The 10 villages with family compound-scale nano-grids will introduce a new model to Vanuatu, different from the mainstay of household-scale systems used to date. This new model will emphasize somewhat larger systems (300 W) to enable more productive uses and more central management and repair than the household systems typically now in use. The management model will call for collecting revenues for power use, which will contribute to sustainability of the systems, as funds collected can be reinvested in parts and repairs the systems need over time. As part of the process, it will be important to educate end users from the start, that, although the nano-grids are family compound in scale, the systems are part of village electrification and, with no up-front costs, fee payment for electricity used will be ongoing. (Education is important, as experience shows villagers may be confused with ongoing payments in which the system is never "fully purchased.") The PV systems will provide better local air quality than the diesel generator alternative that might have been adopted were these PV nano-grids not introduced, as well as GHG ERs and cost savings over the system lifetimes, as compared to diesel generation.

Economics: Because these family compound-scale PV systems will have substantial batteries, they will have a relatively high utilization capacity. It is assumed that they achieve 70% utilization capacity over 75% of each 24-hour period and are up 90% of the time, for an overall utilization rate of 47%. Thus, villages with 2.4 kW installed (8 x 300 W) achieve 9,881 kWh per year of power utilized; and the village with 3.3 kW installed (11 x 300W) will achieve 13,587 kWh per year of power utilized.[39] Assuming electricity tariffs are USD0.20 per kWh, the 2.4 kW villages will bring

[39] Total kWh generated over the lifetime of this set of systems is computed as follows: The per year total is (9,881 kW/year x 9 systems) + (13,587 kW/year x 1 system) = 102,516 kWh/ year. Over 20 years, the total is 2,050.32 MWh.

in revenues of USD 1,976 per year and the 3.3 kW village will bring in revenues of USD 2,717 per year. Thus, the payback of systems in all the ten villages is achieved after six years. A DCF/NPV analysis is given in Annex 18. As much of the initial system costs (i.e. the hardware) will be covered by grant, revenues will be ample to cover operation and maintenance, as well as battery replacement, even though these are not included in the payback period calculation.

GHG Emission Reduction: Using the parameters of 0.3 liters of diesel per kWh and 2.68 kg CO2 per liter diesel (for comparison to what would happen if diesel gen sets were adopted instead of PV nano-grids), villages with 2.4 kW in systems (or 8 nano-grids) achieve GHG ERs of 7,987 kg CO2 per year and the village with 3.3 kW in systems (or 11 nano-grids) achieves GHG ERs of 10,982 kg CO2 per year. Over a 20-year lifetime, that will be 159.74 tons CO2 for the villages with 2.4 kW in systems (8 nano-grids) and 219.64 tons CO2 for the village with 3.3 kW in systems (or 11 nano-grids). Because there are nine of the former and one of the later, the grand total CO2 ERs for these ten villages with family compound-scale nano-grids deployed across them will be 1,657.3 tons CO2 over 20 years.

5. Energy Efficient Cook Stove Demos

BRANTV Energy Efficient Cook Stove Demos	
Baseline energy efficient cook stove demos	**Incremental energy efficient cook stove demos**
N/A	• Road show and sale of 12,000 energy efficient cook stoves across the nation

The energy efficient cook stove demo work will involve working with experts to determine the most appropriate cook stove that can be made in Vanuatu by local artisans for reasonable cost and that will be acceptable by the people of Vanuatu as replacement for cooking over an open-hearth fire. Already, Mr. Gilbert Gibson, living in Vanuatu since 1974, has developed a rocket stove for which his artisanal supply cannot meet demand. The stove uses local materials, including pumice, a type of volcanic rock found in the ocean. The stove reduces wood use by 50% and lasts approximately three or four years. Critical to this demo will be the training of artisans to fabricate the selected EE cook stove. These will include apprentices based in Port Vila as well as those located at each of the project's ten village community PV sites, who will be able to have access to the electricity needed to power tools for the manufacture of the cook stoves. Such local artisans distributed on the islands will decrease transport costs and improve the reach of the EE cook stove promotion program. Globally, the cook stoves will provide reduced GHG emissions as compared to the open-hearth fires now predominantly used. In terms of national and local benefits, the cook stoves will reduce fuel wood use, thus both saving people time in collecting wood or money in buying it and preserving Vanuatu's rich natural ecosystems. A particularly important benefit will be substantially reduced smoke as compared to the baseline open hearth fires. The cook stove hardware will be completely co-financed by household purchases of the stoves. Incremental GEF funding will be used for a nation-wide road show to promote the stoves and for training of the artisans and providing them with tools for cook stove fabrication.

Demo sites and preliminary scale: The project will involve the conduct of a "road show" to promote the EE cook stoves nationwide and capacity development for apprentices to learn to make the stoves and for them to have the appropriate equipment to do so. While the aim will be to distribute the stoves nation-wide with a target of purchase by 12,000 families who will use the stoves to prepare three meals a day, efforts may focus particularly on some high potential areas selected because of expected high demand for the stoves. These include: (1) in northern Pentecost, Ivo and 3 or 4 other villages, with a target of 1,225 EE cook stoves to be sold; (2) on Santo, Luganville with a target of 1,512 stoves to be sold; (3) in northern Efate, the capital of Port Vila, the two mainland sites of Epau and Leleba, and the offshore island of Nguna, with a target of 530 stoves to be sold; and (4) in northeast Malekula, on the offshore islands of Vao, Achin, and Urpil, a target of 1,620 stoves to be sold. In addition to the foregoing (or in some cases overlapping with the foregoing), there will be promotion of the use of EE cook stoves at the ten village-scale community PV sites. Sites with both PV and cook stoves, may also integrate PV powered fans with cook stoves for crop drying, as a part of their productive use work.

Costs: Rocket stoves are already in existence and is the preferred energy efficient stove to be fabricated and sold in Vanuatu. The main model of the rocket stove is now being sold in Port Vila for about USD 28. The cost of materials is less than USD 5. The cook stove can also be purchased with a baking attachment for the top. This model is sold for about USD 46 in Port Vila. Experience to date and a focus group during project design suggest that these purchase prices (USD 28 and USD 46) are acceptable to people in Vanuatu; and there is thus not a need to subsidize stove purchase.

Benefits: The cook stoves have many benefits: They improve indoor air quality and thus reduce illness. They lessen the need for fuel wood collection by one-half (assuming the rocket stove currently in existence is selected as the preferred stove). This has benefits to the environment and time-saving benefits for families (or money-saving benefits where people purchase fuel wood). The stoves also reduce GHG emissions from cooking over open hearth fire by one-half (assuming the rocket stove currently in existence is selected as the preferred stove). Open hearth fire is the cooking method used by most of the population in Vanuatu, among which use of any kind of cook stove is quite rare.

GHG Emission Reduction: The annual household fuel wood use in Vanuatu is estimated at 2,600 kg per year. Half of this being saved would be 1,300 kg per year per family. Over 12,000 families (the targeted number of stoves to be sold via project promotion), the savings in fuel wood would be 15,600 tons of fuel wood per year. Using an emissions factor of 1.513 tons of CO2 per ton of fuel wood, the associated GHG ERs are 23,602.8 tons of CO2 per year. Over a three-year lifetime of the stoves, the GHG ERs are 70,808.4 tons of CO2. Much larger ERs will be achieved if a good percentage of families continue to buy new rocket stoves as their old ones wear out.

6. Productive Use Demos

BRANTV Productive Use Demos	
Baseline productive use demos	**Incremental productive use demos**
• Solar freezers for fishing association (with dedicated PV panels	• Broad range of productive uses (e.g. ice making, crop drying,

and batteries) • Solar fridges for cooperatives (with dedicated PV panels and batteries)	welding, sewing, etc.) integrated with general RE power provision and EE cook stove technologies across 30 to 40 or more villages

Solar freezers for fishing association demo: The solar freezers for fishing association demo will demonstrate a system with dedicated solar PV panels and batteries that power solar freezers used expressly for preserving fish caught by fishermen so that they can have more flexibility to adjust their sale of fish to market demand. There is a great need for such technology in off-grid areas, as otherwise fishermen must sell large catches all at once for a low price to intermediaries. And, even worse, some fish may spoil if they cannot be sold. The demo will also demonstrate a system of a fisherman's association or cooperative organized to manage the solar freezers. The organization will charge individual fishermen for use of freezer space and split profits among the owners. The global environmental benefit is reduced GHG ERs as compared to the case in which a diesel generator might have been bought instead to power freezers. The national and local benefits are improved livelihoods for the fishermen and association/ cooperative members, as well as better local air qualify than would have occurred had a diesel generator been purchased. The demo is completely co-financed. Local fishermen will provide some volunteer labor, while government funds will support the purchase of the solar freezer and building materials used in erecting a building to contain the freezers.

Solar fridges for cooperatives demo: The solar fridges for cooperatives demo will demonstrate a system with dedicated solar PV panels and batteries that power solar fridges used by cooperatives. The cooperatives may collect payments from users to help pay for repairs/ parts of the systems, with excess distributed as profits to cooperative members. Given the lack of power in Vanuatu's off-grid areas, the demonstration is important in showing how solar PV power can provide a key productive use. Management by cooperatives is also an important aspect of the demonstration, given the sustainability problem faced by past RE power generation projects when funds for repairs have been lacking. The demo will be completely co-financed. The fridges will be supplied by and set up by contracted solar PV vendors in Vanuatu. The global environmental benefit is reduced GHG ERs as compared to the case in which a diesel generator might have been bought instead to power refrigeration. The national and local benefits are improved livelihoods for cooperative members and users of the refrigeration service as well as better local air qualify than would have occurred had a diesel generator been purchased.

Demos of broad range of productive uses integrated with general RE power provision: Productive use demonstrations will be incorporated across the incremental RE power generation demos (especially the 30 village-scale systems, but also likely in the 10 nano-grid villages) and, possibly, some of the EE cook stove demo villages. The objective of the productive use demos will be both to generate income that will benefit livelihoods and to increase revenues of the village RE power systems from the increased power use resulting from the productive uses. Some of the proposed productive uses include: (1) copra drying using RE powered ventilation fans and EE cook stoves to reduce fuel wood use; (2) other copra value add, such as coconut oil extraction; (3) cold storage for beef, fish, poultry, and pork for sale and self-use; (4) power tools for building sturdier homes and carpentry; (5) kava drying; (6) kava grinding; (7) lighting for extending the time women can work on handicrafts; (8) sewing machines; (9) tourism – power for bungalows; and (10) tourism – power for restaurants for tourists. The importance of these incremental demos is that they go beyond the baseline productive use demos in showing a much broader range of productive use applications. Further, they show how these can be integrated with a general purpose RE power system, rather than depend on a dedicated system as in the case of the baseline solar

freezers and fridges. The project will provide grants and, possibly, loans to demo villages for equipment needed for the incremental productive uses, so that they can be demonstrated in conjunction with village RE power systems and EE cook stoves. Cost effectiveness will be achieved by technical advising on business plans as well as by the synergy of generating both increased revenues for the power systems and increased incomes for villagers.

Annex 2. GHG Emission Reductions Estimates

This annex provides the methodology for and results of calculating the incremental GHG emission reductions ("GHG ERs" or, simply, "ERs") expected to result from the BRANTV Project. ER estimates required for GEF projects are divided into four categories: direct GHG emissions reductions ("DERs"), direct post-project emission reductions ("DPP ERs"), indirect GHG ERs – bottom-up approach, and indirect GHG ERs – top-down approach. Each of these is covered in turn below, though estimates for baseline direct GHG ERs are given first and then added to incremental direct GHG ERs to show total direct GHG ERs in the alternative scenario. The annex closes with an aggregation of key results in a summary table.

1. Baseline direct GHG emission reductions: The baseline direct GHG emission reductions are those due to the co-financed demos that would have occurred in the absence of BRANTV. While it is likely that certain BRANTV activities will enhance/ increase the total GHG emission reductions these baseline demos generate, for the sake of simplicity and for the sake of providing a conservative estimate, all ERs from the baseline demos are for now assumed to be "baseline direct ERs." At the same time, overall capacity factors used are somewhat lower than those used for the incremental demos, reflecting a lower level of productive uses in the baseline scenario. Baseline GHG ERs associated with the baseline demos are shown in Exhibit A2-1.

Exhibit A2-1. Direct GHG ERs for Baseline RE Power Generation Demos*

Technology/Demo	total kW	kWh/ year	Liters diesel per year avoided	GHG ERs per year (kg CO2)	Lifetime of system (years)	GHG ERs over lifetime (tons CO2)
Mini-hydro (Brenwei)	400	1,398,096	419,428.8	1,124,069	30	33,722.1
Large micro-hydro (Talise)	75	262,143	78,642.9	210,763	25	5,269.1
Large PV mini-grids	500	1,563,660	469,098	1,257,183	20	25,143.7
Institutional PV	74	231,421.7	69,426.5	186,063	20	3,721.3
Household PV	900	1,608,336	482,500.8	1,293,102	20	25,862.0
Solar PV freezers/fridges	40.8	212,657.8	63,797.3	170,976.8	20	3,419.5
Total	---	---	---	---	---	**97,137.6**

*Overall capacity factor of 0.4 used for Brenwei and Talise, 0.36 for the PV demos, and 0.60 for PV freezers/fridges.

2. Direct GHG emission reductions: Direct GHG ERs are ERs resulting directly from investment type activities of the project (both those with GEF financing and those with co-financing) such as the demonstrations. Total direct emission reductions (DERs) for the alternative scenario are the sum of the baseline DERs calculated above and the incremental DERs calculated in this sub-section. The net DERs (DERs attributable to BRANTV) are computed per the following equation and are thus equivalent, in the case of BRANTV, to the DERS from the incremental project demos.

$$\text{Direct ER} = [\text{Direct ER}]_{\text{ALTERNATIVE}} - [\text{Direct ER}]_{\text{BASELINE}}$$

Direct GHG ERs due to incremental project demos: The incremental DERs are those that occur beyond the business-as-usual baseline estimates for the lifetime of the incremental equipment installed. For ease of evaluation in the project results framework (which requires results at the time of project close),

incremental DERs that occur during project lifetime are also computed. For BRANTV, the incremental project demos (as covered in Annex 1) are the source of direct ERs.

The incremental project demos include:

- 19 pico-/ small micro hydro mini-grids
- 1 pico-hydro PV hybrid mini-grid
- 10 village-scale community PV systems
- deployment of multiple family compound-scale nano-grids (300 W, 5 buildings each, on average) across 10 villages
- energy efficient cook stoves adopted by 12,000 households

Calculation of the incremental direct ERs for the power generation items above is provided in Exhibit A2-2. To simplify calculations, kW capacity is aggregated by demo type. Referring to Annex 1 ("Project Demos"), the 19 pico-/ micro-hydro demos have a total of 127.5 kW capacity, computed as [(11x5kW) + (5x7.5kW) + (2x10kW) + (1x15kW)]. To this is added 2 kW in incremental capacity of the pico-hydro PV hybrid system for a total of 129.5 kW. The PV in the pico-hydro PV hybrid, which is 5 kW, is accounted for separately as it is not integrated with batteries and thus has lower overall capacity factor than the other PV demos. The village community PV systems have a total of 55 kW, computed as [(8x5kW) + (2x7.5kW)]. The PV nano-grid villages have a total capacity of 24.9 kW, computed as [(9x2.4kW) + (1x3.3kW)].

Exhibit A2-2. Direct GHG ERs for Incremental RE Power Generation Demos*

Technology	total kW	kWh/ year	Liters diesel per year avoided	GHG ERs per year (kg CO2)	Lifetime of system (years)	GHG ERs over lifetime (tons)
Pico/micro hydro	129.5	565,792	169,738	454,896	25	11,372.4
PV no battery	5	10,867	3,260	8,737	20	174.7
Village community PV	55	227,651	68,295	183,031	20	3,660.6
PV nano-grid villages	24.9	103,064	30,919	82,863	20	1,657.3
Total	--	---	---	---	---	**16,865.0**

*Parameters of SFC = 0.3 liter diesel per kWh and 2.68 kg CO2 per liter diesel are used. Average capacity use of hydro is 70 %, over 75 % of 24 hours in day, with 0.95 uptime over the year, for an overall capacity factor of 0.5. Average capacity use of PV-no battery is 70 %, over 5/12 of 24 hours in day with 0.85 uptime over the year, for overall capacity factor of 0.25. Average use of village community PV and PV nano-grid village systems is 70 %, over 75 % of 24 hours in day, with 0.9 uptime over year, for overall capacity factor of 0.47.

Exhibit A2-3 provides the parameters and estimates for GHG ERs for the incremental cook stove demos annually and for the three-year lifetime assumed for the cook stoves.

Exhibit A2-3. Direct Incremental GHG ERs for EE Cook Stove Demos*

Annual household fuel wood use for cooking	Efficiency savings factor	Annual household fuel wood saved with EE stove	Number of cook stoves	Annual fuel wood savings per year across all families	GHG emissions factor for wood (ton CO2 per ton wood)	GHG ERs per year	GHG ERs over 3-year lifetime of stoves

2,600 kgs	0.5	1,300 kgs	12,000	15,600 tons	1.513	23,602.8 tons	**70,808.4 tons**

*Dissemination will focus on those locations where there is a shortage of fuel wood or where fuel wood harvesting is unsustainable (results in reduced biomass). Thus, the cook stove use will lead to GHG ERs.

Finally, to compute total direct incremental GHG ERs we add the incremental ERs from the power generation demos to those of the cook stove demos. In addition, to compute direct incremental GHG ERs during the project's four-year lifetime, there is a need to estimate the roll-out pace of the various demos and then compute aggregate GHGs annually. It is assumed that the first phase of implementation is completed at the end of year 1 of the project, so that a full year of GHG ERs for that equipment is achieved by the end of year 2, etc. Exhibit A2-4 shows the planned roll-out on a proportion basis. For the RE power systems, the amount indicated is the proportion of the total targeted kW of the respective technology involved that has rolled out at the indicated time. For the cook stoves, it is a simple proportion of the total EE cook stoves targeted that are rolled out at the indicated time. Exhibit A2-5 shows the total incremental lifetime DERs and, based on the rollout schedule in Exhibit A2-4, the incremental DERs achieved by mid-project and by end of project.

Exhibit A2-4. Timetable of Completion for Incremental Demos
(units: proportion of total targeted kW or stoves rolled out at specific time)

Technology	End of year 1/ beginning of year 2	End of year 2/ beginning of year 3	End of year 3/ beginning of year 4
Pico/ micro-hydro	0.25	0.35	0.4
PV no battery	0	1	0
Village community PV	0.25	0.35	0.4
PV nano-grid villages	0.25	0.35	0.4
EE cook stoves	0.25	0.35	0.4

Exhibit A2-5. Total Direct Incremental GHG ERs during Lifetime of Equipment (tons CO2)

Technology	Mid-project (end of year 2)	End of project (end of year 4)	Lifetime
RE power generation	180.2	1,350.9	16,865.0
EE cook stoves	5,900.7	43,665.2	70,808.4
Total	**6,080.9**	**45,016.1**	**87,673.5**

Thus, total lifetime direct GHG ERs are 87,673.5 tons CO2 and direct GHG ERs achieved by end of project (EOP) are 45,016.1 tons CO2.

Total alternative scenario direct GHG ERs: Total direct GHG ERs in the alternative scenario are calculated as the sum of baseline direct GHG ERs and incremental direct GHG ERs (see Exhibit A2-6).

Exhibit A2-6. Total Alternative Scenario Direct GHG ERs (in tons of CO2)

Demonstrations	Baseline Direct GHG ERs (A)	Incremental Direct GHG ERs (B)	Total Alternative Scenario Direct GHG ERs (C=A+B)
1. Hydro Demos	38,991.1	11,372.4	50,363.6
2. Hydro PV Hybrid Demos	0	174.7	174.7

3. Village-scale PV Demos	28,864.9	3,660.6	32,525.5
4. Family Compound-scale and Household-scale PV Demos	25,862.0	1,657.3	27,519.3
5. EE Cook Stove Demos	0	70,808.4	70,808.4
6. Productive Use Demos	3,419.5	0*	3,419.5
Total	**97,137.6**	**87,673.4**	**184,811.1**

Net direct GHG ERs: Calculation of net direct GHG ERs, which may also be called incremental DERs or DERs attributable to BRANTV, is shown in Exhibit A2-7. In the case of BRANTV, DERs attributable to the project are one in the same as DERs due to the incremental demos.

Exhibit A2-7. Direct GHG ERs Attributable to BRANTV (in tons of CO2)

Demonstrations	Alternative Direct GHG ERs (C)	Baseline Direct GHG ERs (A)	Direct GHG ERs Attributable to BRANTV (B=C-A)
1. Hydro Demos	50,363.6	38,991.1	11,372.4
2. Hydro PV Hybrid Demos	174.7	0	174.7
3. Village-scale PV Demos	32,525.5	28,864.9	3,660.6
4. Family Compound-scale and Household-scale PV Demos	27,519.3	25,862.0	1,657.3
5. EE Cook Stove Demos	70,808.4	0	70,808.4
6. Productive Use Demos	3,419.5	3,419.5	0*
Total	184,811.1	97,137.6	**87,673.4**

2. Direct Post Project GHG Emission Reductions ("DPPERs"): DPPERs are defined as those GHG ERs that result from the direct support of project activities, but for which equipment is installed after project close. In the case of BRANTV, in addition to support for the project demos, which will result in DERs, project activities will result in plans for replicating the project demos and in the obtaining of financing for these plans. Actual installation of these "replications" is expected to occur after project close. Project activities supporting the replication of the incremental off-grid RE power projects are estimated to have twice "replication effect," such that there will be 38 pico/ small micro-hydro mini-grids, 20 village community PV systems, and 20 villages incorporating roughly 300 W, 5 building nano-grids across the village. There will also be expansion of two pico-hydro systems into pico-hydro PV hybrid mini-grids. As for the EE cook stoves, replication supported by project activities is expected to have a one-time replication effect, so that 12,000 additional stoves are deployed as a direct result of project activities. Thus, DPPERs for the project are as shown in Exhibit A2-8 and total 104,538.5 tons CO2.

Exhibit A2-8. BRANTV DPPERs

Item Replicated	Lifetime GHG ERs of Demos (tons CO2) attributable to BRANTV	No. of Post-BRANTV Projects	DPPERs (tons CO2)
RE Power Generation Demos	16,865.0	Twice of the same set of demos	33,730.1
EE Cook Stoves Demos	70,808.4	Same set of EE cook stoves demos	70,808.4
Total	**---**	**---**	**104,538.5**

3. Consequential GHG Emission Reductions: Consequential ERs (CERs) are those resulting from indirect replications that are stimulated by the project, by its incremental demos, and by its directly supported replications. Replications generating CERs are those that do not receive any direct support from the project, either as TA or investment, and thus may be called "indirect replications." So, unlike those replications associated with DPP ERs, these indirect replications are those that have not received direct project support, such as in the planning and design of the installations. There are two approaches for calculating the CERs, the "bottom-up approach" and the "top-down approach." In both cases, the ten years after project close is considered the "influence period".

Bottom-up Approach

The bottom-up approach uses a simple replication factor (RF) deemed feasible by the project team to estimate amount of systems installed during the ten years influence period and the CERs – the GHG ERs that occur over such equipment's lifetime. In the case of BRANTV, an indirect replication factor of three is used for both the RE power generation demos and for the EE cook stoves demos. In the case of RE power generation, this results in substantial expansion of efforts. In the case of the EE cook stoves, this may result in some expansion but also accounts for replacement of the original cook stoves, which have only a three-year lifetime. Calculation of Bottom-up CERs ("BUCERs") is shown in Exhibit A2-9 and has a result of 576,635.8 tons CO2.

Exhibit A2-9. BRANTV Bottom-Up CERs ("BUCERSs")

Item Replicated	Sum of DERs and DPPERs (tons CO2)	Replication Factor	DPPERs (tons CO2)
RE Power Generation Demos Project supported Replications	50,595.1	3	151,785.4
EE Cook Stoves Demos and Project support Replications	141,616.8	3	424,850.4
Total	---	--	**576,635.8**

Top-down Approach: Top-down consequential ERs are those estimated based on a macro approach that begins with the overall market or overall emission reductions in the country and then breaks this down into the share for which the project may be deemed responsible. The period of influence for which top-down emission reductions are calculated is the ten years following project close. In the case of BRANTV, we break down the top-down approach into two segments, one for EE cook stoves/ traditional biomass and one for electricity.

For traditional biomass, the source *Vanuatu Energy Demand Projections: Business as Usual Scenario* (Global Green Growth Institute, 2016), provides a graph projecting roughly 150,000 tons of traditional biomass consumption in 2021, the last year of BRANTV implementation. The study further projects a growth rate of 3.1 to 4.0 % through 2031 for traditional biomass consumption, stating: "In the absence of changes in household behavior and technologies used for cooking and drying, the national biomass consumption is likely to increase in line with population (3.1% growth) and GDP (4% growth) over the coming 15 years." We thus use an intermediary figure, 3.55 % annually for the ten years following 2021 (that is, for 2022-2031), for the business as usual (BAU) growth of traditional biomass consumption, the main uses of which are cooking and crop drying. The NERM's 2020 target is 5 % savings as compared to business as usual and the 2030 target is a 14 % savings as compared to business as usual. For the top-down alternative scenario, we use a similar range, though apply the bottom value to 2022 (5 % improvement over BAU) and the top value to 2031 (14 % improvement over BAU), interpolating in between for a gradual rise in the improvement over BAU. Exhibit A2-10 shows the annual traditional

biomass consumption in the BAU scenario and in the alternative scenario, the savings in biomass in the alternative scenario and the equivalent GHG ERs. Because there is little activity having the kind of impact BRANTV targets on efficient cook stove use, a relatively high causality factor of 90 % is used to estimate the amount of GHG ERs attributable to the influence of BRANTV.

Exhibit A2-10. Biomass Consumption in BAU versus Alternative Scenario and GHG ERs with Causal Link to BRANTV (units: ktons of biomass or ktons CO2 in the case of ERs, unless indicated as %)

Item	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Baseline	150.0	155.3	160.8	166.5	172.5	178.6	184.9	191.5	198.3	205.3	212.6
Alternative	150.0	147.6	151.2	154.9	158.7	162.5	166.4	170.4	174.5	178.6	182.8
% better	---	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%
biomass saved	---	7.8	9.7	11.7	13.8	16.1	18.5	21.1	23.8	26.7	29.8
GHG ERs*	---	11.8	14.6	17.6	20.9	24.3	28.0	31.9	36.0	40.4	45.0
Causality	---	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
TD-CERs	---	10.6	13.1	15.9	18.8	21.9	25.2	28.7	32.4	36.3	40.5
Total top-down CERs for the 10 years post project: 243,408.1 tons CO2											

*Emissions factor for biomass of 1.513 tons CO2 per ton wood is used.

For electricity generation, the source *Vanuatu Energy Demand Projections: Business as Usual Scenario* (Global Green Growth Institute, 2016), referencing the NERM, provides a graph projecting roughly 92 GWh national electricity consumption in 2021, the last year of BRANTV implementation, and roughly 118 GWh in 2030, one year before the last year of the period of ten years following project close. The NERM's 2016 update indicates that 29% of electricity generation is from renewable sources. In the alternative scenario, it targets that 65% of electricity is from renewables by 2020 and that 100 % is from renewables by 2030, contingent on availability of international financing. Exhibit A2-11 shows how the top-down CERs for electricity are computed. It shows the projected annual electricity consumption through 2031 (using the NERM/ GGI projections), the % renewables in the BAU scenario (considered to remain constant at the 2016 baseline share of 29 %), the % renewables in the alternative scenario (using the 100% NERM target of 2030 for the year 2031 and extrapolating the other years between 2021 and 2031, accordingly, down to the baseline of 29% in 2021), the percentage points difference in RE's share between the alternative scenario and BAU, the additional GWh that are renewable beyond BAU in the alternative scenario, the amount of diesel fuel saved in the alternative scenario as compared to the baseline scenario, and the GHG ERs thus represented by the alternative scenario. A causality factor of 25% is applied to the GHG ERs to get the top-down CERs (TD-CERs) due to BRANTV. A causality factor of 25% is chosen since BRANTV addresses only off-grid electricity and as there are other donor projects contributing to off-grid RE power generation efforts, such as the World Bank's VREP for SHSs, institutional PV, and PV mini-grids and ADB's and IUCN's mini-hydro and large micro-hydro projects, respectively. Summing the TD-CERS over the ten years yields a result of 88,083.8 tons of CO2.

Exhibit A2-11. Projected nationwide Consumption, Share of Renewables in BAU and Alternative Scenarios, and Associated GHG ERs*

(units: GWh for electricity, % when indicated, M liters for diesel, thousand tons CO2 for GHG ERs)

Item	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
GWh (national)	92.0	94.9	97.8	100.7	103.6	106.4	109.3	112.2	115.1	118.0	120.9
% RE – BAU	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
% RE – Alt Sc	29	36.1	43.2	50.3	57.4	64.5	71.6	78.7	85.8	92.9	100

% points better	0	7.1	14.2	21.3	28.4	35.5	42.6	49.7	56.8	63.9	71.0
GWh RE better	0	6.7	13.9	21.4	29.4	37.8	46.6	55.8	65.4	75.4	85.8
Diesel savings	0	2.0	4.2	6.4	8.8	11.3	14.0	16.7	19.6	22.6	25.7
GHG ERs Alt	0	5.4	11.2	17.2	23.6	30.4	37.4	44.8	52.6	60.6	69.0
TD-CERs BRANTV	0	1.4	2.8	4.3	5.9	7.6	9.4	11.2	13.1	15.2	17.3
Total top-down CERs for the 10 years post project: 88,083.8 tons CO2											

*Parameters used: SFC = 0.3 lit diesel per kWh; 2.68 kg CO2 per liter diesel; 0.25 causality factor in attributing impact of BRANTV to overall GHG ERs in the alternative scenario.

Computing the total TD-CERs for the project overall: biomass TD-CERs + electricity TD-CERs = 243,408.1 tons CO2 + 88,083.8 tons CO2 = 331,491.1 tons CO2.

5. Summary: The total lifetime GHG ERs of different types attributable to BRANTV, as well as the lifetime grand total and totals during the project, are summarized in Exhibit A2-12.

Exhibit A2-12. Summary of GHG ERs of Different Types Attributable to BRANTV
(units: tons of CO2)

Lifetime GHG ERs					
DERs	**DPP ERs**	**BU-CERs**	**TD-CERs**	**Total using BU**	**Total using TD**
87,673.45	104,538.5	576,635.8	331,491.1	768,847.8	523,703.8
GHG ERs during BRANTV Implementation					
ERs by mid-project: 6,080.9			ERs by end of project: 45,016.1		

Annex 3. Multi-Year Work Plan

Activity	Year 1				Year 2				Year 3				Year 4			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1.1.1a Training program for local operators of pico-/ small micro-hydro mini-grids (and pico-hydro/ PV hybrid mini-grid)																
1.1.1b Training program for high-level designers and installers of pico-/ small micro-hydro mini-grids (and pico-hydro / PV hybrid mini-grids)																
1.1.1c Training program for local operators of village community PV systems																
1.1.1d Training program for high-level designers and installers of village community PV systems and family compound-scale nano-grids																
1.1.1e Training program in repair of small SHSs and family compound scale (300 W) nano-grids																
1.1.2 Training program in the making of energy efficient cook stoves																
1.1.3 Survey of persons trained in the 6 capacity building programs on use of contents																
1.2.1a Development and production of how-to guidebook and podcasts on pico-/small micro-hydro mini-grids (to include content on pico-hydro/ PV hybrid mini-grids)																
1.2.1b Development and production of how-to guidebook and podcasts on village community PV systems																
1.2.1c Development and production of how-to guidebook and podcasts on energy efficient cook stoves																
1.2.1d Development and production of how-to guidebook and podcasts on small SHSs and family compound-scale nano-grids																
1.2.2 Survey of recipients of how-to guidebooks/ podcasts on use of contents																
1.3.1a Promotion of results of pico-/micro-hydro demos and outreach for identification of new sites (to include content on pico-hydro/ PV hybrid mini-grids)																
1.3.1b Promotion of results of community PV demos and outreach for identification of new sites																
1.3.1c Promotion of results of PV nano-grids demos and outreach for new sites																
1.3.2 Campaign to promote EE cook stoves involving social media, texts, and other means																
1.3.3 Campaign to educate people on household-scale PV systems																
1.3.4 Survey to determine no. of communities interested in replicating project RE power demos																
1.4.1 Assessment of information needs of the energy sector as relates to low carbon energy																
1.4.2 Development and operationalization of an energy information exchange service																

focused on low carbon energy																
1.4.3 Organization and conduct of workshops to strengthen the information exchange service																
1.5.1 Research on the requirements for an energy (petroleum/electricity) supply and consumption monitoring, reporting, database system																
1.5.2 Design and development of the energy supply and consumption database																
1.5.3 Organization and conduct of workshops to develop capacity in use and maintenance of the database																
2.1.1 Development of detailed off-grid rural electrification plan covering all 65 inhabited islands																
2.1.2a Identification of promising pico-/ micro-hydro mini-grid village sites (and possibly promising pico-hydro/ PV hybrid mini-grid sites) and plans for priority sites																
2.1.2b Setting of national targets for pico-/ small micro-hydro mini-grids (and possibly targets for pico-hydro/ PV hybrid mini-grids)																
2.1.3a Identification of villages that are suitable and promising for village community PV systems and family compound PV systems and plans for priority sites																
2.1.3b Setting of national targets for village-based community PV systems and family compound PV systems deployed across full villages																
2.1.4 Launching of implementation of Phase 1 of the Roadmap via facilitation of financing of replication in Component 4																
2.2.1a Development of and adherence to national guidelines for design, sourcing, best price costing, etc. of pico-/micro-hydro mini-grids (and possibly for pico-hydro/ PV hybrid mini-grids)[40]																
2.2.1b Development and enforcement of national standards for pico/small micro-hydro and associated mini-grids (and possibly for pico-hydro/ PV hybrid mini-grids)[41]																
2.2.2a Development of and adherence to national guidelines for design, sourcing, best price costing, etc. of community PV systems[42]																
2.2.2b Development and enforcement of national standards for community PV systems and associated mini-grids and for family compound scale PV nano-grids[43]																

[40]Timeline shown in green is for development only. Adherence (timeline in grey) will take place at the pico-/small micro-hydro demo sites as the demos are implemented in Outcome 5B and beyond at other sites.

[41]Timeline shown in green is for development only. Adoption is targeted to take place in year 3 and enforcement in year 4, when the standards will be required of pico-/ small micro-hydro replications pursuing financing under Outcome 4A and 4B. Timeline for these two steps are shown in grey.

[42]Timeline shown in green is for development only. Adherence (timeline in grey) will take place at the village community PV demo sites as the demos are implemented in Outcome 5B and beyond at other sites.

[43]Timeline shown in green is for development only. Adoption is targeted to take place in year 3 and enforcement in year 4, when the standards will be required of village-scale community PV and village-wide family compound-scale PV nano-grid replications pursuing financing under Outcome 4A and 4B. Timeline for these two steps are shown in grey.

2.2.3 Development of national guidelines on EE cook stoves[44]																
2.2.4 Development of national guidelines for household-scale PV systems and compound-scale PV nano-grids[45]																
2.3.1 Formulation, approval, and enforcement of regulations regarding tariffs for off-grid rural renewable energy power provision[46]																
2.3.2 Formulation, approval, and enforcement of regulations regarding management of multiple household off-grid RE power systems[47]																
2.3.3 Formulation, approval, and enforcement of policy for ensuring PV parts and battery waste are disposed of properly[48]																
2.3.4 Formulation, approval, and enforcement of policy ensuring appropriate batteries/ other off-grid RE system parts are available in local markets[49]																
2.3.5Formulation, approval, and enforcement of preferential policies to encourage private sector investment and financing of off-grid RE[50]																
3.1.1 Analysis and design of preferred model/ models for running off-grid village RE power systems																
3.1.2 Outreach, finalization, and consensus on off-grid village RE management model (will include one-on-one meetings with decision makers and workshop will relevant departments to brainstorm and come up with refinements to ensure a practicable model)																
3.2.1a Carrying out of pilot cooperation with departments from productive sector in identifying promising productive uses and roadmaps																
3.2.1b Carrying out of pilot cooperation between DOE and departments from productive sector in identifying promising village community PV sites																
3.2.1c Design and implementation of an ongoing mechanism for DOE to cooperate with various departments from productive sector on productive uses[51]																
3.2.2 Carrying out of pilot cooperation between DOE and WRD in identifying pico-/micro-hydro sites and subsequent design and implementation of institutional mechanism for ongoing cooperation[52]																

[44] Timeline shown in green is for development only. Adherence will take place at the EE cook stove demo sites as the demos are implemented throughout the rest of the project.
[45] Timeline shown in green is for development only. Adherence (timeline in grey) will take place at the village-wide family compound-scale demo sites as the demos are implemented in Outcome 5B and beyond at other sites.
[46]Timeline shown in green is for formulation. Approval and enforcement timeline is shown in grey.
[47]Timeline shown in green is for formulation. Approval and enforcement timeline is shown in grey.
[48]Timeline shown in green is for formulation. Approval and enforcement timeline is shown in grey.
[49]Timeline shown in green is for formulation. Approval and enforcement timeline is shown in grey.
[50]Timeline shown in green is for formulation. Approval and enforcement timeline is shown in grey.
[51] Green is for design and grey is for implementation.
[52] Green is for design and grey is for implementation.

3.2.3 Carrying out of pilot cooperation between DOE and other departments in identifying EE stove sites and promote stoves and subsequent design and implementation of institutional mechanism for ongoing cooperation[53]																
3.3.1 Setting up/implementation of cross institutional mechanism for enforcement/ adherence to RE/EE policies and regulations[54]																
3.4.1 Development and launch of implementation of system to ensure that batteries and repairs available to households-scale PV on islands[55]																
3.4.2 Development and launch of implementation of system to ensure households scale PV system parts are properly disposed of[56]																
3.5.1 Establishment and operationalization of the DOE of Northern Vanuatu Rural Renewable Energy and Energy Efficiency Promotion Center in Luganville[57]																
4A.1.1 Identification of and outreach to international sources of funding for NGEF																
4A.2.1 Assistance to local replication project proponents to apply to NGEF for loans or grants																
4A.3.1 Assistance/ advising to local entrepreneurs to design productive use projects and apply to NGEF for loans or grants																
4B.1.1 Design and conduct of training program for banks on financing low carbon development																
4B.2.1 Designing and advising on launch of commercial or private sector financing scheme (loan or equity) for RE and EE projects																
4B.3.1 Assistance to banks or equity investors in connecting with viable RE and EE projects and achieving financial close on loans or equity investment																
4B.4.1 Evaluation of commercial/ private sector financing scheme; suggestions for improvement																
5A.1.1 Research, liaison, and conduct of TA to achieve high quality, low cost sourcing and transparent best cost pricing for pico-/ micro-hydro mini-grids (including any special parts needed to expand pico-hydro to pico-hydro/ PV hybrid)																
5A.1.2 Sourcing, costing, and local parts supply work for village community PV systems, compound-scale PV nano-grids, and small SHSs and plug-and-play PV systems																
5A.1.3 Support to artisans in sourcing of parts (at best cost for quality parts) for EE cook stove fabrication																

[53] Green is for design and grey is for implementation.
[54] Green is for setting up and grey is for implementation.
[55] Green is for development and grey is for launch of implementation.
[56] Green is for development and grey is for launch of implementation.
[57] Green is for establishment and grey is for operationalization.

5A.2.1a Confirmation of ownership/ availability of land and volunteer work for each pico/micro-hydro station (including expansion of one pico-hydro to pico-hydro/ PV hybrid)																	
5A.2.1b Confirmation of ownership/ availability of land and volunteer work for each community PV station																	
5A.2.1c Confirmation of ownership/availability of land and volunteer work for family compound scale PV nano-grids across 10 villages																	
5A.3.1 Carrying out of research and testing of EE cook stoves appropriate to Vanuatu																	
5A.4.1a Periodic monitoring and reporting of all key aspects of project's pico-/ micro-hydro demos (including 1 pico-hydro/ PV hybrid site) and dissemination of reports																	
5A.4.1b Periodic monitoring and reporting of all key aspects of project's village community PV demos and dissemination of reports																	
5A.4.1c Periodic monitoring and reporting on all key aspects of project's family compound-scale PV nano-grids across 10 villages and dissemination of reports																	
5A.4.2 Periodic monitoring and reporting of EE cook stove dissemination program and dissemination of reports																	
5A.5.1 Identification of and assessment of the future potential of RE and EE applications not already being pursued by BRANTV or other energy projects in Vanuatu																	
5B.1.1 Design of pico/micro-hydro mini-grids and pico-hydro PV hybrid mini-grid																	
5B.1.2 ESMP for incremental hydro demos																	
5B.1.3 Implementation of a comprehensive hydro-based energy generation demo program – baseline: Installation, operation, and maintenance of 600 kW Brenwei Hydro, 75 kW Talise Hydro; and incremental - installation, operation, and maintenance of 20 pico-/ small micro-hydro mini-grids (including expansion of 1 pico-hydro mini-grid to pico-hydro / PV hybrid mini-grid)																	
5B.2.1 Design of village-scale community PV demos																	
5B.2.2 ESMP for village-scale community PV demos																	
5B.2.3 Implementation of a comprehensive village-scale commercial solar PV energy services business demo program – baseline: Installation, operation, and maintenance of 5 PV mini-grids (about 100 kW each) and 37 institutional PV systems (1.9 to 5.2 kW each); and incremental: Installation, operation, and maintenance of 10 village community PV systems																	
5B.3.1 Design of compound-scale PV nano-grids																	
5B.3.2 ESMP for compound-scale PV nano-grids																	
5B.3.3 Implementation of a comprehensive household and family scale commercial solar PV energy services business demo program – baseline: Installation of household scale 120W to 1.6 kW PV systems under VREP; and incremental: Installation,																	

operation, and maintenance of family compound-scale PV nano-grids (up to 300 W each) across 10 villages																	
5B.4.1 Design of EE cook stove demo																	
5B.4.2 ESMP of EE cook stove demo																	
5B.4.3 Implementation of comprehensive EE cook stove demo – marketing component: Roadshow to demonstrate EE cook stoves to villagers to promote their sale and use; and fabrication, sale, and use component: Fabrication and selling of EE cook stoves to 12,000 households and their use 3 meals per day																	
5B.5.1 Design of productive use demos																	
5B.5.2 Implementation of a comprehensive productive use of renewable energy (PURE) program – baseline: Implementation of DC PV solar freezers, refrigeration under EU-GIZ and SPC projects; incremental: Implementation of productive use demonstrations at project pico-/ micro-hydro mini-grid demo sites, pico-hydro/ PV hybrid site, village community PV system sites, and PV nano-grid village sites																	

Annex 4. Project Monitoring Plan

Monitoring	Indicators	Description	Data Source/ Collection Methods	Frequency	Responsible for Data Collection	Means of Verification	Assumptions on Data Collection
Project Objective: Enabling the achievement of the energy access, sustainable energy, and green growth targets of Vanuatu	Cumulative tons of incremental GHG emissions reduced from business as usual (tons CO_2)	Direct greenhouse gas emission reductions that are attributable to the incremental activities of the project, e.g., from adoption of village-scale off-grid rural RE (pico-/ small micro-hydro mini-grids, village community PV with or without mini-grid, family compound-scale PV nano-grids installed across a village), and EE cook stoves	Project RE power generation demo monitoring reports, project EE cook stove/ crop drier dissemination monitoring reports. GEF GHG direct emission reduction ("DER") calculation methodology to be used.	Annually, reported in DO tab of GEF PIR (also reported in GEF CCM Tracking Tool at mid-term and end of project)	Project consultants and project team responsible for collecting relevant data for demo monitoring reports. Project team responsible for GHG ER calculations.	Reference to project monitoring reports and GEF CCM Tracking Tool, combined with field visits, at mid-term and end of project by MTR and TE consultants	Villagers willing and able to accurately report EE cook stove use and reduction in fuel wood use. Sample reporting on these items accurately reflects average use of EE cook stoves by full group newly making use of such cook stoves
	Incremental number of households in rural areas whose level of energy access is increased via village-scale off-grid RE or that benefit from newly adopting EE cook stoves	Number of households will be computed based on the sum of the number of households with an EE cook stove that did not have one before launch of project and the number of households that, after launch of project, get access to village RE power (hydro, village-scale community PV, or family compound-scale nano-grid PV) that exceeds their previous potential level of access to power in kWh per day by at least 50%. (The level of access to power is based on the amount of power they	Project RE power generation demo monitoring reports, project EE cook stove/ crop drier dissemination monitoring reports. For purpose of this indicator, monitoring work will need to gather information on household electricity use and/or EE cook stove use prior to project implementation	Annually, reported in DO tab of GEF PIR	Project consultants and project team responsible for collecting relevant data for demo monitoring reports	Reference to DO tab of GEF PIR, combined with field visits, at mid-term and end of project by MTR and TE consultants	Villagers willing and able to accurately report electricity use and EE cook stove use prior to project implementation

		could use daily, not their actual use.)					
	Total new, incremental reductions in or newly avoided amounts of annual diesel consumption achieved (liters DFO)[58]	Diesel use avoided by new amounts of village RE power generation due to project incremental demos as compared to what diesel use in village or household would have been had diesel power generators been adopted instead of RE power generation	Project RE power generation demo monitoring reports. Aggregate kWh of electricity use indicated in these reports multiplied by appropriate SFC = 0.3 liter/kWh)	Annually, reported in DO tab of GEF PIR	Project consultants and project team responsible for collecting relevant data for demo monitoring reports	Reference to DO tab of GEF PIR, combined with field visits, at mid-term and end of project by MTR and TE consultants	---
	Incremental fuel wood saved annually by use of energy efficient cook stoves (kg)[59]	Savings in fuel wood achieved across Vanuatu by switching from open hearth fire to EE cook stoves	Project EE cook stove/ crop dryer dissemination demo monitoring reports. Calculations of fuel wood use reduction ideally will be based on actual reporting of households, though may also use estimates of 2,600 kg per family per year being reduced by half (or other verified performance factor of cook stove) when family uses EE cook stove instead of open hearth fire.	Annually, reported in DO tab of GEF PIR	Project consultants and project team responsible for collecting relevant data for demo monitoring reports	Reference to DO tab in GEF PIR, combined with field visits, at mid-term and end of project by MTR and TE consultants	Villagers willing and able to accurately report EE cook stove use and reduction in fuel wood use. Sample reporting on these items accurately reflects average use of EE cook stoves by full group to whom they are distributed. Or, if used instead, estimate of 2,600 kg per year per family accurately reflects average in fuel wood use per family using open hearth fire for cooking in Vanuatu

[58] Diesel Fuel Oils (DFO's) HHV (higher heat value), which is the same as the GCV (gross calorific value) and assumes the water from combustion is entirely condensed, is 44,800 kJ/ kg (source www.eisco.co).

[59] The HHV (see footnote 5 above for explanation of HHV) of dry wood is estimated to be the range of 14,400 - 17,400 kJ/kg (source www.eisco.co).

Outcome 1. Improved capacity and awareness on sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	Estimated number of individuals in Vanuatu that are newly (as of start of project) involved in operating, maintaining, repairing, designing, and/or installing off-grid rural RE power systems (pico-/ micro-hydro, community scale PV, family compound-scale PV nano-grids, and/or SHSs) as one of their main sources of income	Number of persons in Vanuatu newly involved since start of project in technical aspects of rural off-grid RE business, either hydro or PV related, as a key source of their income	Project commissioned surveys	Twice during project, once at mid-term and once at end of project	Project consultants and project team members responsible for carrying out survey and assessing results	Reference to results of project surveys	For persons involved in SHS repair, project surveys (which will focus on project trainees and how-to guide recipients) capture majority of participants in this trade who use it as a main source of income
	Number of artisans in Vanuatu fabricating EE cook stoves as their main source of income	Number of EE artisans trained by the project that master fabrication course, show strong interest in going into the EE cook stove business, are given tools by the project if needed, and set up production and begin to fabricate EE cook stoves either in Port Vila or the islands	Records of test results of EE cook stove training course. Project records of tool distribution. Project EE cook stove/ crop dryer dissemination demo monitoring reports	Annually, reported in DO tab of GEF PIR	Project team and project consultants carrying out demo monitoring	Reference to project training course test results, records of tool distribution, and project EE cook stove/ crop dryer dissemination demo monitoring reports	Methodology captures majority of EE cook stove artisans. Additional artisans not trained by the project and not cooperating with project trainees do not begin fabricating EE cook stoves in large numbers until after close of project.
Outcome 2. Improved policy, planning, and regulatory regimes in the	Portion of nation's off-grid villages for which a comprehensive electrification plan has been	Indicator assesses number of off-grid villages for which comprehensive electrification plan is prepared. To be counted, plan for each village	*Vanuatu Off-Grid Rural Electrification Plan* (or in-progress draft thereof); Vanuatu National Statistics Office data	Annually, reported in DO tab of GEF PIR	Project team	Reference to *Vanuatu Off-Grid Rural Electrification Plan* (or in-progress draft	Vanuatu National Statistics Office has updated and accurate reporting on number of off-grid villages in nation

application of sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	determined	should indicate type of RE technology to be used and type of management system for fee collection, repairs, and sustainability. Vanuatu has roughly 2,000 off-grid villages assumed, so that ¼ would be 500 villages and 100% would be 2,000 villages.	on number of off-grid villages			thereof)	
	Number of new RE and EE cook stove related guidelines and sets of standards that are being enforced (standards) or adhered to (guidelines)	Assessment of indicator will allocate one point for each of the following that are adopted and being enforced (standards) or adhered to (guidelines): (i) pico-/ micro-hydro mini-grid guidelines (ii) pico-/ micro-hydro mini-grid standards, (iii) village community PV guidelines, (iv) village community PV and compound-scale PV standards, (v) EE cook stove guidelines	Government documentation of adopted standards and guidelines; project RE power generation demo monitoring reports, project EE cook stove/ crop drier dissemination demo monitoring reports; proposals submitted for new off-grid RE projects under financing component	Annually, reported in DO tab of GEF PIR	Project team	Reference to government documentation of standards and guidelines, demo monitoring reports, and proposals for new off-gird RE projects	Loan and grant applications required to address adherence to standards
	Number of regulations under the *Off-Grid Rural Electrification Policy* that are enforced	Assessment of indicator will allocate one point for each of the following that are adopted and are being enforced: (i) regulations related to setting tariffs for village-scale off-grid RE power, (ii) regulations regarding the management and O&M of village-scale off-grid RE power systems, (iii) regulations regarding the disposal of PV parts and batteries, (iv)	Government documentation of adopted regulations and preferential policies; consultation with relevant government agencies and field sites to confirm enforcement	Annually, reported in DO tab of GEF PIR	Project team working with DOE	Reference to regulation and policy documentation; reference to findings recorded by project team from consultations with relevant government agencies and field sites	Government agencies and field sites, when consulted, report accurately on the status of enforcement of regulations and policies

		regulations regarding the availability of replacement parts (including batteries) for household-scale PV and for village scale off-grid RE power systems (including PV and hydro), and (v) preferential import policies for off-grid RE parts and equipment or other preferential policies to promote off-grid RE.					
Outcome 3. Established institutional framework enables the effective enforcement of policies and regulations, and implementation of plans, programs, and projects, on the application of sustainable energy and low carbon technologies	Number of pico-/ small micro-hydro, village community PV, and village sets of family compound-scale nano-grid sites at which management model enables fee collection, savings for repairs/ parts, and payment of operator	Number of project demo sites at which amount of electricity use is being metered by household/ business, at which fees are collected per power use, and at which these fees are being used to pay the operator and to set aside monthly savings for repairs/ parts. Savings accounts should have safety mechanisms to ensure funds are not withdrawn for other purposes.	Project RE power generation demo monitoring reports	Annually, reported in DO tab of GEF PIR	Project consultants and project team members carrying out monitoring of project off-grid RE power sites	Reference to project RE power generation demo monitoring reports	---
	Number of villages at which DOE has cooperated with other national-level departments to implement rural electrification or EE cook stoves, as well as productive uses of RE/EE	Number of verified sites of off-grid RE power generation, productive uses thereof, or EE cook stove dissemination at which DOE has cooperated with other national-level departments on site identification and implementation, namely	Project records on cooperation between DOE and other departments in site identification and implementation because of project activities	Annually, reported in DO tab of GEF PIR	Project team and DOE (via consultation)	Reference to project records on results of project's institutional coordination efforts	Project team can capture all sites at which project's institutional cooperation activities bear fruit and report these in its project records

	applications, if relevant	cooperation with DWR on dual water supply – pico-hydro projects, with Dept. of Forestry on priority EE cook stoves sites, and with departments in the productive sector on high potential sites for productive use of RE power					
	Number of new sites in off-grid areas where private sector entities or local governments offer replacement batteries for household-scale PV systems	Number of verified new sites offering replacement batteries for household-scale PV systems for sale. (This addresses past problems of lack of access to replacement batteries on the islands.)	Project records on household-scale PV battery availability on the islands, developed through consultation with DOE and with PV vendors.	Annually, reported in DO tab of GEF PIR	Project team and DOE (via consultations)	Reference to project records on results of project's efforts to promote local availability of parts for household-scale PV systems; cross-checking of findings with contacts at indicated sites	PV vendors provide accurate information or contact information is available for cross-checking of their input
Outcome 4A. Increased availability of, and access to, financing for sustainable energy, energy access, and low carbon (RE and EE) initiatives in the energy supply and demand sectors	Amount of new international funding confirmed with funding agencies for infusion in NGEF because of BRANTV efforts	Amount of funding that donors are newly (since BRANTV launch) planning to provide to NGEF with clear link to being a result of BRANTV efforts	NGEF records on expected support from donors; consultation with donors to confirm expected support; consultation with NGEF and donors to confirm role of BRANTV efforts	Annually, reported in DO tab of GEF PIR	Project team with support from NGEF	Reference to NGEF records and to project records on relevant consultations with NGEF and donors	Consulted persons at donors and NGEF involved in or knowledgeable of process leading to commitment of funds so that they may assess whether attribution to BRANTV is warranted
	Amount of potential funding represented by applications from various parties in Vanuatu to NGEF for replications of	Aggregate amount of funding requests represented by Vanuatu-sourced applications to NGEF for pico-/small micro-hydro mini-grids, village-scale community	NGEF records on applications for funding; actual applications to NGEF for funding	Annually, reported in DO tab of GEF PIR	Project team with support from NGEF	Reference to NGEF records and to actual applications to verify such records	---

	the project demos or for productive use initiatives	PV, compound-scale PV nano-grids deployed across villages, and productive applications or RE power					
Outcome 4B. Increased financing and investments from private sector on sustainable energy and low carbon projects in the energy supply and demand sectors	Amount of funding allocated to commercial or private sector financing scheme for low carbon projects	Aggregate amounts committed by private/ commercial sector either to loan funds or to direct investment (equity) funds for financing off-grid RE power generation and EE projects	Records of private/ commercial sector organizations; published information and calls for proposals; consultations with private/ commercial sector entities	Annually, reported in DO tab of GEF PIR	Project team via their consultation of private/ commercial sector entities	Reference to records of project team consultations with private/ commercial sector, records of private/ commercial sector, and public calls for proposals	Private/ commercial sector entities willing to disclose total amount of funds made available in their financing mechanisms for RE and EE
	Amount of funding represented by financial closes reached for loans or direct equity investments to RE and EE projects under commercial or private sector financing scheme for low carbon projects	Aggregate amounts committed under private/ commercial sector financing schemes to specific RE and EE projects, either via loan financing mechanisms or direct equity investment financing mechanisms. Criteria for inclusion of specific projects require that financial close has been met.	Records of private/ commercial sector organizations regarding confirmed projects supported by their financing mechanisms; consultation with private/ commercial sector entities	Annually, reported in DO tab of GEF PIR	Project team via their consultation of private/ commercial sector entities	Reference to records of project team consultations with private sector, records of private sector	Private/ commercial sector entities willing to disclose amount of funding achieving financial close for RE and EE projects
Outcome 5A. Sustainable energy and low carbon (RE and EE) techniques and practices adopted and implemented with both cost and technical viability in the	Number of types of key off-grid RE power generation and mini-grid related equipment/ parts newly available or available at 25% or more less than cost at start of project	Indicator assesses how many types of key off-grid RE equipment are newly available in Vanuatu (that were not available in-country before) or are now available at 25% or more less than cost at start of project. Assessment will give one point for each of the following that meets	Project records on results of project sourcing work. Market research by project team.	Annually, reported in DO tab of GEF PIR	Project team	Reference to project records on its sourcing work and to report of market research carried out by project team.	Market research by project team yields comprehensive assessment of products and prices available in Vanuatu market at start of project and at times of annual indicator updating

energy, public, private sector, and residential sectors of the country		one of the two aforementioned criteria: (i) quality pico-/ small micro-hydro turbine/ generator set with ELC, (ii) key parts for repair of quality turbine/ generator set, (iii) solar panels for community PV, family compound-scale PV nano-grids, or small household-scale SHS, (iv) batteries for community PV, family compound-scale PV nano-grid, or small SHS, (v) inverters, (vi) plug and play PV system, (vii) meters to monitor household power usage, and (viii) other mini-grid parts, such as cabling, etc.					
	Number of cases of high quality village RE systems (pico-/small micro-hydro mini-grid, village community PV with or without mini-grid, or villages fully populated with compound-scale PV nano-grids) achieved at low end international cost benchmarks	Indicator will assess whether off-grid RE power installations are meeting international benchmarks for being relatively low cost. One point will be allocated for each quality system that achieves one of the three following costing benchmarks: (1) pico-/ micro-hydro: USD 2,500 per kW or less; (2) PV mini-grid including batteries: USD 5,000 per kW; and (3) PV nano-grid to be achieved at USD 6,000 per kW, or USD 6 per watt. Quality defined	Project RE power generation demo monitoring reports. Project records of procurement for demo off-grid RE power installations. Other records of procurement for the systems/ parts that do not take place through the project.	Annually, reported in DO tab of GEF PIR	Project consultants and project team members carrying out monitoring of RE power generation demos	Reference to project demo monitoring reports, project procurement records, and other non-project procurement records, if relevant	In cases for which some parts are acquired through routes other than project procurement (if such cases occur), accurate records are kept and available to be included in the assessment of total systems costs.

		as those that operate well for one year or more without substantial problems and that use quality equipment as identified in the project's sourcing work					
	Reduction in fuel wood use consistently achieved by newly distributed EE cook stoves as compared to open hearth fire (%)	Indicator assesses the proportion by which EE cook stoves reduce household fuel wood use from their baseline of fuel wood use when they were using open hearth fire for cooking	Project EE cook stove and EE crop dryer demo monitoring reports; survey of villagers using EE cook stoves for inclusion in such reports	Annually, reported in DO tab of GEF PIR	Project consultants and project team members carrying out monitoring of EE cook stove demos	Reference to project EE cook stove demo monitoring reports and recorded results of surveys of villagers using such EE cook stoves	Villagers adopting EE cook stoves able and willing to accurately convey reduction in fuel wood use after adopting EE cook stove, as compared to baseline of open hearth fire cooking
Outcome 5B. Enhanced confidence in the economic and technical viability and long-term sustainability of sustainable energy and low carbon technology projects	No. of communities and private sector entities in both on-grid and off-grid areas that are interested in replicating the RE-based power generation system demos: • Pico-/ small micro-hydro • Hybrid pico-hydro & PV • Village community PV (with or without mini-grid) • Village-wide family compound-scale	Indicator assesses the number of communities and private sector entities interested in replicating the project pico-/ small micro-hydro demos, its pico-hydro PV hybrid demo, its village community PV demos, or its village-wide family compound-scale PV nano-grids as evidenced either by the community/ private sector entity reaching out to the project, DOE, or funding agencies with its proposed replication or by reporting such interest to the relevant survey conducted under activity 1.3.4	Records of results of Activity 1.3.1a, b, and c in terms of communities proposing replication projects; results of survey conducted under Activity 1.3.4; records of results of Activities 4A.2.1, 4B.3.1, and 4B.4.1 in terms of evidence of applications for financing replications of project demos	Two times: Once at the end of year 3 and once at the end of year 4, with year 3 result reported in DO tab of the last GEF PIR and year 4 assessment results available for project's TE	Project team members involved in Outputs 1.3, 4A.2, 4B.3, and 4B.4 and project consultant carrying out Activity 1.3.4 (survey on community interest in replication of incremental demos)	Reference to Activity 1.3.4 written survey report and to project documentation on results of Outputs 1.3, 4A.2, 4B.3, and 4B.4	Surveyed communities accurately report their level of interest in /seriousness about replication

	PV nano-grids						
	No. of households, communities, and private sector entities in both on-grid and off-grid areas that are interested in replicating the EE and productive use application demos: • EE cook stoves • RE-powered freezers	Indicator assesses the number of households, communities, and private sector entities interested in acquiring EE cook stoves and freezers to be powered by off-grid RE power	Results of survey conducted under Activity 1.3.4; records of results of Activities 4A.3.1, 4B.3.1, and 4B.4.1 in terms of evidence of applications for financing replications of project demos	Two times: Once at the end of year 3 and once at the end of year 4, with year 3 result reported in DO tab of the last GEF PIR and year 4 assessment results available for project's TE	Project team members involved in Outputs 1.3, 4A.3, 4B.3, and 4B.4 and project consultant carrying out Activity 1.3.4 (survey on community interest in replication of incremental demos)	Reference to Activity 1.3.4 written survey report and to project documentation on results of Outputs 1.3, 4A.3, 4B.3, and 4B.4	Surveyed communities accurately report their level of interest in /seriousness about replication

Annex 5. Evaluation Plan

Evaluation Title	Planned start date Month/year	Planned end date Month/year	Included in the Country Office Evaluation Plan	Budget for consultants	Other budget (i.e. travel, site visits etc.)	Budget for translation
Mid-Term Review	May 1, 2020 (mid-way through 4-year implementation)	July 1, 2020	Yes	USD 21,250 (assuming 25 days for one national and one international consultant)	USD 5,800 (assuming twelve-day mission)	None
Terminal Evaluation	Feb. 1, 2022 (3 months before operational closure)	April 30,2022 (at latest, final to be submitted within 3 months after operational closure of April 30, 2022, which will be July 31, 2022)	Yes	USD 21,250 (assuming 25 days for one national and one international consultant)	USD 5,800 (assuming twelve-day mission)	None
Total Evaluation Budget				USD 54,100		

Annex 6: Tracking Tool

(See Separate Electronic Document)

Annex 7. Terms of Reference

The sections below contain preliminary terms of reference (TORs) for the Project Board, the National Project Director, each of the PMU staff, and selected key consultants or other key partners. The TORs are provided in brief form and should be enhanced once recruiting is under way.

1. Project Board

The project board will have responsibility for monitoring of the project at a high level and for providing high-level support and decision-making as needed.

Tasks
- Meeting twice annually, for a total of eight times over the project's four-year lifetime
- High-level monitoring of project progress particularly in reviewing of outcome-level and objective-level progress of the project
- Decision-making about major issues facing project that cannot be resolved at the working level
- Provision of high-level support to push progress in certain areas in which such support can make a difference, such as in policy-making and enforcement and inter-departmental coordination
- Holding of end of project review to capture lessons learned, discuss opportunities for scaling up and highlighting of project results, and discuss findings of terminal evaluation

General Qualifications of Project Board Members
- Roles as senior level officials and managers within government and other organizations
- Expertise in areas relevant to project, such as productive sectors, water resources, cooperative management, energy, power sector, planning, policy, and finance

2. National Project Director (NPD)

The NPD will be responsible for week-to-week oversight of the project management unit (PMU) and providing guidance in strategy to the project. This will be a part-time role. The NPD will follow up with project issues as needed and meet with the project team at least once per week to discuss progress and next steps. The NPD will be a government employee; and, thus, the NPD's inputs will be supported through GOV co-financing.

Tasks
- Guidance to the PMU team in implementation, including meetings with project team at least once per week
- Handling of financial requests and review of financial reports
- Technical coordination in project implementation with other government stakeholders
- Liaison for assignment of project responsibilities to DOE permanent staff
- Reporting to Project Board on project progress
- Promoting the project to high level officials to gain their buy-in
- Representation of the project at important meetings
- Active involvement in design of the project's management mechanism for off-grid rural power systems

Qualifications
- Senior official of DOE
- Experience in management of development projects
- Strong experience in rural off-grid electrification
- Strong knowledge of the energy sector

- Experience in policy making, regulatory design, and planning in Vanuatu
- Knowledge of financial management
- High level of enthusiasm for RE and EE
- High level of integrity

3. Project Manager

The Project Manager will be responsible for managing day-to-day implementation of the project and will lead the PMU team. Experienced in both the technical and policy side of energy and electrification, the project manager will be a mid-career person with a degree in engineering. The position will be full time for the full duration of the project – four years. The Project Manager will be based in the Port Vila and Luganville Offices of DOE, depending on project needs. Given the large proportion of project demos in the northern part of the country, it is likely the Project Manager will be based in Luganville most the time.

Tasks
- Management of project implementation
- Management of PMU team
- Organization and support of implementation of project demos
- Organization and support of project's policy work
- Organization and support of project's training work
- Organization and support of project's finance work
- Management of the recruitment of consultants and other team members and partners for the project
- Guidance and review of the work of consultants
- Oversight and guidance of procurement for the project
- Liaison with various project partners for implementation
- Liaison with various groups for reaching consensus on management models for off-grid power systems
- Monitoring of project demos
- Development of strategy for various aspects of project implementation
- Promotion of the project and its results

Qualifications
- Bachelor's degree in electrical engineering
- Experience in the energy sector, particularly the power sector
- Hands-on experience with RE power systems and EE projects
- Experience in RE and EE related policy work
- Knowledge of pico/ small micro-hydro, PV, and energy efficient cook stoves
- Knowledgeable about management systems for off-grid RE power systems and sustainability issues
- Experience managing small teams in project implementation
- Experience managing consultants and contractors
- High level of integrity

4. Implementation and Monitoring Officer

The Implementation and Monitoring Officer will be a member of the PMU and will be responsible for supporting implementation of a wide range of project activities and providing core support for monitoring project demos and project results. The Implementation and Monitoring Officer will have a degree in electrical engineering and strong skills in written and oral communication. The position will be full time for the full duration of the project – four years. The Implementation and Monitoring Officer will be based in the Port Vila and Luganville Offices of DOE, depending on project needs. Given the large proportion

of project demos in the northern part of the country, it is likely the Implementation and Monitoring Officer will be based in Luganville most the time.

Tasks
- Support of implementation of project demos
- Monitoring of project demos
- Support and organization of project's training work
- Support of project's awareness work
- Support of project's preparation of how-to manuals and MP4/5s
- Support of project's replication plan work
- Coordination of meetings for project's institutional work
- Under the guidance of the project manager, preparation of TORs for consultants and contractors
- Liaison with various project partners for implementation
- Monitoring of project indicators for annual reporting (including objective, outcome, and output level indicators)
- Preparation of quarterly and annual reports
- Assistance in promoting project results

Qualifications
- Bachelor's degree in electrical engineering
- Strong skills in written and oral communication, in both English and Bislama (with writing skills evidenced by writing sample)
- Studies or experience in RE and EE preferred
- Experience in supporting implementation of energy/ power related projects preferred
- Good skills with Microsoft Office, including Word, Excel, and PowerPoint
- High level of integrity

5. Finance and Administration Officer

The Finance and Administration Officer will be a member of the PMU and will be responsible for handling all the project's finance and administrative needs, including administrative aspects of procurement. The Finance and Administrative Officer will have a background or experience in accounting, finance, and/or administration. Knowledge of the energy and power sectors will be a plus. The position will be full time for the full duration of the project – four years. The Finance and Administration Officer will be based in the Port Vila and Luganville Offices of DOE, depending on project needs.

Tasks
- Development and implementation of project accounting and reporting procedures
- Conducting of bank reconciliation
- Preparation of documentation for procurement
- Posting of calls for consultants and sub-contractors and management of incoming applications
- Development of record keeping for procurement processes
- Arrangement for payments to be made by the project
- Coordination with various partners
- Liaison work for setting up meetings
- Support for implementation of financing components of the project

Qualifications
- Bachelor's degree in accounting, finance, administration, or business

- Strong skills in written and oral communication, in both English and Bislama (with writing skills evidenced by writing sample)
- Knowledge of and enthusiasm for RE and EE preferred
- Experience in supporting implementation of development projects preferred
- Good skills with Microsoft Office, including Word, Excel, and PowerPoint
- High level of integrity

6. National Water Resources Engineer

The National Water Resources Engineer will be retained on a part-time basis to handle the design aspect of the water works for the project pico-/ small micro-hydro demos. The Engineer will be a senior expert in designing and implementing projects with water works aspects. The National Water Resources Engineer will also support the project in training and how-to guide book work for pico-/ small micro-hydro. This expert will be needed about half-time during the first three years of the project when the pico/ micro-hydro demos are being designed and installed and when training and how-to guide book work on pico-/small micro-hydro are underway.

Tasks
- Design of water works aspects of project pico-/small micro-hydro demos
- As needed, overseeing onsite water works implementation of the project's pico-/ small micro-hydro demos
- Design and provision of training in water works aspects of pico-/ small micro-hydro demos
- Inputs on water-works aspect to pico-/ small micro-hydro how-to guide and MP4/5s
- Support to GOV efforts to identify additional appropriate pico-/ small micro-hydro sites
- Technical support and advising to cooperation between DOE and Department of Water Resources to integrate gravity drop water supply projects with pico-hydro projects

Qualifications
- Extensive experience designing water engineering projects in Vanuatu
- Extensive experience implementing water engineering projects in Vanuatu
- Track record of successful water engineering projects
- Strong written and oral communication skills
- Experience in site identification for water engineering projects
- Experience in training preferred
- Experience in documenting procedures preferred
- Experience coordinating with government departments preferred
- Strong knowledge of water supply projects and geography of water resources across Vanuatu preferred

7. National PV Installation Expert

The National PV Installation Expert will be retained on a part-time basis to handle the design and installation aspects of the project's village-scale community PV and family compound-scale PV nano-grid demos, as well as support training and how-to guide needs. The National PV Installation Expert will be a senior expert in the PV area with extensive experience with larger systems up to a maximum of 10 kW. The expert will be retained during the first three years of the project when the PV demos are being designed and installed and when the training and how-to guides are underway.

Tasks
- Design of project's village-scale community PV demos
- Design of project's family compound-scale PV nano-grid demos

- Management of implementation of project's village-scale community PV demos
- Management of implementation of project's family compound-scale PV nano-grid demos
- Design and provision of training in village-scale community PV demos and family compound-scale PV nano-grid demos
- Support of preparation of how-to guides and MP4/5s on PV installations of various sizes

Qualifications
- Extensive experience designing PV systems up to 10 kW
- Extensive experience overseeing installation of PV systems up to 10 kW
- Track record of successfully installed PV projects
- Strong written and oral communication skills
- Experience in training preferred
- Experience in documenting procedures preferred
- Extensive knowledge regarding parts of PV systems

8. Local Electricians

The Local Electricians will be retained by the project on an as-needed basis for support of the pico/ small micro-hydro demos, the village-scale community PV demos, the family compound-scale PV nano-grid demos, and the extensive nation-wide PV training targeting 300 trainees across the country. The project will retain two to three local electricians on each of three key islands for project implementation: (1) Santo, (2) Pentecost, (3) Gaua, and (4) Tanna. These Local Electricians will already have experience as rural electricians, but will be trained by the project to obtain certification and further expertise. They will lead volunteer villagers in work to install the project demos and provide training locally, on their islands, and possibly on other nearby ones if needed. They will also be involved in the identification of suitable sites for replication of the project demos.

Tasks
- Participation in training in electrical wiring on Port Vila or Luganville
- Achievement of passing grade on certification test on electrical wiring
- Leading of volunteer villagers in installation of the relevant pico-/small micro-hydro demos and PV related demos
- Provision of local monitoring and troubling shooting and repair of project demos
- Participation in PV training provided by the project
- Provision of training to local people in repair of small household-scale PV systems

Qualifications
- Experience as a rural electrician, providing electrical installations and repairs in rural areas
- Track record of strong positive results in electrical work
- Residence on one of the designated islands (Santo, Pentecost, Gaua, or Tanna)
- Strong oral communication skills
- High level of integrity
- Interest in promoting improved lives for local people via electrification
- Strong adherence to safety standards and precautions

9. National EE Cook Stove and EE Crop Dryer Expert

The National EE Cook Stove and EE Crop Dryer Expert will be a key part-time consultant to the project throughout its four years. The expert, who will have experience in training, design, and dissemination of energy efficient cook stoves and energy efficient crop dryers, will lead the project's EE cook stove and

EE crop dryer efforts. This will include design and testing of systems and, most critically, the training of a cohort of artisans to fabricate the stoves and dryers and the preparation of how-to materials.

Tasks
- Research and testing of promising EE cook stove and EE crop dryer models for local fabrication
- Documentation of results of past and current research on and testing of EE cook stoves and EE crop dryer models
- Design of training program for artisans of EE cook stoves and EE crop dryers, who will be from Port Vila as well as other islands where the project will implement village-scale community PV projects, the power of which may be used in the fabrication process
- Implementation of multiple training programs for potential artisans of EE cook stoves and EE crop dryers, some in Port Vila and some in other locations
- Provision of follow-up coaching sessions in Port Vila and the islands to artisans trained in EE cook stove and EE crop dryer fabrication
- Provision of inputs and guidance for preparation of EE cook stove and EE crop dryer how-to guide and related MP4/5s
- Fielding of follow up phone calls from artisans with queries on EE cook stove and EE crop dryer fabrication
- Support of PMU in refining strategy for EE cook stove and EE crop dryer dissemination
- Participation, as needed, in EE cook stove and EE crop dryer road show

Qualifications
- Extensive experience in researching and testing EE cook stoves and EE crop dryers
- Extensive experience in fabrication and sale of EE cook stoves
- Track record of successful implementation of development projects in Vanuatu
- Experience in designing and implementing training programs
- Strong written and oral communication skills
- Experience in documenting procedures preferred
- High level of integrity

10. EE Cook Stove and Crop Dryer Artisans

The EE Cook Stove and Crop Dryer Artisans will cooperate with the project. While they will not be paid cash by the project, those artisans that master training and show seriousness of purpose will be provided with EE cook stove and crop dryer fabrication equipment and will be supported with project resources invested in a road show that will potentially increase their future sales of EE cook stoves and EE crop dryers that they fabricate. Ten of these artisans will be based at the project's village-scale community PV sites (one at each site), where they can take advantage of the availability of PV power for their fabrication work and promote their EE cook stoves and EE dryers in local markets on the relevant island. Other artisans will be based in Port Vila. In total, there will be 20 to 30 such artisans who pass the required mastery test and move on to fabricating EE cook stoves and EE crop dryers with project-supplied tools and equipment.

Tasks
- Participation in training in EE cook stove and EE crop dryer fabrication in Port Vila or other places where the training course is offered
- Achievement of passing score on mastery test associated with course
- Cooperation with project to produce and promote sale of EE cook stoves and EE crop dryers near place of residence
- Participation in project EE cook stove and EE crop dryer road show at relevant locations

Qualifications
- Basic handyman or workshop skills
- Seriousness of purpose; record of being hardworking
- Hand strength needed to fabricate EE cook stoves
- High level of integrity
- Interest in promoting improved lives via EE cook stoves
- Strong interest in generating income via fabrication and sale of EE cook stoves and EE crop dryers
- Strong adherence to safety standards and precautions

11. International Pico-/Micro- Hydro Expert

The International Pico-/Micro-Hydro Expert will be retained on a part-time basis (around 18 person weeks) to provide expert guidance to the project team and national experts in the design of the project's pico-/micro-hydro demos, the project's pico-hydro PV hybrid demo, the sourcing (at low cost but good quality) of pico-/micro-hydro equipment and parts for Vanuatu, and determination of best-price comprehensive costing for pico-/micro-hydro installations in Vanuatu. The Expert will have a strong background both in the design side of pico-/micro-hydro and hybrid pico-hydro PV systems, as well as having strong experience in sourcing of pico-/ small micro-hydro equipment and parts and costing pico-/ small micro-hydro projects. If all this background cannot be found in one person, the assignment might have to be broken into two or three parts and two or three consultants hired to cover: (i) pico-/micro-hydro mini-grid system design, (ii) pico-hydro PV hybrid mini-grid system design, and (iii) sourcing of pico-/ small micro-hydro equipment and parts and best price costing of quality systems.

Tasks
- Provision of guidance and support to the design work of the project's pico-/small micro-hydro demos
- Provision guidance and support to the design work of the project's pico-hydro PV hybrid demo
- Provision of on-site guidance to implementation of the pico-hydro PV hybrid demo and three to four of the other pico-/ small micro-hydro demos
- Design of and provision of high-level training in pico-/small micro-hydro to a group of five persons in Vanuatu with high potential for moving Vanuatu to national mastery of design and installation of such systems
- Provision of inputs for project's how-to guide on pico-/small micro-hydro and related MP4/5s
- Provision of guidance on national standards for pico-/small micro-hydro

Qualifications
- Extensive experience in design of pico-hydro/ small micro-hydro mini-grids
- Extensive experience overseeing installation of pico-hydro/ small micro-hydro mini-grids
- Track record of successfully installed and long-lasting pico-hydro/ small micro-hydro mini-grids
- Strong written and oral communication skills
- Experience in training preferred
- Experience in documenting procedures preferred
- Extensive knowledge regarding sourcing of pico-/ small micro-hydro equipment and parts
- Connections with low cost/ high quality suppliers preferred
- Expertise in costing of pico-/small micro-hydro systems and knowledge of how to reduce costs without sacrificing quality

12. International PV Expert

The International PV Expert will be retained on a part-time basis (around 10 person weeks) to provide expert guidance on the sourcing (at low cost but good quality) of PV equipment and parts for Vanuatu, determination of best-price comprehensive costing for PV installations in Vanuatu, training on PV system design, input for how-to guidebooks on PV systems, and input on desirable standards for PV and related products. The Expert will have a strong background both in PV system design and installation and in quality and pricing issues about PV panels and other parts of PV systems. The Expert will further have strong experience in sourcing such parts. If all this background cannot be found in one person, the assignment might have to be broken into two or three consultants hired, respectively, to cover: (i) training in system design, (ii) sourcing of good quality PV system parts at low price and costing of PV systems, and (iii) standard setting for PV parts and systems.

Tasks
- Research on and development of sourcing channels for Vanuatu to access PV system parts of good quality at low, internationally competitive prices (recognizing that currently these parts/ systems are much higher cost in Vanuatu than international norms)
- Provision of comprehensive costing guidelines for various types of PV systems in Vanuatu, identifying means of achieving internationally competitive costing structures for installing such systems
- Design and provision of high-level training in PV system design to a group of five persons in Vanuatu with high potential for moving Vanuatu to more extensive national mastery of design and installation of such systems at high quality, but low cost
- Provision of inputs for project's how-to guide on PV systems and related MP4/5s
- Provision of guidance on national standards for PV parts and systems

Qualifications
- Extensive experience in sourcing PV parts
- Extensive experience in design and installation of PV systems
- Track record of successfully installed and long-lasting PV systems
- Strong written and oral communication skills
- Experience in training preferred
- Experience in documenting procedures preferred
- Extensive knowledge regarding channels for sourcing of PV parts
- Connections with low cost/ high quality PV parts suppliers preferred
- Extensive expertise in costing of PV systems and knowledge of how to reduce costs without sacrificing quality

13. International EE Cook Stove/ Crop Dryer Expert

The International EE Cook Stove/ Crop Dryer Expert will be retained on a limited, part-time basis (around 4 person weeks) to provide expert guidance on potential best models and potential energy savings of EE cook stoves that may be fabricated in Vanuatu by local artisans. This work will be supplementary to that provided by the National EE Cook Stove/ Crop Dryer effort to ensure that as comprehensive as possible an assessment is made. The International Expert will work closely with the National EE Cook Stove/ Crop Dryer to confirm research results and best choice models for dissemination in Vanuatu.

Tasks
- Review and assess findings of research and testing of National EE Cook Stove/ Crop Dryer Expert
- Provision of recommendations of alternative models of EE cook stove and/or EE crop dryer for Vanuatu or, alternatively, provide recommendations for improvements of Vanuatu's existing EE cook stove and EE crop dryer models

- Conduct of verification testing of optimal models of EE cook stoves and EE crop dryers to be fabricated in Vanuatu
- Provision of guidance on testing the lifetime of selected models
- Development of medium-term and long-term recommendations to DOE for EE cook stove and EE crop dryer models to get fabricated and disseminated in Vanuatu

Qualifications
- Extensive experience and knowledge of EE cook stoves
- Strong knowledge and experience of EE crop dryers
- Extensive experience implementing EE cook stove projects in developing countries
- Experience testing EE cook stoves for their energy efficiency and durability/ lifetime
- Strong written and oral communication skills

Annex 8. Social and Environmental Screening

Project Information

Project Information	
1. Project Title	Barrier Removal for Achieving the NERM Targets of Vanuatu (BRANTV)
2. Project Number	PIMS 5926
3. Location (Global/Region/Country)	Vanuatu

Part A. Integrating Overarching Principles to Strengthen Social and Environmental Sustainability

QUESTION 1: How Does the Project Integrate the Overarching Principles to Strengthen Social and Environmental Sustainability?
Briefly describe in the space below how the Project mainstreams the human-rights based approach
The project is mainly on climate change mitigation, in general, and particularly sustainable energy. Because it is mainly focused on rural areas of Vanuatu, where indigenous people live, the project takes care to adopt a strong human-rights based approach in its design. First, the project emphasizes provision of off-grid renewable energy-based power and energy efficient cook stoves to improve peoples' lives both through the conveniences these bring regarding daily needs for lighting, etc. and through the potential income generating opportunities these facilitate. As for the latter, the project puts strong emphasis on creating income generating activities (via "productive use of renewable energy and energy efficiency") for indigenous peoples. Further, for indigenous peoples, the project will implement FPIC ("Free, Prior and Informed Consent,"), in line with Standard 6 of UNDP Environmental and Social Standards. During the PPG, the project development team (PDT) conducted extensive consultations with local people regarding potential renewable energy (RE) and energy efficiency (EE) related activities in their villages to determine their willingness to participate and their preferences. During full project implementation, this highly consultative approach will be continued. All demos making use of tribal or individual land will move forward only with full consent of the land-owning groups or individuals, with the application of FPIC as required by SES Standard 6. In addition, strong efforts will be made to ensure that marginalized and disadvantaged groups within communities are participating in group decision making and are targeted to benefit from income generating activities promoted by the project. Finally, the project also, working with Department of Energy (DOE), will establish a grievance redress mechanism for individuals affected by the project's activities. Beyond these special efforts regarding the project demos, the implementation of all project activities will be in line with the principles of the human-rights based approach. The implementing partner and other involved partners acknowledge human rights practices under international law and the application of human rights-related standards in the design and implementation of the project. The project is designed to enhance the availability, accessibility, and quality of benefits and services for all relevant target groups, including those that are potentially marginalized individuals and groups.
Briefly describe in the space below how the Project is likely to improve gender equality and women's empowerment
The proposed GEF project will promote gender equality and women's empowerment on multiple levels, from the village, community level to the urban national government official and professional level, and even, to some extent, to the international level. Most importantly, at the local level, the project will strive to enhance the position of women. In community consultations and decision-making sessions, it will be required that at least half of those providing input and making decisions are women. As the PPG illuminated, women in Vanuatu are often the ones making the most contributions at the community level of volunteer village labor for development projects. As such, they should have strong influence on decisions regarding BRANTV demonstration projects and thus their input will be emphasized in the consultation process. Further, as the project will be promoting a significant amount and range of income-generating productive use

activities, the project will ensure that at least half of funds allocated for such activities go to initiatives mainly benefiting women. Already during the PPG phase, specific productive use activities benefiting women have been identified. At the next level of the project, which includes several training/ capacity building efforts, the project will ensure that women are well-represented among trainees. For the training of 300 persons in the repair of household PV systems it will be ensured that at least half of trainees are women. Experience in other countries has shown that not only does this approach empower women, but it also leads to greater sustainability of results, as women (especially women that already have children) are less likely to out-migrate for work, so that their skills can be used on a long-term basis. Other trainings and workshops provided by the project will strive to ensure that at least 30% of participants are women. Lastly, in its recruitments of consultants and sub-contractors, both national and international, the project will proactively seek to include women and achieve at least a 30% ratio of women in total consultant person-days.

Briefly describe in the space below how the Project mainstreams environmental sustainability

The proposed project is focused on technologies that will bring both global and local environmental benefits. The RE and EE technologies, on which the project focuses, have strong GHG emission reduction potential, thus benefiting the global environment. As for the local environment, the RE power generation technologies, with no emissions from operation, represent a much cleaner alternative for the local environment than do diesel gen sets. EE cook stoves can substantially reduce the amount of fuel wood used in cooking (one of Vanuatu's main energy uses) and at the same time improve indoor air quality, which benefits women and children who spend the most time near indoor open hearth cooking fires. Thus, the EE cook stoves provide environmental benefits both to Vanuatu's forests and to its people (health-wise). The project in addressing policy, capacity, institutions, financing, and technical and cost aspects, aims to mainstream RE and EE in Vanuatu, promoting extensive replication of the project demos, and thus contributing strongly to the mainstreaming of environmental sustainability in the nation. At the same time, the project will address environmental risks associated with low carbon technologies. Particularly with the growing installations of household-scale PV systems across the country, in many cases supported by donor projects, there is strong concern among stakeholders in Vanuatu about the disposal of PV related wastes, especially PV panels and batteries. Thus, the project design includes activities to design and implement an institutional mechanism and related regulations to ensure that such PV wastes are disposed of properly across the country. As for the specific demo initiatives of the project, limited, site-specific environmental and social impact assessments (ESIAs) will be undertaken for all 20 of the projects pico-/ small micro-hydro demos, with specific attention to the impact of water diversion in these very small-scale projects. Such assessments will also be undertaken for all 10 of the project's village-scale community PV system demos and its 10 demo villages with village-wide deployment of compound-scale PV nano-grids. These assessments will all be aggregated together and integrated to develop the project's Environmental and Social Management Plan (ESMP), which will be prepared during project implementation. Implementation of specific demos will not begin until the management measures as detailed in the ESMP are approved and put in place (e.g. incorporated into demo implementation plans).

Part B. Identifying and Managing Social and Environmental Risks

QUESTION 2: What are the Potential Social and Environmental Risks? *Note: Describe briefly potential social and environmental risks identified in Attachment 1 – Risk Screening Checklist (based on any "Yes" responses). If no risks have been identified in Attachment 1 then note "No Risks Identified" and skip to Question 4 and Select "Low Risk". Questions 5 and 6 not required for Low Risk Projects.*	**QUESTION 3: What is the level of significance of the potential social and environmental risks?** *Note: Respond to Questions 4 and 5 below before proceeding to Question 6*			**QUESTION 6: What social and environmental assessment and management measures have been conducted and/or are required to address potential risks (for Risks with Moderate and High Significance)?**
Risk Description	***Impact and Probability (1-5)***	***Significance (Low, Moderate, High)***	***Comments***	***Description of assessment and management measures as reflected in the Project design. If ESIA or SESA is required note that the assessment should consider all potential impacts and risks.***
Risk 1: The 20 pico-/ small micro-hydro mini-grids and the 10 village-scale community PV systems may involve use of land for which indigenous peoples have rights. *Principle 1 Could the Project lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social or cultural) of the affected population and particularly of marginalized groups?* *Standard 6 –* *Are indigenous peoples present in the Project area (including Project area of influence)?* *Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?* *Would the proposed Project potentially affect the human rights, lands, natural resources, territories, and traditional livelihoods of indigenous peoples (regardless of whether indigenous peoples possess*	I=3 P=5	Moderate	Most of the project demos will likely be based on indigenous land – either land owned by individual households or tribal land owned by tribal groups. While extensive preliminary consultations have been carried out with these groups, full FPIC processes have not yet been implemented.	Project design calls for extensive consultation with local people. For each of the project demos, FPIC processes will be carried out and documented (per UNDP Standard 6) as part of the limited, site-specific environmental and social impact assessments (ESIA) and all other project activities that involve these communities. An overall project ESMP will be developed based on those assessments. No relevant project activities will begin until the ESMP has been approved and its management measures are put in place.

the legal titles to such areas, whether the Project is located within or outside of the lands and territories inhabited by the affected peoples, or whether the indigenous peoples are recognized as indigenous peoples by the country in question)? *Has there been an absence of culturally appropriate consultations carried out with the objective of achieving FPIC on matters that may affect the rights and interests, lands, resources, territories and traditional livelihoods of the indigenous peoples concerned?*				
Risk 2: The project could reinforce ongoing problems in Vanuatu of lack of opportunity for women, if necessary and appropriate actions are not taken. *Principle 2- Would the Project potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?*	I= 3 P=2	Moderate	The project will present opportunities for individuals and groups, including opportunities for support in productive use of renewable energy, opportunities to attend workshops and training, and opportunities to be hired as a consultant or contractor to the project. Thus, if care is not taken, existing discrimination in Vanuatu towards women could be continue to come to play through the project.	Through the application of its Gender Strategy, which was developed based on a gender analysis, the project will take special measures to ensure that any discrimination against women met with in the project is countered and that, beyond this, the project makes special efforts to enhance the role of women. Thus, there will be special efforts to involve women in productive use of RE efforts (so they get at least 50% of the benefits of project funding for these), to involve women with strong representation at training (so they represent at least 50% of 300 persons trained in household-scale PV system repair and at least 30% of participants in other trainings), and to ensure a significant proportion of project consultants are women (accounting for at least 30% of consultant person-days).
Risk 3: Pico-/ small micro-hydro and village-scale community PV projects may be sited on areas of habitat that could be adversely affected. *Standard 1* *Would the project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services?* *Does the Project involve changes to the use of lands and resources that may have adverse impacts on habitats, ecosystems, and/or livelihoods? (Note: if restrictions and/or limitations of access to lands would apply, refer to Standard 5)*	I=2 P=3	Moderate		Project partners have committed their physical environment to develop the project's pico-/ small micro-hydro mini-grid demos and village-scale community PV demos and will demarcate areas for setting up these systems. During project implementation, limited environmental and social impact assessments will be conducted for each of the project's small scale RE demos and be completed prior to any physical work beginning on establishment of the demos. Any required mitigation measures will be clearly articulated in these assessments and will be aggregated into a broader ESMP of the project, prepared during implementation, that will also have general mitigation measures (cutting across multiple demos) that will be required.

Risk 4: Construction safety risks exist to communities and workers associated with the project's pico-/ small micro-hydro mini-grid demos, its village-scale community PV demos, and its compound-scale PV nano-grids. Further, risks to artisans may occur in their fabrication of EE cook stoves. As for risks to the community, the transmission of electric power of all types of the RE power generation demos present risks to the community. *Standard 3 –* *Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities?* *Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?* *Does the Project pose potential risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during Project construction, operation, or decommissioning?*	I=2 P=4	Moderate		The project ESMP and its constituent, limited, site-specific environmental and social assessments for each of the project demos will address these safety risks and determine mitigation/management measures to be adopted. The project will provide training to local rural electricians prior to installation so that they can become certified in electric wiring and master associated safety skills. Further, most wires will be buried underground as a precaution to address both the potential for natural disaster and safety issues. Relevant safety training will further be provided to communities and thus will minimize or avoid any community health risks and safety issues about construction work, installed systems, or discarded batteries. Further, the project will develop institutions and policies for the safe disposal of PV batteries, panels, and other parts and support implementation of safe disposal systems.
Risk 5: Construction of pico-/ small micro-hydro and PV-related demo projects will generate wastes. Further, PV panels and batteries will require disposal at end of life. EE cook stoves, which may have a life of just 3 to 4 years will also generate waste materials. *Standard 7 –* *Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?* *Standard 3 - Would the Project pose potential risks*	I=3 P=5	Moderate	Lithium and/or lead-acid batteries for the PV installations, when they are disposed of, will be key potentially dangerous products to be introduced.	Project will ensure proper disposal of wastes from construction of RE demos and of waste of batteries, PV panels, and EE cook stoves at end of life. Disposal plans will be one of the requirements of the limited site-specific environmental and social impact assessment (ESIAs) that will be conducted for each of the demos and be constituents of the project's ESMP. In addition, the project will be developing an institutional plan and policy for nation-wide safe disposal of PV panels, batteries, and other PV parts; and the project will further promote on-the-ground implementation of this plan and policy.

to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?				
Risk 6: Natural disasters, frequent in Vanuatu, will destroy installed off-grid RE power system demos of the project. *Standard 2, question 2.2* *Standard 3, question 3.5*	I = 4 P = 1	Moderate		This risk will be assessed during the ESIAs and captured in the management measures of the ESMP as determined appropriate. Requirements for project's off-grid RE power demo design work will explicitly include incorporation of natural disaster risk mitigation measures.
Risk 7: The location of the demos and associated infrastructure could raise concerns from communities, if appropriate measures are not taken. *Standard 1, question 1.3*	I = 4 P = 1	Moderate	There will be some change in land usage due to the installation of pico-/ small micro-hydro mini-grids and village-scale community PV systems with battery station. This means that some land (at present unused) will be unavailable for other uses and some water in streams/ rivers near villages will be diverted to small-scale power applications.	This risk will be assessed during the ESIAs and captured in the management measures of the ESMP as determined appropriate. FPIC will be applied throughout all project activities that involve indigenous communities. The Stakeholder Engagement Plan will be implemented through the project, and updated as necessary.
Risk 8: Income-generating activities (freezers for fishermen and cook stove construction) could be done in an unsustainable manner if appropriate measures are not taken. *Standard 1, question 1.11*	I = 4 P = 1	Moderate		This risk will be assessed during the ESIAs and captured in the management measures of the ESMP as determined appropriate.
	QUESTION 4: What is the overall Project risk categorization?			
	Select one (see SESP for guidance)			**Comments**
	Low Risk	☐		
	Moderate Risk	√☐		The project's moderate risks triggered both environmental and social standards, and will be furthered assessed through ESIAs during the implementation of the project, before relevant activities

			begin.
	High Risk	☐	
	QUESTION 5: Based on the identified risks and risk categorization, what requirements of the SES are relevant?		
	Check all that apply		**Comments**
	Principle 1: Human Rights	√	Moderate risk, to be fully assessed during the ESIAs, with management measures in the resulting ESMP.
	Principle 2: Gender Equality and Women's Empowerment	√	Moderate risk to be addressed through the implementation of the Gender Strategy.
	1. Biodiversity Conservation and Natural Resource Management	√	Moderate risk, to be fully assessed during the ESIAs, with management measures in the resulting ESMP.
	2. Climate Change Mitigation and Adaptation	√	Moderate risk, to be fully assessed during the ESIAs, with management measures in the resulting ESMP.
	3. Community Health, Safety and Working Conditions	√	Moderate risk, to be fully assessed during the ESIAs, with management measures in the resulting ESMP.
	4. Cultural Heritage	☐	No risk identified
	5. Displacement and Resettlement	☐	No risk identified
	6. Indigenous Peoples	√	Moderate risk, to be fully assessed during the ESIAs, with management measures in the resulting ESMP. FPIC will be consistently applied in all relevant project activities.
	7. Pollution Prevention and Resource Efficiency	√	Moderate risk, to be fully assessed during the ESIAs, with management measures in the resulting ESMP.

Final Sign Off

Signature	***Date***	***Description***
QA Assessor		UNDP staff member responsible for the Project, typically a UNDP Programme Officer. Final signature confirms they have "checked" to ensure that the SESP is adequately conducted.
QA Approver		UNDP senior manager, typically the UNDP Deputy Country Director (DCD), Country Director (CD), Deputy Resident Representative (DRR), or Resident Representative (RR). The QA Approver cannot also be the QA Assessor. Final signature confirms they have "cleared" the SESP prior to submittal to the PAC.
PAC Chair		UNDP chair of the PAC. In some cases, PAC Chair may also be the QA Approver. Final signature confirms that the SESP was considered as part of the project appraisal and considered in recommendations of the PAC.

SESP Attachment 1. Social and Environmental Risk Screening Checklist

Checklist Potential Social and Environmental Risks	
Principles 1: Human Rights	**Yes/No**
1. Could the Project lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social or cultural) of the affected population and particularly of marginalized groups?	Yes
2. Is there a likelihood that the Project would have inequitable or discriminatory adverse impacts on affected populations, particularly people living in poverty or marginalized or excluded individuals or groups? [60]	No
3. Could the Project potentially restrict availability, quality of and access to resources or basic services, particularly for marginalized individuals or groups?	No
4. Is there a likelihood that the Project would exclude any potentially affected stakeholders, particularly marginalized groups, from fully participating in decisions that may affect them?	No
5. Is there a risk that duty-bearers do not have the capacity to meet their obligations in the Project?	No
6. Is there a risk that rights-holders do not have the capacity to claim their rights?	No
7. Have local communities or individuals, given the opportunity, raised human rights concerns regarding the Project during the stakeholder engagement process?	No
8. Is there a risk that the Project would exacerbate conflicts among and/or the risk of violence to project-affected communities and individuals?	No
Principle 2: Gender Equality and Women's Empowerment	
1. Is there a likelihood that the proposed Project would have adverse impacts on gender equality and/or the situation of women and girls?	No
2. Would the Project potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?	Yes
3. Have women's groups/leaders raised gender equality concerns regarding the Project during the stakeholder engagement process and has this been included in the overall Project proposal and in the risk assessment?	No
4. Would the Project potentially limit women's ability to use, develop and protect natural resources, considering different roles and positions of women and men in accessing environmental goods and services? *For example, activities that could lead to natural resources degradation or depletion in communities who depend on these resources for their livelihoods and well-being*	No
Principle 3: Environmental Sustainability: Screening questions regarding environmental risks are encompassed by the specific Standard-related questions below	
Standard 1: Biodiversity Conservation and Sustainable Natural Resource Management	
1.1 Would the Project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services? *For example, through habitat loss, conversion or degradation, fragmentation, hydrological changes*	Yes
1.2 Are any Project activities proposed within or adjacent to critical habitats and/or environmentally sensitive areas, including legally protected areas (e.g. nature reserve, national park), areas proposed for protection, or recognized as such by authoritative sources and/or indigenous peoples or local communities?	No
1.3 Does the Project involve changes to the use of lands and resources that may have adverse impacts on habitats, ecosystems, and/or livelihoods? (Note: if restrictions and/or limitations of access to lands would apply, refer to Standard 5)	Yes
1.4 Would Project activities pose risks to endangered species?	No
1.5 Would the Project pose a risk of introducing invasive alien species?	No
1.6 Does the Project involve harvesting of natural forests, plantation development, or reforestation?	No

[60] Prohibited grounds of discrimination include race, ethnicity, gender, age, language, disability, sexual orientation, religion, political or other opinion, national or social or geographical origin, property, birth or other status including as an indigenous person or as a member of a minority. References to "women and men" or similar is understood to include women and men, boys and girls, and other groups discriminated against based on their gender identities, such as transgender people and transsexuals.

1.7 Does the Project involve the production and/or harvesting of fish populations or other aquatic species?	No
1.8 Does the Project involve significant extraction, diversion or containment of surface or ground water? *For example, construction of dams, reservoirs, river basin developments, groundwater extraction*	No
1.9 Does the Project involve utilization of genetic resources? (e.g. collection and/or harvesting, commercial development)	No
1.10 Would the Project generate potential adverse trans-boundary or global environmental concerns?	No
1.11 Would the Project result in secondary or consequential development activities which could lead to adverse social and environmental effects, or would it generate cumulative impacts with other known existing or planned activities in the area? *For example, a new road through forested lands will generate direct environmental and social impacts (e.g. felling of trees, earthworks, potential relocation of inhabitants). The new road may also facilitate encroachment on lands by illegal settlers or generate unplanned commercial development along the route, potentially in sensitive areas. These are indirect, secondary, or induced impacts that need to be considered. Also, if similar developments in the same forested area are planned, then cumulative impacts of multiple activities (even if not part of the same Project) need to be considered.*	Yes
Standard 2: Climate Change Mitigation and Adaptation	
2.1 Will the proposed Project result in significant[61] greenhouse gas emissions or may exacerbate climate change?	No
2.2 Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?	Yes
2.3 Is the proposed Project likely to directly or indirectly increase social and environmental vulnerability to climate change now or in the future (also known as maladaptive practices)? *For example, changes to land use planning may encourage further development of floodplains, potentially increasing the population's vulnerability to climate change, specifically flooding*	No
Standard 3: Community Health, Safety and Working Conditions	
3.1 Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities?	Yes
3.2 Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?	Yes
3.3 Does the Project involve large-scale infrastructure development (e.g. dams, roads, buildings)?	No
3.4 Would failure of structural elements of the Project pose risks to communities? (e.g. collapse of buildings or infrastructure)	No
3.5 Would the proposed Project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, and erosion, flooding or extreme climatic conditions?	Yes
3.6 Would the Project result in potential increased health risks (e.g. from water-borne or other vector-borne diseases or communicable infections such as HIV/AIDS)?	No
3.7 Does the Project pose potential risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during Project construction, operation, or decommissioning?	Yes
3.8 Does the Project involve support for employment or livelihoods that may fail to comply with national and international labor standards (i.e. principles and standards of ILO fundamental conventions)?	No
3.9 Does the Project engage security personnel that may pose a potential risk to health and safety of communities and/or individuals (e.g. due to a lack of adequate training or accountability)?	No
Standard 4: Cultural Heritage	
4.1 Will the proposed Project result in interventions that would potentially adversely impact sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible	No

[61] In regards to CO_2, 'significant emissions' corresponds generally to more than 25,000 tons per year (from both direct and indirect sources). [The Guidance Note on Climate Change Mitigation and Adaptation provides additional information on GHG emissions.]

	forms of culture (e.g. knowledge, innovations, practices)? (Note: Projects intended to protect and conserve Cultural Heritage may also have inadvertent adverse impacts)	
4.2	Does the Project propose utilizing tangible and/or intangible forms of cultural heritage for commercial or other purposes?	No
Standard 5: Displacement and Resettlement		
5.1	Would the Project potentially involve temporary or permanent and full or partial physical displacement?	No
5.2	Would the Project possibly result in economic displacement (e.g. loss of assets or access to resources due to land acquisition or access restrictions – even in the absence of physical relocation)?	No
5.3	Is there a risk that the Project would lead to forced evictions?[62]	No
5.4	Would the proposed Project possibly affect land tenure arrangements and/or community based property rights/customary rights to land, territories and/or resources?	No
Standard 6: Indigenous Peoples		
6.1	Are indigenous peoples present in the Project area (including Project area of influence)?	Yes
6.2	Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?	Yes
6.3	Would the proposed Project potentially affect the human rights, lands, natural resources, territories, and traditional livelihoods of indigenous peoples (regardless of whether indigenous peoples possess the legal titles to such areas, whether the Project is located within or outside of the lands and territories inhabited by the affected peoples, or whether the indigenous peoples are recognized as indigenous peoples by the country in question)? *If the answer to the screening question 6.3 is "yes" the potential risk impacts are considered potentially severe and/or critical and the Project would be categorized as either Moderate or High Risk.*	Yes
6.4	Has there been an absence of culturally appropriate consultations carried out with the objective of achieving FPIC on matters that may affect the rights and interests, lands, resources, territories and traditional livelihoods of the indigenous peoples concerned?	Yes[63]
6.5	Does the proposed Project involve the utilization and/or commercial development of natural resources on lands and territories claimed by indigenous peoples?	No
6.6	Is there a potential for forced eviction or the whole or partial physical or economic displacement of indigenous peoples, including through access restrictions to lands, territories, and resources?	No
6.7	Would the Project adversely affect the development priorities of indigenous peoples as defined by them?	No
6.8	Would the Project potentially affect the physical and cultural survival of indigenous peoples?	No
6.9	Would the Project potentially affect the Cultural Heritage of indigenous peoples, including through the commercialization or use of their traditional knowledge and practices?	No
Standard 7: Pollution Prevention and Resource Efficiency		
7.1	Would the Project potentially result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and/or trans-boundary impacts?	Yes
7.2	Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	Yes
7.3	Will the proposed Project potentially involve the manufacture, trade, release, and/or use of hazardous chemicals and/or materials? Does the Project propose use of chemicals or materials subject to international bans or phase-outs? *For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Conventions on Persistent Organic Pollutants or the Montreal Protocol*	No

[62] Forced evictions include acts and/or omissions involving the coerced or involuntary displacement of individuals, groups, or communities from homes and/or lands and common property resources that were occupied or depended upon, thus eliminating the ability of an individual, group, or community to reside or work in a specific dwelling, residence, or location without the provision of, and access to, appropriate forms of legal or other protections.

[63] Extensive initial consultations have been carried out with communities in which the project demos will be developed. During project implementation, full FPIC process will be carried out per UNDP Environmental and Social Standard 7.

7.4	Will the proposed Project involve the application of pesticides that may have a negative effect on the environment or human health?	No
7.5	Does the Project include activities that require significant consumption of raw materials, energy, and/or water?	No

Annex 9. UNDP Project Quality Assurance Report

PROJECT QA ASSESSMENT: DESIGN AND APPRAISAL (VANUATU BRANTV)

OVERALL PROJECT

EXEMPLARY (5) ◎◎◎◎◎	HIGHLY SATISFACTORY (4) ◎◎◎◎○	SATISFACTORY (3) ◎◎◎○○	NEEDS IMPROVEMENT (2) ◎◎○○○	INADEQUATE (1) ◎○○○○
At least four criteria are rated Exemplary, and all criteria are rated High or Exemplary.	All criteria are rated Satisfactory or higher, and at least four criteria are rated High or Exemplary.	At least six criteria are rated Satisfactory or higher, and only one may be rated Needs Improvement. The SES criterion must be rated Satisfactory or above.	At least three criteria are rated Satisfactory or higher, and only four criteria may be rated Needs Improvement.	One or more criteria are rated Inadequate, or five or more criteria are rated Needs Improvement.

DECISION

- **APPROVE** – the project is of sufficient quality to continue as planned**.** Any management actions must be addressed in a timely manner.
- **APPROVE WITH QUALIFICATIONS** – the project has issues that must be addressed before the project document can be approved. Any management actions must be addressed in a timely manner.
- **DISAPPROVE** – the project has significant issues that should prevent the project from being approved as drafted.

RATING CRITERIA

STRATEGIC

1. Does the project's Theory of Change specify how it will contribute to higher level change? (Select the option from 1-3 that best reflects the project): • **3:** The project has a theory of change with explicit assumptions and clear change pathway describing how the project will contribute to outcome level change as specified in the programme/CPD, backed by credible evidence of what works effectively in this context. The project document clearly describes why the project's strategy is the best approach now. • **2:** The project has a theory of change. It has an explicit change pathway that explains how the project intends to contribute to outcome-level change and why the project strategy is the best approach now, but is backed by limited evidence. • **1:** The project does not have a theory of change, but the project document may describe in generic terms how the project will contribute to development results, without specifying the key assumptions. It does not make an explicit link to the programme/CPD's theory of change. *Note: Management Action or strong management justification must be given for a score of 1 Evidence: Under the project's theory of change, the removal of the immediate causes of the core problem of the non-achievement of the energy access, sustainable energy and green growth targets of the country, will lead to the transitioning of Vanuatu into a situation in which its National Energy Road Map (NERM) targets related to Energy Efficiency (EE) and Renewable Energy (RE) are on track to be met. Exhibit 2 shows the linkages between the development challenge (core problem) and its immediate causes. It also shows that addressing these immediate causes lead to a change in situation in which Vanuatu gets on track for meeting its RE and EE related targets. As part of its strategy, BRANTV adopts a design in which each major barrier type is addressed in separate project components. However, since some of the barriers are inter-related, the relevant component activities are carried out in an integrated manner. For example, capacity building will address the same RE and EE technology areas that are addressed by the project demonstration activities, since these are	3 / 2 / 1	**Evidence** See notes

a means of removing not only the technical barriers but also those related to capacity. As another example, the work on addressing institutional barriers also include the development and implementation of the sustainable management mechanism for the operation and maintenance of each project demo. The barrier removal approach and the development and implementation of integrated activities among the major project components have been successfully adopted in other UNDP-GEF projects in the Asia Pacific Region.	
2. Is the project aligned with the thematic focus of the UNDP Strategic Plan? (select the option from 1-3 that best reflects the project): • **3:** The project responds to one of the three areas of development work[64] as specified in the Strategic Plan; it addresses at least one of the proposed new and emerging areas[65]; an issues-based analysis has been incorporated into the project design; and the project's RRF includes all the relevant SP output indicators. *(all must be true to select this option)* • **2:** The project responds to one of the three areas of development work[1] as specified in the Strategic Plan. The project's RRF includes at least one SP output indicator, if relevant. *(both must be true to select this option)* • **1:** While the project may respond to one of the three areas of development work[1] as specified in the Strategic Plan, it is based on a sectoral approach without addressing the complexity of the development issue. None of the relevant SP indicators are included in the RRF. This answer is also selected if the project does not respond to any of the three areas of development work in the Strategic Plan. Evidence: The project is aligned to Outcome 1, and it supports output indicator 1.4 (Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented).	3 | 2 1 **Evidence**
RELEVANT	
3. Does the project have strategies to effectively identify, engage and ensure the meaningful participation of targeted groups/geographic areas with a priority focus on the excluded and marginalized? (select the option from 1-3 that best reflects this project): • **3:** The target groups/geographic areas are appropriately specified, prioritising the excluded and/or marginalised. Beneficiaries will be identified through a rigorous process based on evidence (if applicable.) The project has an explicit strategy to identify, engage and ensure the meaningful participation of specified target groups/geographic areas throughout the project, including through monitoring and decision-making (such as representation on the project board) *(all must be true to select this option)* • **2:** The target groups/geographic areas are appropriately specified, prioritising the excluded and/or marginalised. The project document states how beneficiaries will be identified, engaged and how meaningful participation will be ensured throughout the project. *(both must be true to select this option)* • **1:** The target groups/geographic areas are not specified, or do not prioritize excluded and/or marginalised populations. The project does not have a written strategy to identify or engage or ensure the meaningful participation of the target groups/geographic areas throughout the project. *Note: Management Action must be taken for a score of 1, or select not applicable. Evidence: Annex 1 of the project document provides summaries of plans for the incremental project demonstration activities by technology type. The plans were worked out during two extensive missions/ field trips in November and December 2017. Reports prepared based on these missions/ field trips are *BRANTV PPG Mission 2 – Scoping Site Visits (Tanna, Pentecost, Santo, Gaua, and Efate) – November 2017,* and *BRANTV Detailed Technical Study Report – December 4 – 28, 2017*. The following demonstration activities are specifically targeted and prioritizes the excluded and/or marginalized: (1) 19 pico and small micro-hydro mini-grids; (2) one pico-hydro PV hybrid mini-grid; (3) 10 village-scale community PV systems (with or without mini-grid); (4) family compound-scale PV systems (typically each 300 W and including five buildings) deployed across 10 villages;	3 | 2 1 *Select (all) targeted groups: (drop-down)* **Evidence** See notes

[64] 1. Sustainable development pathways; 2. Inclusive and effective democratic governance; 3. Resilience building

[65] sustainable production technologies, access to modern energy services and energy efficiency, natural resources management, extractive industries, urbanization, citizen security, social protection, and risk management for resilience

(5) 12,000 energy efficient cook stoves; and
(6) productive uses across 30 to 40 or more villages.

The target groups (i.e. local villagers and indigenous people, women, and other marginalized groups in the villages) also feature in the overall stakeholder and communications plan (Annex 14) of the project.

4. Have knowledge, good practices, and past lessons learned of UNDP and others informed the project design? (select the option from 1-3 that best reflects this project):

- **3:** Knowledge and lessons learned (gained e.g. through peer assist sessions) backed by credible evidence from evaluation, corporate policies/strategies, and monitoring have been explicitly used, with appropriate referencing, to develop the project's theory of change and justify the approach used by the project over alternatives.
- **2:** The project design mentions knowledge and lessons learned backed by evidence/sources, which inform the project's theory of change but have not been used/are not sufficient to justify the approach selected over alternatives.
- **1:** There is only scant or no mention of knowledge and lessons learned informing the project design. Any references that are made are not backed by evidence.

*Note: Management Action or strong management justification must be given for a score of 1

Evidence
The project design has incorporated good practices and past lessons from a strategic perspective in relation to achieving the targets of the NERM (2013), NERM (2016), and the 2017 Census. The following are extracted from section II of the project document:

- *Off-grid renewable energy power generation*: From a development perspective, low levels of electricity access in rural areas results in both a lower quality of life than might otherwise be enjoyed and a lack of access to income generating activities that depend on access to power. The original NERM (2013) had a target of achieving 100% electricity access in long-term off-grid areas by 2020. The updated NERM (2016) indicates that only 9% access in these long-term off-grid areas had been achieved by 2015. Vanuatu's 2017 census indicates that 71% of the nation's roughly 280,000 people lack access to grid electricity. Of those off-grid households, per the census, over half have no access to power aside from a solar lantern; and around 72% of have access only at this solar lantern level or somewhat better level of pico-PV systems (usually 10 to 20 W). While donor efforts to improve energy access in rural areas via renewable energy (RE) have been substantial, it is widely agreed that poor sustainability of off-grid RE power systems has resulted in repeated failures of such donor projects. Even when systems are installed at no up-front cost to households, lack of funds for repairs and lack of local access to parts and services repeatedly result in broken down systems for the long-run. For village-scale RE power systems, in addition to such sustainability problems, an issue regarding replicability is that in-country capabilities are extremely limited, so that the few systems set up require costly international contractors and take protracted periods to complete.
- *Energy efficiency in rural areas*: In terms of energy efficiency in rural areas, two important opportunities in Vanuatu are energy efficient cook stoves and energy efficient crop drying. Currently, large amounts of wood are used in open hearth fires by almost all rural families in Vanuatu for cooking. Wood is also used in an inefficient process for drying crops in rural areas. Worldwide, indoor air pollution from open hearth fires in village huts is considered the air pollution problem negatively impacting the most people; and it disproportionately affects women and children. The situation in Vanuatu appears to correspond to these worldwide trends. Further, cutting of wood for fires is already leading to deforestation in certain areas of the nation, where fuel wood is becoming scarce. Vanuatu's NERM recognizes that EE cook stoves may reduce air emissions by 90% and energy consumption by 50%. It further calls for the promotion of such cook stoves and EE crop driers as among its highest rated priorities. While EE cook stoves have begun to be sold on a very limited level in Vanuatu's urban areas, such stoves are mostly unknown to people living in rural areas.

3 | 2 | 1

Evidence
See notes

5. Does the project use gender analysis in the project design and does the project respond to this gender analysis with

3 | 2 | 1

concrete measures to address gender inequities and empower women? (select the option from 1-3 that best reflects this project): • **3:** A participatory gender analysis on the project has been conducted. This analysis reflects on the different needs, roles and access to/control over resources of women and men, and it is fully integrated into the project document. The project establishes concrete priorities to address gender inequalities in its strategy. The results framework includes outputs and activities that specifically respond to this gender analysis, with indicators that measure and monitor results contributing to gender equality. *(all must be true to select this option)* • **2:** A gender analysis on the project has been conducted. This analysis reflects on the different needs, roles and access to/control over resources of women and men. Gender concerns are integrated in the development challenge and strategy sections of the project document. The results framework includes outputs and activities that specifically respond to this gender analysis, with indicators that measure and monitor results contributing to gender equality. *(all must be true to select this option)* • **1:** The project design may or may not mention information and/or data on the differential impact of the project's development situation on gender relations, women and men, but the constraints have not been clearly identified and interventions have not been considered. *Note: Management Action or strong management justification must be given for a score of 1 Evidence A gender survey was conducted in accordance with the UNDP quality assurance assessment for designing and appraising development projects. The Gender Survey was undertaken in December 2017 and helped set the scene for the overall gender assessment that will determine the extent to which gender needs are being addressed through the BRANTV demonstration activities. As described in the relevant annex of the project document, the Gender Survey comprised three methods: (i) Key informant interviews - the purpose of which is to deepen the grasp of context, coping strategies and issues of concern in relation to accessing energy in the context of BRANTV; (ii) Single sex focus groups - the purpose of which is to identify respective gender roles and duties of men and women, as well as to identify gender-specific coping strategies, practices and concerns in relation to accessing energy; and (iii) Time use surveys - the purpose of which is to track the number of hours per day that men and women typically devote to various activities (productive and reproductive) in a specific community, to detect gender differentiated patterns of time use. The stakeholder engagement and communications plan of the project document states that women in rural Vanuatu often do much of the work and particularly the volunteer work associated with donor projects. At the same time, they often have less opportunity than men for increasing their income and educational level. The project will put special emphasis on the involvement of women in village community meetings with the project, ensuring that 50% of participants (or at least decision-making participants) at such meetings are women. The project will also proactively seek the involvement of women in productive use initiatives, assuring that 50% of project funds for productive uses go to initiatives mainly involving women.	**Evidence** See notes
6. Does UNDP have a clear advantage to engage in the role envisioned by the project vis-à-vis national partners, other development partners, and other actors? (select from options 1-3 that best reflects this project): • **3:** An analysis has been conducted on the role of other partners in the area where the project intends to work, and credible evidence supports the proposed engagement of UNDP and partners through the project. It is clear how results achieved by relevant partners will contribute to outcome level change complementing the project's intended results. If relevant, options for south-south and triangular cooperation have been considered, as appropriate. *(all must be true to select this option)* • **2:** Some analysis has been conducted on the role of other partners where the project intends to work, and relatively limited evidence supports the proposed engagement of and division of labour between UNDP and partners through the project. Options for south-south and triangular cooperation may not have not been fully developed during project design, even if relevant opportunities have been identified. • **1:** No clear analysis has been conducted on the role of other partners in the area that the project intends to work, and relatively limited evidence supports the proposed engagement of UNDP and partners through the project. There is risk that the project overlaps and/or does not coordinate with partners' interventions in this area. Options for south-south and triangular cooperation have not been considered, despite its potential relevance. *Note: Management Action or strong management justification must be given for a score of 1 Evidence:	3 | 2 1 **Evidence** See notes

UNDP comparative advantage: The project design leverages UNDP's comparative advantage in bringing different donors and government departments together to address NERM targets. Further, the project leverages UNDP's strengths in the policy and planning arena, capacity building, institutional work, and integrating demonstrations with the foregoing areas.

The Stakeholder Engagement & Communications Plan, as part of the mapping exercise that was undertaken during PPG, identified and listed the following:

Other donors/ donor projects and programs: Other donors involved in RE and EE in Vanuatu include the Asian Development Bank (ADB) and its 400 kW Brenwei hydro project, the World Bank and its VREP Phase 1 and 2 Project (which provides subsidies for plug-and-play PV, SHSs, institutional scale PV, and PV mini-grids), EU-GIZ (which has a solar freezer and biogas project), SPC (which has solar freezer and fridge project), GGGI (which has completed a solar fridge project and is assisting Vanuatu in setting up its NGEF), New Zealand High Commission (which is supporting VREP and also providing support with UNICEF in the area of water supply), IUCN and its 75 kW Talise micro-hydro project, JICA (which is likely to support 600 kW expansion of Sarakata hydro and which will be providing TA support in EE as well), and China Ministry of Commerce ("China Aid"), which provides training support in various areas related to RE.

Means of engagement: The project will seek to engage other donors (both multi-lateral and bi-lateral) and relevant donor projects and programs via involving them in the inception workshop. Further the most relevant initiatives of donors make up the baseline of BRANTV. These include the hydro, PV, and solar fridge/freezer initiatives. Donors will be kept abreast of project activities, as relevant. Particularly, village off-grid RE power generation management model of the project will be shared with the donor projects pursing village-scale RE power installations, where the model may also provide a solution to the sustainability problem that highly concerns all donors working in this area. Further, the PV sourcing work of the project will be an important to VREP (as plug-and-play systems sold so far as a part of VREP have far exceeded international norms in price – by over 100 %), so the project will keep in close touch with VREP on findings and next steps. Further, the work on ensuring PV system parts availability in the islands will contribute to the sustainability of VREP as will the work on a system for disposal of PV waste. As such, the project will work to engage VREP closely in this work. As for work with the Department of Water Resources in integrating gravity feed water supply projects with pico-hydro systems, the project will engage the New Zealand High Commission, UNICEF, and the Red Cross in discussions vis-à-vis their support of water supply projects in Vanuatu. The project will engage China Aid in discussions about possible additional tailor-made training for Vanuatu and additional sourcing/ cost assessment support in areas of strong Chinese expertise, particularly pico-/ small micro-hydro. As a part of Outcome 4A, the project will assist NGEF in reaching out to other donors (including those not yet active in Vanuatu) about potential funding replication of BRANTV demos via NGEF.

SOCIAL & ENVIRONMENTAL STANDARDS

7. Does the project seek to further the realization of human rights using a human right based approach? (select from options 1-3 that best reflects this project):

- **3:** Credible evidence that the project aims to further the realization of human rights, upholding the relevant international and national laws and standards in the project. Any potential adverse impacts on enjoyment of human rights were rigorously identified and assessed as relevant, with appropriate mitigation and management measures incorporated into project design and budget. *(all must be true to select this option)*
- **2:** Some evidence that the project aims to further the realization of human rights. Potential adverse impacts on enjoyment of human rights were identified and assessed as relevant, and appropriate mitigation and management measures incorporated into the project design and budget.
- **1:** No evidence that the project aims to further the realization of human rights. Limited or no evidence that potential adverse impacts on enjoyment of human rights were considered.

*Note: Management action or strong management justification must be given for a score of 1

Evidence:
Although the project document does not contain specific HRBA terminologies (such as duty bearers and rights holders), the project is designed to ensure access to clean energy, which is integral to the full enjoyment of a wide range of human rights.

3	2
1	

Evidence
See notes

8. Did the project consider potential environmental opportunities and adverse impacts, applying a precautionary

3	2
1	

approach? (select from options 1-3 that best reflects this project): • **3:** Credible evidence that opportunities to enhance environmental sustainability and integrate poverty-environment linkages were fully considered as relevant, and integrated in project strategy and design. Credible evidence that potential adverse environmental impacts have been identified and rigorously assessed with appropriate management and mitigation measures incorporated into project design and budget. *(all must be true to select this option)*. • **2:** No evidence that opportunities to strengthen environmental sustainability and poverty-environment linkages were considered. Credible evidence that potential adverse environmental impacts have been identified and assessed, if relevant, and appropriate management and mitigation measures incorporated into project design and budget. • **1:** No evidence that opportunities to strengthen environmental sustainability and poverty-environment linkages were considered. Limited or no evidence that potential adverse environmental impacts were adequately considered. *Note: Management action or strong management justification must be given for a score of 1 Evidence (as described in the project document): BRANTV has the objective of enabling the achievement of the energy access, sustainable energy, and green growth targets in Vanuatu's National Energy Road Map (NERM) via facilitating the application of renewable energy (RE) and energy efficiency (EE) technologies. Without incremental support through this project, Vanuatu is unlikely to meet the NERM's ambitious 2020 and 2030 targets in these areas. Lack of progress towards targets, in turn, is associated with stymied progress toward other development objectives, such as increased incomes, improved standards of living, and improved health. **Relevance to global environment and the SDGs:** BRANTV's aim to enable Vanuatu to achieve its NERM targets via the application of RE and EE technologies is relevant to both to the global environment and to the SDGs. In terms of the global environment, achievement of NERM targets will have substantial benefits in reducing greenhouse gas (GHG) emissions from the business as usual scenario. New RE power generation in off-grid areas will represent the alternative to diesel generators. The updated NERM (2016) targets that 65% of national electricity generation be from RE in 2020, though indicates that a level of only 29% had been met by 2012. As for EE cook stoves and EE crop driers, these will reduce GHG emissions for burning of wood by about 50%. An ambitious program for nation-wide dissemination of such products, if successful, will lead to substantial GHG emission reductions. Enabling achievement of the development targets of increased energy access, sustainable energy, and green growth targets clearly addresses SDG 7, "Ensure access to affordable, reliable, sustainable, and modern energy for all;" and it also addresses SDG13, "Take urgent action to combat climate change and its impacts." Such work as envisioned in the project design also has the potential to address other SDGs including: SDG8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all" (via productive uses of RE and EE for income generation); and SDG3 "Ensure healthy lives and promote well-being for all at all ages" (via improved air quality achieved via EE cook stoves and RE power systems as compared to business as usual with open hearth fires and diesel generators).	**Evidence** See notes
9. Has the Social and Environmental Screening Procedure (SESP) been conducted to identify potential social and environmental impacts and risks? The SESP is not required for projects in which UNDP is Administrative Agent only and/or projects comprised solely of reports, coordination of events, trainings, workshops, meetings, conferences and/or communication materials and information dissemination. [if yes, upload the completed checklist. If SESP is not required, provide the reason for the exemption in the evidence section.]	Yes / No SESP and checklist available as Annex 8
MANAGEMENT & MONITORING	
10. Does the project have a strong results framework? (select from options 1-3 that best reflects this project): • **3:** The project's selection of outputs and activities are at an appropriate level and relate in a clear way to the project's theory of change. Outputs are accompanied by SMART, results-oriented indicators that measure all the key expected changes identified in the theory of change, each with credible data sources, and populated	3 / 2 1

baselines and targets, including gender sensitive, sex-disaggregated indicators where appropriate. *(all must be true to select this option)* • **2:** The project's selection of outputs and activities are at an appropriate level, but may not cover all aspects of the project's theory of change. Outputs are accompanied by SMART, results-oriented indicators, but baselines, targets and data sources may not yet be fully specified. Some use of gender sensitive, sex-disaggregated indicators, as appropriate. *(all must be true to select this option)* • **1:** The results framework does not meet all the conditions specified in selection "2" above. This includes: the project's selection of outputs and activities are not at an appropriate level and do not relate in a clear way to the project's theory of change; outputs are not accompanied by SMART, results-oriented indicators that measure the expected change, and have not been populated with baselines and targets; data sources are not specified, and/or no gender sensitive, sex-disaggregation of indicators. *Note: Management Action or strong management justification must be given for a score of 1 Evidence: The project document contains an elaborated project results framework as per the standard UNDP-GEF format, along with outcomes and corresponding indicators, baselines and targets. All the 7 project outcomes are clearly related to the project's theory of change.	**Evidence** See notes	
11. Is there a comprehensive and costed M&E plan in place with specified data collection sources and methods to support evidence-based management, monitoring and evaluation of the project? Evidence: The project document contains a costed M&E plan and a Monitoring Plan as per the standard UNDP-GEF format	Yes (3)	No (1)
12. Is the project's governance mechanism clearly defined in the project document, including planned composition of the project board? (select from options 1-3 that best reflects this project): • **3:** The project's governance mechanism is fully defined in the project composition. Individuals have been specified for each position in the governance mechanism (especially all members of the project board.) Project Board members have agreed on their roles and responsibilities as specified in the terms of reference. The ToR of the project board has been attached to the project document. *(all must be true to select this option)*. • **2:** The project's governance mechanism is defined in the project document; specific institutions are noted as holding key governance roles, but individuals may not have been specified yet. The ProDoc lists the most important responsibilities of the project board, project director/manager and quality assurance roles. *(all must be true to select this option)* • **1:** The project's governance mechanism is loosely defined in the project document, only mentioning key roles that will need to be filled later. No information on the responsibilities of key positions in the governance mechanism is provided. *Note: Management Action or strong management justification must be given for a score of 1 Evidence: The project document contains a well-defined governance mechanism that clearly outlines the roles and responsibilities of entities involved.	3	2 1 **Evidence** See notes
13. Have the project risks been identified with clear plans stated to manage and mitigate each risk? (select from options 1-3 that best reflects this project): • **3:** Project risks related to the achievement of results are fully described in the project risk log, based on comprehensive analysis drawing on the theory of change, Social and Environmental Standards and screening, situation analysis, capacity assessments and other analysis. Clear and complete plan in place to manage and mitigate each risk. *(both must be true to select this option)* • **2:** Project risks related to the achievement of results identified in the initial project risk log with mitigation measures identified for each risk. • **1:** Some risks may be identified in the initial project risk log, but no evidence of analysis and no clear risk mitigation measures identified. This option is also selected if risks are not clearly identified and no initial risk log is included with the project document.	3	2 1 **Evidence** See notes

*Note: Management Action must be taken for a score of 1 Evidence: The project document contains a risk log, as part of the annexes. The identified risks are related to the achievement of results and are fully described based on comprehensive analysis conducted during the PPG.		
EFFICIENT		
14. Have specific measures for ensuring cost-efficient use of resources been explicitly mentioned as part of the project design? This can include: i) using the theory of change analysis to explore different options of achieving the maximum results with the resources available; ii) using a portfolio management approach to improve cost effectiveness through synergies with other interventions; iii) through joint operations (e.g., monitoring or procurement) with other partners. Evidence: The project document outlines certain aspects of the project's strategy that will promote cost efficiency as follows: • *Stimulation of replication of the project demos:* The project will invest in RE and EE demos, which will be critical in providing proof of concept and proof of costing, so that others will be willing to replicate them, thus leveraging in project funds far beyond the project demos. The project will further provide technical assistance (TA) support in multiple areas to stimulate replication of the project demos. These areas include awareness raising that encourages local people to submit proposals of suitable sites, site identification work by government departments, preparation of a village-by-village *Vanuatu Off-Grid Rural Electrification Plan*, and liaison work for local project proponents, NGEF, and private/ commercial finance sector entities to facilitate replication of the project demos. • *Work in sourcing and costing of RE equipment and design/ installation services:* The project will carry out technical assistance in sourcing and costing with an aim of identifying good quality equipment for the least cost. This will increase the cost efficiency of the project demos, as well as the overall cost efficiency of the project. • *Savings in the long-run as compared to diesel generation:* Over the long run, with the sourcing and best cost pricing work, RE will provide greater cost efficiency for local communities than would the alternative of diesel generators. • *Leveraging of TA funds to promote investment by other parties in RE and EE in Vanuatu*: The project will invest a large proportion of GEF funds in TA in the capacity, awareness, policy, institutional, and financing areas, which are relatively low in cost, to leverage funding from other sources for actual installations of RE and EE equipment, which is relatively high in cost. There are a range of ways the project does this. The project includes activities that involve TA support to the commercial / private sector in designing EE and RE financing mechanisms, but looks to other parties to set up the actual funds for realization of these mechanisms. As another example, the project will use TA funds to support NGEF in fundraising from international parties for the financing of RE and EE in Vanuatu. • *Provision of TA support to ensure co-financed investments are sustainable:* With limited TA funds, BRANTV addresses the gaps that may otherwise jeopardize the sustainability of a large amount of donor financing for RE installations in the PV and hydro areas. This BRANTV work includes support of extensive training in the islands for PV repairs, support to develop local supplies of replacement PV system parts (especially batteries), and development of village-scale RE power management systems that can achieve the sustainability that has been so elusive to such installations thus far.	Yes (3)	No (1)
15. Are explicit plans in place to ensure the project links up with other relevant on-going projects and initiatives, whether led by UNDP, national or other partners, to achieve more efficient results (including, for example, through sharing resources or coordinating delivery?) Evidence: As previously stated, the project will seek to engage other donors (both multi-lateral and bi-lateral) and relevant donor projects and programs via involving them in the inception workshop. Further the most relevant initiatives of donors make up the baseline of BRANTV. These include the hydro, PV, and solar fridge/freezer initiatives. Donors will be kept abreast of project activities, as relevant. Particularly, village off-grid RE power generation management model of the project will be shared with the donor projects pursing village-scale RE power installations, where the model may also provide a solution to the sustainability problem that highly concerns all donors working in this area. Further, the PV sourcing work of the project will be an important to VREP (as plug-and-play systems sold so far as a part of VREP have far exceeded	Yes (3)	No (1)

international norms in price – by over 100 %), so the project will keep in close touch with VREP on findings and next steps. Further, the work on ensuring PV system parts availability in the islands will contribute to the sustainability of VREP as will the work on a system for disposal of PV waste. As such, the project will work to engage VREP closely in this work. As for work with the Department of Water Resources in integrating gravity feed water supply projects with pico-hydro systems, the project will engage the New Zealand High Commission, UNICEF, and the Red Cross in discussions vis-à-vis their support of water supply projects in Vanuatu. The project will engage ChinaAid in discussions about possible additional tailor-made training for Vanuatu and additional sourcing/ cost assessment support in areas of strong Chinese expertise, particularly pico-/ small micro-hydro. As a part of Outcome 4A, the project will assist NGEF in reaching out to other donors (including those not yet active in Vanuatu) about potential funding replication of BRANTV demos via NGEF.		
16. Is the budget justified and supported with valid estimates? • **3:** The project's budget is at the activity level with funding sources, and is specified for the duration of the project period in a multi-year budget. Costs are supported with valid estimates using benchmarks from similar projects or activities. Cost implications from inflation and foreign exchange exposure have been estimated and incorporated in the budget. • **2:** The project's budget is at the activity level with funding sources, when possible, and is specified for the duration of the project in a multi-year budget. Costs are supported with valid estimates based on prevailing rates. • **1:** The project's budget is not specified at the activity level, and/or may not be captured in a multi-year budget. Evidence: The project document contains a total budget and work plan with clearly identified funding sources for each outcome (equivalent to ATLAS activity). Costs are supported with valid estimates using benchmarks from similar projects or activities. Cost implications from inflation and foreign exchange exposure have been estimated and incorporated in the budget.	3	2 1 **Evidence** See notes
17. Is the Country Office fully recovering the costs involved with project implementation? • **3:** The budget fully covers all project costs that are attributable to the project, including programme management and development effectiveness services related to strategic country programme planning, quality assurance, pipeline development, policy advocacy services, finance, procurement, human resources, administration, issuance of contracts, security, travel, assets, general services, information and communications based on full costing in accordance with prevailing UNDP policies (i.e., UPL, LPL.) • **2:** The budget covers significant project costs that are attributable to the project based on prevailing UNDP policies (i.e., UPL, LPL) as relevant. • **1:** The budget does not adequately cover project costs that are attributable to the project, and UNDP is cross-subsidizing the project. *Note: Management Action must be given for a score of 1. The budget must be revised to fully reflect the costs of implementation before the project commences. Evidence: The budget fully covers all project costs that are attributable to the project. The role of UNDP in providing implementation support has been predicted and budgeted for. The commitment that will operationalize this is the *Letter of Agreement (LoA)* between UNDP and Government of Vanuatu for the provision of support services. The LoA template is also contained in the project document.	3	2 1 **Evidence** See notes
EFFECTIVE		
18. Is the chosen implementation modality most appropriate? (select from options 1-3 that best reflects this project): • **3:** The required implementing partner assessments (capacity assessment, HACT micro assessment) have been conducted, and there is evidence that options for implementation modalities have been thoroughly considered. There is a strong justification for choosing the selected modality, based on the development context. *(both must be true to select this option)*	3	2 1 **Evidence** This is being planned

• **2:** The required implementing partner assessments (capacity assessment, HACT micro assessment) have been conducted and the implementation modality chosen is consistent with the results of the assessments. • **1:** The required assessments have not been conducted, but there may be evidence that options for implementation modalities have been considered. *Note: Management Action or strong management justification must be given for a score of 1	for April 2018.
19. Have targeted groups, prioritizing marginalized and excluded populations that will be affected by the project, been engaged in the design of the project in a way that addresses any underlying causes of exclusion and discrimination? • 3: Credible evidence that all targeted groups, prioritising marginalized and excluded populations that will be involved in or affected by the project, have been actively engaged in the design of the project. Their views, rights and any constraints have been analysed and incorporated into the root cause analysis of the theory of change which seeks to address any underlying causes of exclusion and discrimination and the selection of project interventions. • 2: Some evidence that key targeted groups, prioritising marginalized and excluded populations that will be involved in the project, have been engaged in the design of the project. Some evidence that their views, rights and any constraints have been analysed and incorporated into the root cause analysis of the theory of change and the selection of project interventions. • 1: No evidence of engagement with marginalized and excluded populations that will be involved in the project during project design. No evidence that the views, rights and constraints of populations have been incorporated into the project. Evidence: As previously stated, the target groups (i.e. local villagers and indigenous people, women, and other marginalized groups in the villages) were consulted and engaged during the PPG hence, feature strongly in the overall stakeholder and communications plan (Annex 14) of the project. The project design approach was inclusive with special emphasis on the needs of communities and remote populations (including the disadvantaged families, etc.) in the rural areas. Social and economic activities that require energy as a basic input were considered e.g. for education, communications, housing development, livelihood, domestic household requirements, recreation and other basic human needs.	3 2 1 **Evidence**
20. Does the project conduct regular monitoring activities, have explicit plans for evaluation, and include other lesson learning (e.g. through After Action Reviews or Lessons Learned Workshops), timed to inform course corrections if needed during project implementation? Evidence: The project team will conduct annual monitoring of the indicators in the Project Results Framework. The project will also have a mid-term review and terminal evaluation, as well as mid-term and end-of-project updates of the CCM tracking tool. There will be special activities to carry out more in-depth monitoring and reporting on the project demos. The project's low carbon information exchange will provide access to project documents and project learnings via its website.	Yes (3) / No (1)
21. The gender marker for all project outputs are scored at GEN2 or GEN3, indicating that gender has been fully mainstreamed into all project outputs at a minimum. *Note: Management Action or strong management justification must be given for a score of "no" Evidence: The stakeholder engagement and communications plan of the project document states that women in rural Vanuatu often do much of the work and particularly the volunteer work associated with donor projects. At the same time, they often have less opportunity than men for increasing their income and educational level. The project will put special emphasis on the involvement of women in village community meetings with the project, ensuring that 50% of participants (or at least decision-making participants) at such meetings are women. The project will also proactively seek the involvement of women in productive use initiatives, assuring that 50% of project funds for productive uses go to initiatives mainly involving women.	Yes (3) / No (1) **Evidence**
22. Is there a realistic multi-year work plan and budget to ensure outputs are delivered on time and within allotted	3 2 1

resources? (select from options 1-3 that best reflects this project): • **3:** The project has a realistic work plan & budget covering the duration of the project *at the activity* level to ensure outputs are delivered on time and within the allotted resources. • **2:** The project has a work plan & budget covering the duration of the project at the output level. • **1:** The project does not yet have a work plan & budget covering the duration of the project. Evidence: The project document contains a realistic multi-year workplan that is set at activity level while the budget is set at the outcome level.	**Evidence**
SUSTAINABILITY & NATIONAL OWNERSHIP	
23. Have national partners led, or proactively engaged in, the design of the project? (select from options 1-3 that best reflects this project): • **3:** National partners have full ownership of the project and led the process of the development of the project jointly with UNDP. • **2:** The project has been developed by UNDP in close consultation with national partners. • **1:** The project has been developed by UNDP with limited or no engagement with national partners. Evidence: National partners were consulted during all formulation missions throughout the PPG. Although representatives from the implementing partner were consistently engaged, the process was still led by UNDP via the UNDP-consultants.	3 2 1 **Evidence**
24. Are key institutions and systems identified, and is there a strategy for strengthening specific/ comprehensive capacities based on capacity assessments conducted? (select from options 0-4 that best reflects this project): • **3:** The project has a comprehensive strategy for strengthening specific capacities of national institutions based on a systematic and detailed capacity assessment that has been completed. This strategy includes an approach to regularly monitor national capacities using clear indicators and rigorous methods of data collection, and adjust the strategy to strengthen national capacities accordingly. • **2.5:** A capacity assessment has been completed. The project document has identified activities that will be undertaken to strengthen capacity of national institutions, but these activities are not part of a comprehensive strategy to monitor and strengthen national capacities. • **2:** A capacity assessment is planned after the start of the project. There are plans to develop a strategy to strengthen specific capacities of national institutions based on the results of the capacity assessment. • **1.5:** There is mention in the project document of capacities of national institutions to be strengthened through the project, but no capacity assessments or specific strategy development are planned. • **1:** Capacity assessments have not been carried out and are not foreseen. There is no strategy for strengthening specific capacities of national institutions.	3 2.5 2 1.5 1 **Evidence**
25. Is there is a clear strategy embedded in the project specifying how the project will use national systems (i.e., procurement, monitoring, evaluations, etc.,) to the extent possible? Evidence: The BRANTV Project is national in scope and therefore includes and involves many national systems and coordination mechanisms for its activities and outputs, particularly in: awareness raising, training, policy-making and regulatory enforcement, RE/EE equipment procurement, monitoring and evaluation (adherence to the GHG emissions reduction goal i.e. 6,085.6 tons CO_2 by mid-term and 45,051.2 tons CO_2), capacity development in rural communities, information dissemination, and resource budgeting. Further, the Project Document describes how the full-time project team will work with permanent DOE staff and be based within the two DOE offices (the main Port Vila Office and the newly set up one in Luganville, which will serve as the Northern Island RE and EE Promotion Center.	Yes (3) / No (1)
26. Is there a clear transition arrangement/ phase-out plan developed with key stakeholders to sustain or scale up results (including resource mobilization strategy)? Evidence: The BRANTV project is designed to enable the achievement of the energy access, sustainable energy, and green growth targets of Vanuatu. The enabling conditions are created through the adoption of supportive policies/regulations and institutional mechanisms to facilitate the widespread applications of EE and RE technologies in the residential and	Yes (3) / No (1)

public sectors in Vanuatu to help ensure sustainability of these systems and frameworks that will be established. A suitable follow-up action plan will be developed for approval and enforcement after project completion. The project design represents the aim to design a sustainable management system for off-grid RE systems that has the buy-in of key decision makers. The system will ensure funds from electricity payments are set aside for repairs/ parts needed in the future. Further, the project design includes activities to stimulate replication of the project demos and financing thereof, with DOE working in conjunction with other government departments to identify sites and with the project team/ DOE working with NGEF and the private/ commercial sector to mobilize funds for replication.		

Annex 10: UNDP Risk Log

OFFLINE RISK LOG

Project Title: Barrier Removal for Achieving the NERM Targets of Vanuatu (BRANTV)	Project ID: 00101357	Date: February 2018

#	Description	Date identified	Type	Probability & Impact	Countermeasures / Management Response	Owner	Submitted, updated by	Last Update	Status
1	Natural disasters, frequent in Vanuatu, will destroy installed off-grid RE power system demos of the project.	July 2016	Environ -mental	Project will fail to achieve critical aim of demonstrating long-term sustainability of off-grid RE power systems in Vanuatu. P=1, I=4, significance= moderate	Requirements for project's off-grid RE power demo design work will explicitly include incorporation of natural disaster risk mitigation measures.	PMU	Project Dev't Team	Feb. 2018	Reducing (due to incorporation of mitigation into design)
2	Diversion of water for pico-/small micro-hydro demos will negatively impact ecosystem and/or will impact other uses.	Feb. 2018	Environ mental and Social	Local ecosystem will be disturbed and/or social friction will ensue due to loss of availability of water for other economic uses, such as irrigation. P=1, I=3, significance= low	Limited social and environmental assessments will be conducted for these small systems to ensure such problems do not occur. If the assessments identify needed mitigation measures, the project will require such measures to be implemented before construction can begin.	PMU	Project Dev't Team	Feb. 2018	Reducing (due to requirement of social and environmental assessment)
3	The location of the demos and associated infrastructure could raise concerns from communities, if appropriate measures are not taken.	Feb 2018	Environ mental & Social	There will be some change in land usage due to the installation of pico-/ small micro-hydro mini-grids and village-scale community PV systems with battery station. I = 4, P = 1, significance = moderate	This risk will be assessed during the ESIAs and captured in the management measures of the ESMP as determined appropriate. FPIC will be applied throughout all project activities that involve indigenous communities.	PMU and DOE	Project Dev't Team	Feb 2018	Reducing (due to incorporation of mitigation into design)
4	Construction safety	Feb	Environ	I = 2, P = 4, significance =	Project ESMP and its constituent,	PMU	Project	Feb	Reducing (due

	risks exist to communities and workers associated with the project demos. Further, risks to artisans may occur in their fabrication of EE cook stoves. As for risks to the community, the transmission of electric power of all types of the RE power generation demos present risks to the community	2018	mental and Social	moderate	limited, site-specific ESIA for each of the demos will address these safety risks and determine mitigation and management measures to be adopted. Training to local rural electricians prior to installation will be provided so that they can become certified in electric wiring and master associated safety skills. Most wires will be buried underground as a precaution to address both the potential for natural disaster and safety issues. Relevant safety training will be provided to communities and thus will minimize or avoid any community health risks and safety issues about construction work, installed systems, or discarded batteries. Project will develop institutions and policies for the safe disposal of PV batteries, panels, and other parts and support implementation of safe disposal systems.		Dev't Team	2018	to requirement of social and environmental assessment)
5	Construction of demo projects will generate wastes. Further, PV system parts and cook stove parts will be abandoned after their useful lifetime.	Feb. 2018	Environ -mental	Toxic wastes from lithium ion and lead acid batteries and PV panels will get into water systems and affect aquatic life. Cook stove parts will liter the environment and not be recycled. P=2, I=3, significance= moderate	Project will ensure proper disposal of wastes from construction of RE demos and of waste of batteries, PV panels, and EE cook stoves at end of life. Disposal plans will be one of the requirements of the limited site-specific ESIAs that will be conducted for each of the demos and be constituents of the project's ESMP. Project will devise institutional system and policies for dealing with PV waste, not only from the project but for the entire nation. Project will support implementation of these. Limited environmental and social	PMU, Dept. of Environ ment, DOE	Project Dev't Team	Feb. 2018	Reducing (due to plans for dealing with PV system waste and due to requirement of social and environ-mental assessment)

					assessment for cook stove demos will assess how to deal with cook stove waste disposal/ recycling once a product's useful lifetime ends.				
6	Income-generating activities (freezers for fishermen and cook stove construction) could be done in an unsustainable manner if appropriate measures are not taken.	Feb 2018	Environmental	I = 4, P = 1, significance = moderate	This risk will be assessed during the ESIAs and captured in the management measures of the ESMP as determined appropriate.	PMU, MCT	Project Dev't Team	Feb 2018	Reducing (due to requirement of social and environmental assessment)
7	Project will reinforce ongoing problems in Vanuatu of lack of opportunity for women and other marginalized groups.	Feb. 2018	Social	Project opportunities and benefits will flow mainly to men and to households which are relatively well off, this falling short of UN priority to empower the marginalized. P=2, I=3, significance= moderate	Project will require that certain targets are met in terms of the participation of women and marginalized groups in decision-making and will also require that at least half of funds for productive uses are allocated to initiatives mainly involving women.	PMU, DOE	Project Dev't Team	Feb. 2018	Reducing (due to plans to address issue by project targets for involving these groups)
8	Demos will be established on lands of indigenous people against their will.	Feb. 2018	Social	Project demos are likely to be destroyed/ vandalized due to indigenous people having been deprived of their rights. P=1, I=4, significance= moderate	Project will carry out FPIC (Free Prior and Informed Consent) processes to ensure that proper consultation and agreement of indigenous people occurs before any demos are established. Further, project, working with DOE, will institute a process for reporting grievances.	PMU, DOE	Project Dev't Team	Feb. 2018	Reducing (due to plans for FPIC and grievance reporting mechanism)
9	Off-grid RE power systems supported by project will lack the funds to carry out repairs and purchase new parts as needed.	Feb. 2018	Financial	Project demos will be left inoperable and in disrepair and project will not achieve one of its central priorities of overcoming historical lack of sustainability of village power systems in	Project will design management mechanism for village off-grid RE systems and build consensus among officials for the system, which will prioritize fee collection and saving of a portion of revenues for repairs and parts. Successful demonstration of the	PMU, DOE	Project Dev't Team	Feb. 2018	Reducing (due to plans for introducing effective off-grid village RE power management

				Vanuatu. P=3, I=4, significance= high	sustainable management mechanism will encourage previously discouraged stakeholders to promote replication of the BRANTV demos.				system)
10	High cost of transport between islands will not allow regular access to project sites for project monitoring purposes.	July 2016	Financial	The project's large number of small demos will not be realizable due to lack of visits by the project team and relevant consultants. P=1, I=4, significance= moderate	Project will address the transport cost issue in two ways: First, DOE will co-finance a northern office and the project team and some DOE staff will be based there much of the time, cutting costs for visits to northern sites, which predominate among demo sites. Second, the project will train and engage two to three local, rural electricians on four key islands where there are demos to assist in monitoring the demos and guiding their development, as a means both of cutting travel costs and raising local capacity to promote sustainability.	PMU, DOE	Project Dev't Team	Feb. 2018	Reducing (due to plans for northern office and trained local electricians on four main islands of the project)
11	Inadequate local capacity will result in lack of national experts to fill national roles, lack of personnel to operate demos, and lack of effective project management.	July 2016	Operational	The project's demos and other activities will not be implemented due to lack of project management capacity, lack of national consultants, and lack of technical skills on the islands. P-1, I=4, significance= moderate	Project will engage a project team of three full-time staff, two of which will be actively engaged in national consultant roles much of the time (engaged in roll-out of the project demos, etc.), thus addressing the challenge of recruiting qualified national consultants in Vanuatu. This substantial project team, which will be led by a highly experienced project manager, will also ensure that project management is strong. Lastly, the project will provide training to a select group of local persons on the islands so that they can serve as operators for the off-grid village RE power systems.	UNDP, DOE	Project Dev't Team	Feb. 2018	Reducing (due to strategy of developing a strong team of three full-time PMO staff and strategy of training local operators)
12	Lack of political will and coordination among government	July 2016	Political, Organizational,	Without policy and planning support going into the future, project results will be less likely to replicated	Project has specific activities to promote institutional coordination. Further, project combines demonstration of financial, technical,	DOE UNDP	Project Dev't Team	Feb. 2018	No change

	departments will result in RE and EE policies, plans, standards, and guidelines either not being adopted or not being effectively implemented.		and Regula-tory	and, if replicated, less likely to be successful due to lack of standards and guidelines. P=4, I=2, significance= moderate	and management system viability with such policy work, so that decision-makers will be encouraged by the positive results they see to continue promoting RE and EE.				
13	Lack of capacity in marketing and promotion will result in lack of knowledge across the country about fair prices and preferred sourcing channels for RE systems, successes with the RE demos, and the availability and benefits of EE cook stoves.	Feb. 2018	Strategi c	Without strong marketing and promotion on costing of systems and success of demos, "demand pull" for such systems will remain limited so that replication will be weak. P=2, I=4, significance= moderate	Project allocates specific funds for awareness raising to mitigate this risk. For the EE cook stoves, the project also allocates substantial funding for a "road show," so that the EE cook stoves can be taken from village to village for demonstration.	PMU	Project Dev't Team	Feb. 2018	Reducing (due to the design of specific awareness raising and road show activities)
14	Unsuccessful productive use initiatives will result in lack expected of income generation.	Feb. 2018	Financi al	Without strong income generation from productive uses, project's intended "business model" for RE power generation will fail. That is, productive uses will not generate strong revenues for the RE power systems that can in turn be used to ensure their sustainability through funds set aside for maintenance and repairs. P=3, I=3, significance= moderate	Project will develop coordination between DOE and departments in the productive sectors to identify promising productive uses in various locations. Further, project will have specific activities to design the productive uses, which will be selected via consultation with local communities and business advising by the project. Business advising will ensure that products have a good potential market and that business plans are viable.	PMU	Project Dev't Team	Feb. 2018	Reducing (due to the design of coordination between DOE and departments in the productive sectors and plans for advising of communities on markets and business plan viability)

Annex 11. Capacity Assessment of Implementing Partner

Micro HACT Assessment of the Department of Energy, Ministry of Climate Change

Background

The micro assessment is part of the requirements under the Harmonized Approach to Cash Transfers (HACT) Framework. The HACT framework represents a common operational framework for UN agencies' transfer of cash to government and non-governmental implementing partners. The micro-assessment assesses the implementing partner's control framework. It results in a risk rating (low, moderate, significant or high). The overall risk rating is used by the UN agencies, along with other available information (e.g. history of engagement with the agency and previous assurance results), to determine the type and frequency of assurance activities as per each agency's guideline and can be taken into consideration when selecting the appropriate cash transfer modality for an implementing partner.

Scope

The micro-assessment for the BRANTV Project provides an overall assessment of the Department of Energy's programme, financial and operations management policies, procedures, systems and internal controls. It includes:

- A review of the Department of Energy's legal status, governance structures and financial viability, programme management, organizational structure and staffing, accounting policies and procedures, fixed assets and inventory, financial reporting and monitoring, and procurement; and
- A focus on compliance with policies, procedures, regulations and institutional arrangements that are issued both by the Government and the Department of Energy.

It considers results of any previous audits and micro assessments conducted of the Department of Energy.

Methodology

The HACT micro-assessment will be conducted by an independent audit firm. Through discussion with management, observation and walk-through tests of transactions, the assessment is made on the Department of Energy's related internal control system with emphasis on:

- The effectiveness of the systems in providing the Department of Energy's management with accurate and timely information for management of funds and assets in accordance with work plans and agreements with the United Nations agencies; and
- The general effectiveness of the internal control system in protecting the assets and resources of the Department of Energy.

The results of the micro-assessment are discussed with applicable UNDP personnel and the Department of Energy prior to finalization of the report. The assessment uses a consultative approach and includes interviews with key personnel.

Timeframe

The HACT micro-assessment of the Department of Energy, as implementing partner for the BRANTV Project, will be undertaken in March and completed by April 2018.

Annex 12. Letter of Agreement between UNDP and Government of Vanuatu for the Provision of Support Services

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Project Title "**Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV)**"

PIMS # TBD, Project ID: TBD, Output ID: TBD

Excellency,

1. Reference is made to consultations between officials of the Government of ***Vanuatu*** (hereinafter referred to as "the Government") and officials of UNDP with respect to the provision of support services by the UNDP country office for nationally managed programmes and projects. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution designated in the relevant programme support document or project document, as described below.

2. The UNDP country office may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP country office shall ensure that the capacity of the Government-designated institution is strengthened to enable it to carry out such activities directly. The costs incurred by the UNDP country office in providing such support services shall be recovered from the administrative budget of the office.

3. The UNDP country office may provide, at the request of the designated institution, the following support services for the activities of the programme/project:

(a) Identification and/or recruitment of project and programme personnel;
(b) Identification and facilitation of training activities;
(c) Procurement of goods and services.

4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies and procedures. Support services described in paragraph 3 above shall be detailed in an annex to the programme support document or project document, in the form provided in the Attachment hereto. If the requirements for support services by the country office change during the life of a programme or project, the annex to the programme support document or project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.

5. The relevant provisions of the Standard Basic Assistance Agreement (SBAA) between the Authorities of the Government of ***Vanuatu*** and the United Nations Development Programme (UNDP), signed by the Parties on July 18, 2008 (the "SBAA") including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its designated institution. The responsibility of the UNDP country office for the provision of the support services described herein shall be limited to the provision of such support services detailed in the annex to the programme support document or project document.

6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

7. The manner and method of cost-recovery by the UNDP country office in providing the support services described in paragraph 3 above shall be specified in the annex to the programme support document or project document.

8. The UNDP country office shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

_____

Signed on behalf of UNDP
Mr. Bakhodir Burkhanov
Country Director
Date:

_____

For the Government of *Vanuatu*
Mr. Benjamin Jesse,
Director-General, Department of Energy
Ministry of Climate Change and Natural Disaster
Government of Vanuatu
Date:

Attachment: Description of UNDP Country Office Support Services

1. Reference is made to consultations between the Ministry of Climate Change and Natural Disaster, the institution designated by the Government of ***Vanuatu***, and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed programme or project "**Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV)"** (PIMS # 5926, Project ID: 00099978, Output ID: 00103158)

2. In accordance with the provisions of the letter of agreement signed and the programme support document (*project document*), the UNDP country office shall provide support services for the Programme as described below.

3. Support services to be provided:

Support services	**Schedule for the provision of the support services**	**Cost to UNDP of providing such support services (where appropriate)**	**Amount and method of reimbursement of UNDP (where appropriate)**
1. Support MOCC in the identification and/or recruitment of project personnel * Project Coordinator * Finance Officer	January – March 2019	As per the UPL: US$ 893.96 per case, including recurring cost after hire (i.e. payments)	Should be approved by the Project Board; then UNDP will directly charge the project upon receipt of request of services from the Implementing Partner/Project Board
2. Procurement of goods: * Data show * PCs * Printers	January – March 2019	As per the UPL: US$ 706.11 for each purchasing process	As above
3. Procurement of Services Contractual services for companies	Ongoing throughout implementation when applicable	As per the UPL: US$ 327.53 each hiring	As above
4. Payment Process	Ongoing throughout implementation when applicable	As per the UPL: US$ 30.64 for each	As above
5. Staff HR & Benefits Administration & Management	Ongoing throughout implementation when applicable	N/A	N/A
6. Recurrent personnel management services: Staff Payroll & Banking Administration & Management	Ongoing throughout implementation when applicable	N/A	N/A
7. Ticket request (booking, purchase)	Ongoing throughout implementation when	As per the UPL: US$ 28.91 for each	As above

Support services	Schedule for the provision of the support services	Cost to UNDP of providing such support services (where appropriate)	Amount and method of reimbursement of UNDP (where appropriate)
	applicable		
8. F10 settlement	Ongoing throughout implementation when applicable	As per the UPL: US$ 29.20 for each	As above
9. Support Implementing Partner in conducting workshops and training events	Ongoing throughout implementation when applicable	As per the UPL: US$ 23.44 per day (for preparation and during workshop)	As above
		Total DPC: up to USD 15,000 from GEF grant	

4. Description of functions and responsibilities of the parties involved:

UNDP will conduct the full process while the role of the Implementing Partner (IP) will be as follows:

- The Implementing Partner will send a timetable for services requested annually/ updated quarterly
- The Implementing Partner will send the request to UNDP for the services enclosing the specifications or Terms of Reference required
- For the hiring staff process: the IP representatives will be on the interview panel,
- For Hiring CV: the IP representatives will be on the interview panel, or participate in CV review in case an interview is not scheduled.

Annex 13. List of Organizations and Persons Consulted during Project Design

I. National Government

1. Department of Energy – Director: Antony Garae
2. Electrification Division, Department of Energy - Matthew Tasale, Manager, Electrification
3. Energy Efficiency Division, Department of Energy - Joseph Temakon, Principal Scientific Officer for Energy Efficiency, and Willie Obed, Project Manager, Energy Efficiency
4. Finance Division – Hellen Wilson Tom, Manager, Finance
5. Rural Electrification, Electrification Division, Department of Energy - Chris Simelum, Principal Scientific Officer for Rural Electrification
6. National Advisory Board for Climate Change - Anna Bule, Secretariat Manager
7. Utility Regulatory Authority - Dr. Hasso Bhatia, Director, Davidson, and one other colleague
8. Department of Strategy, Policy, Planning and Aid Coordination (DSPPAC) - Gregoir Nimbtik, Director
9. Department of Tourism - Jerry Spooner, Principle Accreditation Officer
10. Ministry of Finance - Tony Sewen, Director, Finance and Treasury, Ministry of Finance
11. Ministry of Climate Change and Natural Disaster – Jesse Benjamin, Director General

II. Donor and Donor Projects

1. GGGI - Paul Kaun, Vanuatu Program Head
2. JICA - Yoko Asano, Project Formulation Advisor, JICA Vanuatu Office, and Ini Tabiaga, JICA Vanuatu Office
3. Vanuatu Rural Electrification Program (VREP, project of World Bank supported by New Zealand), Leith Veremaito, Program Manager
4. World Bank - Leisande Otto, Liaison Officer
5. Asian Development Bank Extended Mission in Vanuatu - Nancy Wells, Senior Country Coordination Officer
6. EU-GIZ Project - Japeth Jacob, DOE team member; and Osborne Melenami, GIZ project staff
7. New Zealand High Commission - Simon Donald, Second Secretary
8. UNDP-GEF Small Grants - Leah Nimoho, Head of UNDP-GEF Small Grants for Vanuatu
9. GBOPA Project (project of World Bank) - Tony Harris, Project Manager
10. GIZ - Henry Vira, National Coordinator
11. Bilateral Cooperation, China Ministry of Commerce (at Chinese Embassy, Vanuatu) – Ms. Chen Ruhua and Mr. Song

III. Commercial and Private Sector

1. UNELCO - David Lefevre, General Manager
2. PCS - Belinda Strid, General Manager
3. QBE Insurance - Jason Thomas, General Manager
4. Village Infrastructure Angels (VIA) - Stewart Craine, Managing Director (via Skype), Paul Hannon, Vanuatu Country Manager, and one other colleague
5. VUI - Peter Allen, General Manager (via Skype)
6. Switched On Services - Adam Chamberlain, Managing Director, and Chris
7. Rapid Electrical - Mr. Salim Buksh, Sales and Warehouse Manager
8. Bank of South Pacific - Stuart Beren, General Manager
9. GreenTech - Eric Kerres, Manager
10. Savvy Solar - Charlie Davies, Co-owner
11. National Bank of Vanuatu - John Aruhuri, Head of Rural Banking Services
12. E-Tech, Sashi Singh, General Manager
13. Digicel - Sajjad Ahmed, Chief Technical Officer

IV. Other Experts

1. Dr. Herb Wade, Expert on Rural Electrification (via Skype)
2. Gilbert Gibson, Energy Efficient Cook Stove Expert and Artisan based in Port Vila

V. Stakeholders based in Tanna

1. Epil Mae – Village Chief Tom, his grandson John, and other family members
2. Isaka Village – various women community members in joint focus group meeting, second chief of village, husband-wife bungalow proprietors (one of which has served as consultant to development projects)
3. Iquaramanu Village (at foot of Mount Malin) – Tom, a villager
4. Yatokuri Village, Port Resolution – staff member of women's center, and Thomas Wane, Principal, Port Resolution Primary School (also second to chief of Sulfur Bay)
5. Imaki Village, various villagers (including seasonal workers to New Zealand)
6. Lenakel (administrative center of Tanna) – government employee regarding situation of water and power in villages; Wilson and Evelyne, proprietors of guest house, regarding hydro resources on Tanna and PV situation in various villages in Tanna

VI. Stakeholders based in Pentecost

1. Pango Village – leaders and other villagers
2. Melsissi Catholic Mission - Father Jotto Kenny Malatu, Head of Mission
3. Waterfall Village – proprietor of Noda Guest House, who is from Waterfall Village
4. Bwatnapni Village - Father Godrington, Father in the Anglican Church and Chairman of the Community, and Jim Basi, Secondary School Principal and Physics Teacher
5. Nambarut Village - Tony Tevi, Chairman of the Ward Council
6. Loltong Village – Matthew Bule, Chairman of Village Committee
7. Latana Catholic Mission and associated village (neighbors Loltong) – son of chief
8. Abatumtora - Ben, Pastor
9. Angoro Village and associated commercial center – two National Bank of Vanuatu staff; women sewing in nearby women's center

VII. Stakeholders based in Santo

1. Northern District Hospital (Luganville) – Chief Engineer; person from finance department
2. VUI head office (Luganville) – Olivier and one other colleague responsible for customer service
3. Millennium School Project –one person resident at site
4. Belu Shop (which has wind hybrid PV system) – one of the owners
5. Kole Village – local villagers
6. Lathi Village – Chief Danston
7. Lori Village – Chief Francisco
8. Hog's Harbor – staff person of cooperative
9. Bodmas – village chief and other villagers
10. Falambil Village – George Nafook, Chief, as well as other villagers
11. Lape River - Reuben Bu, resident of Lape Village

VIII. Stakeholders based in Gaua

1. Nemen Village – community members (via community meeting)
2. Aworor Village – teacher from primary school and George, entrepreneur who owns hotel near airport and owns relevant land on stream that may be used as resource for one of the proposed pico-/ small micro-hydro stations
3. Siriti Village – Acting Chief John

4. Villages near airport – Roy, local entrepreneur and driver who trained recently in China, and Linda (responsible for local water supply projects), Red Cross

IX. Stakeholders based in Efate other than in Port Vila

1. Epau Village – various villagers involved in EE cook stove focus group, including woman with JICA PV system still operational and Chairperson of India PV project; Lena/ Rebeca Spetall, "Solar Mama" handling repairs for India PV project

Annex 14. Stakeholder Engagement/ Communications Plan

The various elements of the project's stakeholder engagement and communication plan are woven throughout the project's components and activities as described in the main text of this document. This annex consolidates these various elements of the stakeholder engagement and communication plan in one place, so that the reader can get a comprehensive picture of how the project will engage and communicate with various types of stakeholders. It builds on Section IV-ii of the main text of this document, which presents the project's partners and relevant projects of other donors, and Section IV-iii, which discusses stakeholder engagement.

Exhibit 14-1 below shows the stakeholder engagement aspects of the plan. It lists and briefly describes the relevant stakeholders in the first column. In the second column, it explains the plan for engaging the stakeholders in the project.

14-1. Stakeholder Engagement Plan: Stakeholder Descriptions and Means of Engagement

Stakeholder Group or Organization	Means of Engagement
Department of Energy, Ministry of Climate Change and Natural Disaster (DOE-MCCND): The DOE is responsible for overseeing Vanuatu's energy development and issuing relevant policies and plans. DOE is engaged in the implementation of several donor projects related to energy access, renewable energy, and energy efficiency. MCCND, in turn, is the ministry overseeing the work of DOE.	As the ministry overseeing the work of DOE, the implementing partner (IP) of the proposed project, MCCND will lead the Project Steering Committee (Project Board). DOE, in turn, will be a key member of the project board work closely with the project team to ensure the project is well-implemented. The NPD will be a DOE official. A few key DOE staff will work side-by-side with the project team on many aspects of implementation, particularly policy-related aspects, institutional aspects, and demo implementation and monitoring aspects. DOE is both the proposed project's key partner and its willing target of influence. That is, not only has DOE proposed this project, it will also be the organization targeted to develop the proposed plans and policies and promote these to the wider government for adoption. Ensuring DOE's high level of engagement, DOE was instrumentally involved in both two PPG missions; and the content of the project document largely reflects ideas generated by the DOE team based on the gaps they are seeing in the energy landscape in their nation regarding achieving their National Energy Roadmap (NERM) Targets.
National Government Departments in the Productive Sectors: In Vanuatu, these include Department of Cooperatives, Department of Agriculture, Department of Livestock, Department of Fisheries, and Department of Tourism	The project will engage these departments in cooperating with DOE for identifying promising productive uses of renewable energy and energy efficiency applications in rural areas through a two-step process. The first step will consist of meetings between DOE and these departments to brainstorm and identify promising productive uses of RE and EE. The second step will be to jointly identify villages that are particularly promising for combining new RE power or EE crop drying capabilities with such productive uses and jointly implementing plans thereby developed. Based on the foregoing type of early-stage cooperation, the project will further strive to develop a long-term coordination mechanism for this work and engage these parties in signing relevant MOUs on such coordination. In addition to productive use oriented cooperation, the project and DOE will engage some of these departments, particularly the Department of Cooperatives, in its work to develop a viable business model for management of village-scale off-grid RE system. The model should include the three elements of fee collection, engaging and paying a local system operator, and saving funds for future repairs and parts. Having a national level organization involved to ensure that funds saved

	for repairs and parts are not diverted to other uses will be important; and it is possible that Department of Cooperatives or some other organization in the productive sector will play that role.
Water Resources Department: Responsible for overseeing water supply provision in Vanuatu. The Water Resources Department is working with donors, such as the New Zealand High Commission, in developing water supply projects in rural areas, some of which are gravity drop water feed.	The project will engage the Water Resources Department (WRD) in discussions with DOE on the potential to combine gravity drop water supply systems with pico-hydro power generation systems. In addition to stimulating a general discussion, the project will also aim to engage WRD to work with DOE in identifying actual sites for such hybrid systems.
Department of Forestry: Responsible for overseeing the forestry sector in Vanuatu.	The project will engage Department of Forestry and other relevant departments in cooperation with DOE in identifying priority sites for EE cook stove and EE crop dryer dissemination, as well as in actual promotion of these technologies once the sites are identified.
Department of Environment: Responsible for overseeing environmental protection initiatives in Vanuatu.	The project will engage Department of Environment in discussion regarding policy, institutional mechanism, and implementation for a plan to ensure that PV related wastes are disposed of nationwide in a way that does not endanger the health of the natural environment.
Private sector technical and equipment companies: Includes several PV equipment suppliers in the country as well companies that may be interested in becoming suppliers for pico-/ small micro-hydro related equipment. Also, includes service providers (such as firms that include PV installation in their scope)	Such firms will be invited to be involved in the project both as learners and as bidders for demo project calls for procurement. The project will offer high level trainings in both the pico-/small micro-hydro area and the PV area. The project will be conducting work in identifying best cost channels for sourcing quality projects and providing expected cost breakdowns for overall systems (including parts and labor). Local suppliers will be welcome to leverage this information to improve their sourcing of products and thus can offer products in Vanuatu at a lower price. For products not already supplied in Vanuatu, such as quality pico-hydro equipment, the project will be conducting outreach to potential suppliers about carrying inventory. Finally, the project will work with suppliers on developing means of ensuring that PV replacement parts (especially batteries) are available on the islands and that means of collecting PV related waste are also in place.
Commercial banks: In Vanuatu, these include National Bank of Vanuatu and Bank of South Pacific (BSP), among others.	The project will invite commercial banks to attend its capacity building program for the banks on the financing of RE and EE technologies. The project will (as part of its Outcome 4B) further reach out to the banks, who were first consulted during the PPG phase, regarding the development of financing mechanisms for loans to RE and EE projects – either by extending existing loan funds/ loan lines of business that they have or setting up new loan funds/ lines of business.
Private sector equity investors: These include organizations with capital to invest directly in multiple projects or companies.	Also as part of Outcome 4B, the project will reach out to private sector entities that are potential equity investors in RE and EE projects. The project will discuss with such entities the potential of setting up an equity fund for direct investments in RE and EE projects in Vanuatu.
Local business persons on the islands and in villages: These include local persons who have had some success with business in the past and have an interest in diversifying into new areas. It also includes local persons who may not have had such financial success in the past, but have ideas and a desire	The project will reach out to such persons about forming a local "RESCO," a company that is responsible for running a village-scale off-grid RE system, including daily technical operation and maintenance, billing and collection of fees, saving a portion of fees for repairs and parts, and commissioning repairs and parts replacement, as needed. Such a local RESCO could have the opportunity to manage one or more village-scale RE power systems in its area. The project will also reach out to such persons about pursuing businesses in the areas of productive use of the RE power generated or productive use of EE technologies, such as EE crop

to develop their own business.	dryers, in project demo villages. Further, later in the project, when the project team is promoting replication of the project demos, the project will contact such persons about the potential to develop replication projects and apply to NGEF and/ or to the private sector financing mechanism facilitated by the project for funding of such initiatives.
Engineers / high level technical persons: These will be persons with an education in engineering or extensive experience in technical trade. These persons will either already be involved in the RE sector or interested to get involved in PV and/or pico- / small micro-hydro.	The project will invite such person to participate in its high-level training on the design and installation pico-/ small micro mini-grids and pico-hydro PV mini-grids and in its high-level training on the design and installation of village-scale community PV systems.
Rural electricians: These are persons living in rural communities on the islands that, over time, have developed skills in electrical wiring and repairing electrical equipment.	The project will identify two to three such rural electricians on each of four islands: Pentecost, Santo, Gaua, and Tanna. The project will provide training for such persons both through its training programs and through special certified electrician training in Port Vila and Luganville, so that these persons can become certified. The project will further retain these persons to carry out project activities at the demo sites, including supervision of work, wiring and repairs, and teaching of courses on the islands on household-scale SHS and compound-scale PV nano-grid repair.
Artisans/ potential artisans: These will be persons that either have experience as artisans or are good with their hands and interested in taking up EE cook stove fabrication as a business. Some of these persons will be from key islands of the project (Pentecost, Santo, Gaua, and Tanna), while others will be based in Port Villa. The persons from the islands may be based at one of the ten village-scale community PV demo sites.	The project will train 30 such persons in the fabrication of EE cook stoves. Those that pass the mastery test and show strong interest in taking up this trade will be provided by the project with the necessary tools and equipment for EE cook stove fabrication.
Operators/ potential operators: Persons that are mechanically and electrically oriented and responsible, living in villages and with some available time for part-time work.	The project will select and train a few operators from each village at which there is a project demo. The operators will be paid for their part-time work, which will consist of: operating an off-grid village RE system, preparing bills and collecting payment, transferring funds to required account, troubleshooting basic technical problems, and notifying relevant parties of more significant technical problems.
Local villagers and indigenous people: These will include people in the project demo villages, both the village-scale off-grid power system villages and the villages in which EE cook stoves and EE crop dryers are promoted.	The project will put special emphasis on engagement of local villagers, many of whom are indigenous peoples. Already, during the PPG phase, the project has consulted extensively with local people in the demo villages regarding their interest in RE and EE systems, their willingness to volunteer labor and land as needed, and their ideas for productive uses. The project will during its early stages conduct limited environmental and social impact assessments at each of the 40 demo sites as part of its ESMP. The assessments will include in-depth consultation with local people. The work will include FPIC for indigenous peoples. The project will further carry out activities to confirm land availability (and consensus thereon) for demo projects as needed and to confirm continued willingness of local villagers to volunteer labor for demo installation. Lastly, the project will continue to consult local villagers and indigenous people regarding productive uses and how the project may assist them in starting or expanding their businesses with productive use of RE and EE.

Women: Women in rural Vanuatu often do much of the work and particularly the volunteer work associated with donor projects. At the same time, they often have less opportunity than men for increasing their income and educational level.	The project will put special emphasis on the involvement of women in village community meetings with the project, ensuring that 50% of participants (or at least decision making participants) at such meetings are women. The project will also proactively seek the involvement of women in productive use initiatives, assuring that 50% of project funds for productive uses go to initiatives mainly involving women.
Other marginalized groups in the villages: In addition to women, poorer families and the disabled are other marginalized groups in rural areas.	The project will put special emphasis on ensuring such groups are involved in community decision making meetings and are prioritized for opportunities with project productive use funds and, if viable, opportunities for operator roles.
Other donors/ donor projects and programs: Other donors involved in RE and EE in Vanuatu include the Asian Development Bank (ADB) and its 400 kW Brenwei hydro project, the World Bank and its VREP Phase 1 and 2 Project (which provides subsidies for plug-and-play PV, SHSs, institutional scale PV, and PV mini-grids), EU-GIZ (which has a solar freezer and biogas project), SPC (which has solar freezer and fridge project), GGGI (which has completed a solar fridge project and is assisting Vanuatu in setting up its NGEF), New Zealand High Commission (which is supporting VREP and also providing support with UNICEF in the area of water supply), IUCN and its 75 kW Talise micro-hydro project, JICA (which is likely to support 600 kW expansion of Sarakata hydro and which will be providing TA support in EE as well), and China Ministry of Commerce ("ChinaAid"), which provides training support in various areas related to RE.	The project will seek to engage other donors (both multi-lateral and bi-lateral) and relevant donor projects and programs via involving them in the inception workshop. Further the most relevant initiatives of donors make up the baseline of BRANTV. These include the hydro, PV, and solar fridge/freezer initiatives. Donors will be kept abreast of project activities, as relevant. Particularly, village off-grid RE power generation management model of the project will be shared with the donor projects pursing village-scale RE power installations, where the model may also provide a solution to the sustainability problem that highly concerns all donors working in this area. Further, the PV sourcing work of the project will be an important to VREP (as plug-and-play systems sold so far as a part of VREP have far exceeded international norms in price – by over 100 %), so the project will keep in close touch with VREP on findings and next steps. Further, the work on ensuring PV system parts availability in the islands will contribute to the sustainability of VREP as will the work on a system for disposal of PV waste. As such, the project will work to engage VREP closely in this work. As for work with the Department of Water Resources in integrating gravity feed water supply projects with pico-hydro systems, the project will engage the New Zealand High Commission, UNICEF, and the Red Cross in discussions vis-à-vis their support of water supply projects in Vanuatu. The project will engage ChinaAid in discussions about possible additional tailor-made training for Vanuatu and additional sourcing/ cost assessment support in areas of strong Chinese expertise, particularly pico-/ small micro-hydro. As a part of Outcome 4A, the project will assist NGEF in reaching out to other donors (including those not yet active in Vanuatu) about potential funding replication of BRANTV demos via NGEF.
Local NGOs: These will be those local NGOs active or interested in being active in RE, EE, and rural economic development. Vanwod, a micro-finance NGO, is particularly of interest to the project.	The project will invite various NGOs to the project inception workshop and from there determine their interest in participation in various project activities. The project will reach out to Vanwods during its work for Outcome 4B to see if there is a possibility of developing a finance mechanism with Vanwods for rural RE, EE, and/or productive use.
Other Countries: These will include countries in the South Pacific region that may benefit from the learnings of BRANTV.	Learnings of BRANTV will be disseminated to other countries that may benefit via UNDP offices in the region.

Exhibit 14-2 shows targets associated with the stakeholder engagement plan for selected stakeholder groups.

Exhibit 14-2. Targets Associated with Stakeholder Engagement Plan

Stakeholder Group	Indicator	Target
Department of Energy, Ministry of Climate Change and Natural Disaster (DOE-MCCND)	• Number of sets of new policies, guidelines, and standards issued by DOE for approval by higher authority • Number of DOE permanent staff person-visits to project demo sites to monitor or otherwise engage in the work being done • Number of villages in *Vanuatu Rural Electrification Plan* for which technology and configuration has been determined	11[66] 40 2000
National Government Departments in the Productive Sectors	• Number of meetings between DOE and various departments in the productive sectors regarding cooperation on productive use • Number of sites identified for RE/ productive use cooperation between DOE and departments in productive sectors • Number of meetings held between DOE and departments in the productive sectors regarding management model for off-grid RE power systems	>=15 >=20 >=5
Water Resources Department	• Number of sites identified for combined gravity feed water supply and pico-hydro development	>=20
Department of Forestry	• Number of priority villages at which DOE and Department of Forestry jointly pursue EE cook stove promotion	>=20
Department of Environment	• Number of islands on which new PV waste disposal system is comprehensively piloted	4
Private sector technical and equipment companies	• Number of such companies actively making use of sourcing and costing information provided by the project	5
Commercial banks	• Number of commercial bank personnel attending capacity building program for banks	20
Private sector equity investors	• Number of private sector equity investors approached by the project for involvement in direct investment financing mechanism	5
Local business persons on the islands and in villages	• Number of new productive use initiatives utilizing project's RE power generation or EE crop dryers at project demo sites	80
Engineers / high level technical persons	• Number of such persons completing high level technical training by the project	8
Rural electricians	• Number of rural electricians obtaining electrician certification because of training supported by the project	8
Artisans/ potential artisans	• Number of EE cook stove artisans passing mastery test after training course	15
Operators/ potential operators	• Number of potential operators trained	80
Local villagers and indigenous people	• Number of RE demo sites for which FPIC is completed and incorporated into project ESMP	40
Women	• Share of productive use funds that go to initiatives in which mainly women are involved	>=50%

In addition to engaging key stakeholder groups directly as outlined in Exhibit 14-1 and measured by indicators in Exhibit 14-2, the project will also emphasize strong communications with a broader range of

[66] 4 guidelines, 2 standards, and 5 regulations

stakeholders. Key elements of the project's communication strategy are outlined in Exhibit 14-3. The first column lists and describes the key elements of the communication strategy. That is, the mode of communications and content of the communications are summarized. The second column indicates the target groups for each element of the communications plan. The third and last column provides comments and indicators/ targets as relevant.

Exhibit 14-3. Project Communication Strategy

Key Element of Communication Strategy	Relevant Groups for Dissemination	Indicators/ Targets and Comments
1. Policy and planning related documentation including: *Vanuatu Rural Electrification Road Map*; standards for pico-/ small micro-hydro and village-scale community PV; guidelines for pico-/small micro-hydro, village-scale community PV, household-scale SHSs and family compound-scale nano-grids, and EE cook stoves/ crop dryers; and regulations associated with *Off-Grid Rural Electrification Policy*	-various government departments -decision-makers on policy/ members of Parliament	direct dissemination (e.g. email or hard copy) to 100 persons (*others may access information via the low-carbon information exchange website, as described below*)
2. Project how-to guides and MP4s/ 5s for each of: pico-/small micro hydro, village-scale community PV, SHSs and family compound-scale PV nano-grids, and EE cook stoves	-local villagers that take initiatives to implement and manage systems -rural electricians -engineers and technical persons working or interested in working in EE and RE -potential EE cook stove artisans	Direct dissemination (e.g. email or hard copy/ u-drive) to 2,000 persons (*others may access information via the low-carbon information exchange website, as described below*)
3. Project awareness-raising promotion programs for each of: pico-/small micro-hydro, village-scale community PV, SHSs and family compound-scale PV nano-grids, and EE cook stoves	*Public, in general, especially rural people across the country*	Various methods of promotion via social media, texting, and radio reach 50,000 people
4. Project demo monitoring reports for each of: (i) 19 pico-/ small micro-hydro mini-grids, (ii) 1 pico-hydro PV hybrid mini-grid, (iii) 10 village-scale community PV systems (with or without mini-grid), (iv) 10 villages with family compound-scale PV nano-grids deployed throughout, and (v) wide range of villages in which EE cook stoves and EE crop dryers are promoted	-various national level government officials and local and regional level officials -decision-makers on policy/ members of Parliament -commercial and private sector -donors -technical professionals -experts/ academics	direct dissemination (e.g. email or hard copy) to 300 persons
5. Project low-carbon information exchange	-government officials -commercial and private sector -public, in general -donors -other countries in the region	Online access to all project materials and other low-carbon information as related to Vanuatu achieves 10,000 distinct hits
6. Project energy supply and consumption database	-government officials -commercial and private sector -donors	Online access to database achieves 2,000 distinct hits

Annex 15. Gender Analysis

Background

UNDP and the Government of Vanuatu through the Department of Energy of the Ministry of Climate Change and Natural Disaster, conducted a Gender Survey mission in December 2017. The mission followed from the initial consultations held with key project stakeholders in November 2016 for the log-frame analysis workshop post-GEF approval of the PIF in September 2016; and the project design and expert missions in July and November 2017. The Gender Survey is in accordance with the UNDP quality assurance assessment for designing and appraising development projects. The Gender Survey would set the scene for the overall gender assessment that will determine the extent to which gender needs are being addressed through the BRANTV demonstration activities. Below is a summary of the conduct of the Baseline Gender Survey of BRANV Demonstration Sites and a Gender Analysis based on findings from the survey.

Summary of the Gender Survey

Overall: The survey covered 24 demonstration sites (recommended from the scoping mission undertaken in November 2017) of which 13 sites covered in Mission 1 conducted in early December, and 11 sites covered in late December 2017. The sites selected were from Santo, Pentecost, Tana, Malekula, Gaua, Erramango, and Maewo islands. A good turnout was recorded during the survey period where older women and men (35+ years) and young men and women (18 – 34 years) responded to the different methodologies used. These include evidence gathering, interviews and focus group discussions. In terms of demographic results, there were total of 1,195 population interviewed of which 562 or 45% were women. Key preliminary findings show that women play an important productive and reproductive role ranging from collecting firewood for cooking, tending to the family garden, household chores, caring for the young and elderly, assisting in the construction of local houses, and harvesting copra. At several of the sites, families had access to electricity from solar home systems that were purchased with personal funds. The river and tanks remain the major sources of water supply for some of the communities but much is dependent on the weather. During dry spells, water tanks dry out and the women travel long distances to the next water source.

- *Key informant interviews:* The purpose of this interview method is to deepen the grasp of context, coping strategies and issues of concern in relation to accessing energy in the context of BRANTV. Four influential individuals were interviewed comprising the village headman, the leader of women's group, and leaders of male and female youth groups. Key informants were asked about the main issues that affect people's quality of life, what are the main uses of energy by men and women, what are the benefits and shortcomings of the past energy project, and how could the project be adjusted or modified to make things better.

- *Single sex focus groups:* The purpose of this interview method is to identify respective gender roles and duties of men and women, as well as to identify gender-specific coping strategies, practices and concerns in relation to accessing energy. Four groups of individuals were interviewed comprising: young women (ages between 18 and 34), young men (ages between 18 and 34); older women (ages 35 years and over); and older men (ages 35 years and over). The groups were asked the following questions: their involvement in the energy development project in terms of decision-making, training opportunities, employment, and research; the biggest benefit to women's daily life, because of the energy project; any negative impact from the energy or any development project; level of satisfaction; and suggestions to improve the new energy project.

- *Time use surveys:* The purpose of this interview method to track the number of hours per day that men and women typically devote to various activities (productive and reproductive) in this community, to detect gender differentiated patterns of time use.

Gender Analysis

Challenges or Special Problems Faced by Women in Demo Villages

Per the Gender Survey carried out, some of major challenges faced by most communities visited are the Melanesian culture of male domination where women become inferior and that in these communities, women do not make decisions. Most decisions are made by the chief or the head man in the community. This practice results in women's voices not being heard. Thus, women are left in silence to carry out their normal daily tasks, as though all things are just fine.

Further, with respect to the above, women are expected to do the dirty work, e.g. most of the women are required to cook and prepare food for the family on a typical day, while their husbands can stay around to help. This exposes the women to diseases such as eye infections or lung problems due to direct contact with open fire daily for basically their whole lifetimes.

Some communities show that many of their women do the same work as men, i.e. cultivate crops, produce copra, or plant kava to earn cash for school fees and other basic needs for the family. Similarly, given that weaker structure of a woman's body as compared to the men, they usually get sick (hard work related sickness) and slow down their productivity/family work output at a very early age.

Health services for women is usually very poor. Most of the communities visited have only very basic healthcare services available ("aid post"), while the actual bigger health center is some kilometers away. This is fine for typical minor problems, but not good for women with serious conditions, for example, a woman giving birth.

Having to deal with children under very poor lighting can also cause declining eyesight/ blindness at a very early age. After a hard day's work, women will cook and at the same time tend to the children under very poor lighting.

In some communities, girls are often removed from school for various reasons. One specific reason is the lack of money to pay school fees. In such situations, parents must often decide between sending a son and a daughter to school. They usually choose the son.

Situation Regarding Gender Equity

Per the survey, in most of the communities, women have inferior status and are not treated equally to men. This is based on the accepted culture in Vanuatu. In most of the communities visited, however, women also have some degree of privileges, but these are restricted to their community social structure. They may have the opportunity to be members of women church groups, market groups, or other similar groupings, which usually do take part in community decisions or the addressing of community issues. In addition, woman may have some involvement in businesses or in cultivating cash-crops. For instance, when visiting Pentecost, the survey team found that women are involved in decision making within the community, as well as having some successful small businesses and cultivating kava or taro for income (cash-crops). Yet, at the end of the day, men are still dominant.

Potential of Demos to Benefit Women and Contribute to Gender Equality

Per the survey, there are two major community settings that we can easily divide the respondents into: urban areas and rural areas. Furthermore, the rural areas can be subdivided into large land area and small land area. The type of area will determine the suitable demo to be installed or distributed in these areas.

Benefits for women from energy efficient cook stoves: In the urban areas, there is a growing means of women earning income that is popular in most of the islands of Vanuatu. Traditionally, such income earning opportunities have usually been tied to the kava bars (an economic activity in both urban and rural areas), but have now exploded into much more diverse businesses, in which women prepare all sorts of foods and sell them in roadside markets. Women usually prepare a variety of food usually using open fire and sell these at the roadside markets for 20 VT or USD 20 cent or more per serving, depending on the amount of food provided. The survey showed that, on average, these women spend at least VT 500 (USD 5) per bundle of firewood per day; and, sometimes they use more than a bundle per day depending on the food that they preparing. Energy efficient stove technology, as proposed by the project, would cut the cost by half. They would need only one bundle of firewood for two days instead of for one day. This potential savings to be introduced by the demos also applies to normal cooking for family meals.

The survey team visited a small island visited of the coast of Malekula. The island is so small that there is not enough firewood for cooking. The wood supply is not good because of the increased rate of using the available resources. Thus, the inhabitants of the island depend on the ocean currents to bring in drift wood and other resources from the mangroves. There are times when this does not bring enough fuel wood; and they must purchase firewood from the mainland (Malekula), which is costly to buy. It is also costly to pay for land transport and sea transport for transporting firewood to the island. In this situation, energy efficient stove dissemination will also provide strong benefits. Use of the stoves will firstly slow down the rate of harnessing of the limited fuel wood resources on the island. It will also reduce the frequency of having to go to the mainland for firewood.

In sum, energy efficient stove technology will save women's lives by substantially reducing their exposure to smoke. It will reduce costs that directly affect them. And, it will save time for the women to do other activities rather than gathering firewood. Thus, the technology offers the potential to extend women's lives and, at the same time, raise their standards of living.

Benefits for women from village-scale hydro and PV technologies: As for the other incremental demos, namely those associated with solar and hydro technologies, these target higher level needs or services for women. Firstly, these village RE power demos will enable the village to have available power for basic medical services/supplies, such as proper table lights, vaccine storage, and other services, the hardware for which can be provided by the Ministry of Health or other health providers. Better lighting will also prevent young women from getting their eyes affected from poor indoor lighting.

Lighting made possible by village-scale hydro and PV technologies will have great positive impact. After a hard day's work in the garden, upon reaching the village, the men will head for the nakamal (community hall) for the evening, while the women will be left to fix things at home, i.e. cook, tend to children, help children with homework, and other chores. Once the children's needs are addressed, the women can then do their weaving, sewing, and other income generating activities with appropriate lighting.

In some of the villages, lighting quality in the homes is very poor and the women prefer to use day-light for weaving, sewing, and doing other similar activities. Given their roles in the household, however, they have very limited or no time in the day, hence forcing them to do those things with poor lighting in the night. The quality of lighting that will be available because of the village RE power demos will result in

more work carried out during the night, which will in turn directly boost these household incomes. Thus, there will be sufficient income that may enable households to support the formal education of the girl children, as well as the boys.

Benefits for women from productive uses of RE power: Women in the communities surveyed work very hard in their gardens or farms for both subsistence farming as well as cash crop farming. At the end of the day, since everything sold from these communities are raw materials with no value added, the income is not very high. To make matters worse, the men usually control the finances; and the women are left out of decisions as to how to spend the money earned. If BRANTV introduces technical support in developing productive uses of RE power and provides productive use equipment, the women will have opportunities to make money in ways other than entirely depending on the cash crops, or at least will have ways to raise the value of cash crops to earn extra money. For instance, in the communities where women depend on copra for income, the woman can turn to producing more attractive value add products, such as virgin oil, body oil, and other food items. For villages where they depend on kava, they can cease the marketing of raw kava and move to selling processed dry kava for international markets. For women from villages that depend on fishing for income, availability of ice makers and freezers for storage will enable women to market their fish to more lucrative markets. Finally, for those who depend on roots, crops such as taro, yam, cassava, etc., the addition of processing will enable women to have a broader in which market to sell their produce.

Means to Ensure that Women Benefit from Project Demos

Women's involvement in the project demos will be included in key performance indicators to ensure that their problems can be addressed. For instance, such indicators will include proportion of women involved in or benefiting from specific demo activities. It will be beneficial for women to be part of the decision making on systems and the trainings when installing the systems or repairing systems, as women are always at home doing all the house work. Thus, if any fault occurs in the system, they could fix it instead of waiting for men to fix or install the system. The project will require that women account for at least 50% of village decision-makers in regards the project demos. Thus, if there are committees set up for the systems in various communities, these committees will have at least 50% women members. The women will be involved in the decision-making work of the committee, as well as any operational work the committee does. This role for women in the demos is fitting, as women are the proper managers in a household or community. Thus, they can be good at managing the system, for example, collecting monthly fees from the households in the community and keeping proper records.

Annex 16. Knowledge Management Strategy

Knowledge dissemination is a critical aspect of BRANTV. To be successful, the project will need both to (1) generate the knowledge that Vanuatu needs to get to the next level in the application of RE and EE technologies in its rural areas and (2) ensure that this knowledge reaches a broad range of persons and is available for them to access on an ongoing basis. Thus, within the project activities are interwoven the knowledge management strategy of creating critical information, documenting this information, and ensuring both in the near term and long term that key groups in society both know about this information and can access it as needed.

Key information and knowledge products that will be generated by the project will include the following:

- Information on best channels for sourcing quality pico-/ small micro-hydro, mini-grid, village-scale community PV, compound-scale PV nano-grid, household-scale SHS, and plug-and-play pico-SHS systems at the lowest price possible.
- Cost breakdown for pico-/small micro-hydro mini-grid, village-scale community PV (with or without mini-grid), and compound-scale PV nano-grid, showing the least cost for which various components and work items needed to install quality systems can be procured. Documentation and eventual strong dissemination of this best priced costing information will ensure that Vanuatu is no longer paying far more than international norms for its RE installations.
- How-to guides and accompanying video training on MP4/5s on the installation, maintenance, and repair of rural off-grid RE systems and EE cook stoves and crop dryers. These guides and MP4/5s will be in Bislama and will include the following:

    - How-to guide on pico-/ small micro-hydro and pico-hydro PV hybrid mini-grids
    - How-to guide on village-scale community PV (with or without mini-grid)
    - How to guide on compound-scale PV nano-grids and household-scale SHSs
    - How to guide on EE cook stoves and EE crop dryers

- *Vanuatu Off-Grid Rural Electrification Roadmap*, a Government plan documenting specific technologies and configurations of those technologies for electrifying each of Vanuatu's off-grid villages
- Assessment of potential management models and design of agreed upon management model for village-scale rural off-grid RE systems for which payments for power are collected and saved for future repairs and parts
- Database on energy supply and consumption in Vanuatu
- Environmental and social impact mitigation measures for off-grid RE systems and EE cook stoves and crop dryers (as determined via limited environmental and social impact assessments conducted for each of the 40 demo sites and incorporated into the project's ESMP)
- Information on various models of EE cook stoves and crop dryers and assessment of the most suitable models to be fabricated in Vanuatu (information will include results of testing of energy efficiency of these models)
- Monitoring reports on the project demos including:

    - Reports on experience with the 19 pico-/ small micro-hydro mini-grids
    - Reports on experience with the 1 pico-hydro PV hybrid mini-grid
    - Reports on experience with the 10 village-scale community PV (with or without mini-grid)
    - Reports on experience with the 10 villages in which family compound-scale PV nano-grids are deployed throughout

- Reports on the experience with promoting and adopting EE cook stoves and crop dryers nation-wide

The project will disseminate the above key information and knowledge products and manage their long-term availability via several key strategies:

- National guidelines will be developed on the various sourcing channels, best cost breakdowns, and local availability for the different technologies and be officially issued by the government.
- Activities for the how-to guides (plus MP4/5s) and activities for the demo monitoring and reporting will all include dissemination of the respective items to key audiences.
- The project will include extensive promotion activities to ensure the public, in general, across the nation knows about the results of the hydro, PV, and EE cook stove demos. These activities will utilize social media, text message, and radio. In all cases, these campaigns will promote results of the project demos and in some cases (pico-/small micro-hydro and village-scale community PV) they will ask citizens to identify sites for new, similar projects. In the case of household-scale SHS and compound-scale PV nano-grids, the promotion will also educate people on the best way to maintain their household PV systems, how to seek appropriate replacement batteries, and how to properly discard of materials once no longer used.
- In the case of EE cook stoves, a nationwide roadshow will be undertaken to introduce various villages to the technology.
- For long-term maintenance of knowledge products, the project will be developing an online information exchange focused on low carbon technology. All knowledge products of the project related to low carbon technology (e.g. RE and EE related knowledge products) will be made available through this information exchange. The project will also have a workshop to enhance this low carbon information exchange.
- For the energy supply demand database, online access will also be pursued for long-term upkeep of and access to the data and a workshop will be held during the project to enhance the system.

Annex 17. Annual Targets

Strategy	Indicators	Year 0	Year 1	Year 2	Year 3	Year 4
Project Objective: Enabling the achievement of the energy access, sustainable energy, and green growth targets of Vanuatu	Cumulative tons of incremental GHG emissions reduced from business as usual (tons CO_2)	0	0	6,085.6	20,683.8	45,051.2
	Incremental number of households (w/ at least 20% women-headed) in rural areas whose level of energy access is increased via village-scale off-grid RE or that benefit from newly adopting EE cook stoves	0	3,500	8,400	14,000	14,000
	Total new, incremental reductions in or newly avoided amounts of annual diesel consumption achieved, liters DFO	0	0	67,238	164,631	272,212
	Incremental fuel wood saved annually by use of energy efficient cook stoves, million kgs	0	0	3.9	9.4	15.6
Outcome 1. Improved capacity and awareness on sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	Number of individuals (with at least 30% being women) in Vanuatu that are newly (as of start of project) involved in operating, maintaining, repairing, designing, and/or installing off-grid rural RE power systems as one of their main sources of income.	0	50	150	225	300
	Number of artisans in Vanuatu fabricating EE cook stoves as their main source of income	0	0	10	25	20
Outcome 2. Improved policy, planning, and regulatory regimes in the application of sustainable energy, energy access, and low carbon development in the energy, public, private, and residential sectors	Portion of nation's off-grid villages for which a comprehensive electrification plan has been determined, %	0	0	50	100	100
	Number of regulations under the *Off-Grid Rural Electrification Policy* that are enforced	0	0	0	4	5
Outcome 3. Established institutional framework enables the effective enforcement of policies and regulations, and implementation of plans, programs, and projects, on the application of sustainable	Number of pico-/ small micro-hydro, village community PV, and village sets of family compound-scale nano-grid sites at which management model enables fee collection, savings for repairs/ parts, and payment of operator	0	0	10	24	40
	Number of villages at which DOE has cooperated with other national-level	0	0	0	30	60

energy and low carbon technologies	departments to implement rural electrification or EE cook stoves, as well as productive uses of RE/EE applications, if relevant					
Outcome 4A. Increased availability of, and access to, financing for sustainable energy, energy access, and low carbon (RE and EE) initiatives in the energy supply and demand sectors	Amount of new international funding confirmed with funding entities for infusion into NGEF because of BRANTV efforts, US$ million	0	0.5	2	6	10
Outcome 4B. Increased financing and investments from private sector on sustainable energy and low carbon projects in the energy supply and demand sectors	Amount of funding represented by financial closes reached for loans or direct equity investments to RE and EE projects under commercial or private sector financing scheme for low carbon projects, US$ million	0		0	2	4
Outcome 5A. Sustainable energy and low carbon (RE and EE) techniques and practices adopted and implemented with both cost and technical viability in the energy, public, private sector, and residential sectors of the country	Number of types of key off-grid RE power generation and mini-grid related equipment/ parts newly available or available at 25% or more less than cost at start of project	0	6	8	8	8
Outcome 5B. Enhanced confidence in the economic and technical viability and long-term sustainability of sustainable energy and low carbon technology projects	No. of communities and private sector entities, and households in both on-grid and off-grid areas that are interested in replicating the RE-based power generation system demos: • Pico-/ small micro-hydro • Hybrid pico-hydro & PV • Village community PV (with or without mini-grid) • Village-wide family compound-scale PV nano-grids • EE cook stoves • RE-powered freezers	 • 0 • 0 • 0 • 0 • 0 • 0	 • 0 • 0 • 0 • 0 • 0 • 0	 • 0 • 0 • 0 • 0 • 0 • 0	 • 9 • 1 • 5 • 5 • 3,000 • 15	 • 38 • 2 • 20 • 20 • 12,000 • 60

Annex 18. Financial Analysis

This annex provides information on the financial models and indicators used to assess the financial viability of the BRANTV incremental RE power generation demos. Demos assessed include (1) the pico-/ small micro-hydro demos, (2) the village-scale community PV demos, and (3) the family compound-scale PV nano-grids deployed across villages (with each nano-grid being 300 W on average in scale and connected to five buildings on average). Assessments are done for each of the different scales of such demos planned (i.e. 5 kW, 7.5 kW, 10 kW, and 15 kW for the hydro demos; 5 kW and 7.5 kW for the village-scale community PV demos; and 2.4 kW and 3.3 kW for the total per village of family-compound scale PV nano-grid installation). Up-front costs (including equipment and installation, design, and environmental and social assessment), system revenues over time, and operator salaries over time, along with inflation and discount rates, are key elements incorporated into the model. The methods by which the up-front equipment and installation costs for each type and size system are estimated are given in Annex 1, which provides detailed descriptions of the demos. In the case of pico-hydro/ small micro-hydro systems, the cost of the village mini-grid is included. In the case of the community-scale PV demos, the costs are without mini-grid. For such demos, it is assumed any mini-grid costs, if it is decided to include a mini-grid, will be covered by the village and end users. In the case of the PV nano-grids, the nano-grid is included. As for the design and environmental and social assessment costs, these have been estimated based on an activity-wise BRANTV budget prepared as a part of project design. The activity-wise budget provides total design (and, respectively, environmental and social assessment) costs for each type of system (e.g. hydro, community PV, or compound-scale PV). These are then computed on a per kW basis, considering the total kW to be installed for each system type. The per kW amount is then applied to the relevant system size to come up with costs per system for each of design and environmental and social assessment.

The financial indicators used to assess the financial viability of these demos include the discounted cash flow (DCF), the net present value (NPV), and the internal rate of return (IRR). To get DCF estimates, the future cash flows from electricity revenues minus costs over the lifetime of the systems (25 years for hydro and 20 for PV) are estimated and then discounted to the present time using the factor: $[1/(1+r)^n]$, where r is the discount rate and n is the number of years from the present. Based on discount rate estimates for utilities and the residential sector in similar countries, an annual discount rate of 10% is used. As for future revenues, for simplification, it assumed a constant amount of electricity is sold each year (with a utilization rate of 50% for the hydro systems and 47% for the PV-battery systems) with an initial retail electricity price of USD0.20 per year that rises with inflation at 2.5% per year. Expenses consist of a small monthly salary for a part-time operator (this is scaled up as the size of the system increases) who will be responsible for collecting monthly electricity payments, handling small repairs and maintenance, and informing management in the case of larger problems with the system. A 2.5% inflation rate is also applied to the operator salary. Costs of replacement parts and larger repairs are not included, though it is assumed a good portion of excess revenues will be saved for this purpose. NPV levels can show how sufficient excess revenues (beyond up-front costs and labor costs) when discounted to the present are, both to cover such repairs/ parts and provide a return to investors. Once estimates of revenues minus costs are arrived at for each year, the assumed discount rate factor for each year is applied to the year's cash flow to get the year's cash flow discounted to the present. Then, the discounted cash flows through all years of operation are summed for the overall DCF of the installation.

To get the NPV estimates, the initial investment for the system is subtracted from the DCF (summed for all years). If the result is greater than zero, this shows that the investment is a good one, bringing a higher rate of return than the discount rate (in this case 10%), meaning it brings a higher rate of return than other, standard alternatives.

The IRR shows the annual rate of return, offering another way to compare the project to the discount rate. IRR calculations use an iterative process to show at what discount rate the NPV would be zero, thus showing the rate of the return of the project. As such, the relevant formula that is solved for the discount rate (r) is: $0 = -\text{initial investment} + [(\text{year 1 net income}) \times 1/(1+r)^1] + [(\text{year 2 net income}) \times 1/(1+r)^2] + \ldots. [(\text{year n net income}) \times 1/(1+r)^n]$.

A picture of the spread sheets used to calculate the DCFs, NPVs, and IRRs of each type-scale of system are shown below in Exhibits 18-2 and 18-3. For the DCFs, each year's cash flow is somewhat different due to inflation in both revenues and costs. For each system, the NPV is determined by summing the annual DCFs and the up-front cost of investment is subtracted. For determining the IRR, an excel function is used to carry out the interactive process of finding the discount rate that will bring the left side of the equation to zero. In the case of the IRR estimate, the up-front equipment costs and the non-discounted cash flow for each year are used in the excel function that iteratively computes r.

Exhibit 18-1 summarizes results of the financial analysis. In all cases, results show positive NPVs and IRRs greater than the discount rate of 10%, confirming that the investments (assuming assumptions are met) are good ones. For the hydro systems, the IRR goes up somewhat as scale increases, a result of assumptions that system costs per kW go down as size increases. The PV-battery systems have a somewhat lower IRR than the hydro systems due to somewhat lower utilization rate and generally higher cost per kW. The PV nano-grids have a lower IRR than the village-scale community PV systems, partly due to the smaller scale and partly because the nano-grids include grid costs while the community PV systems do not.

Exhibit 18-1. Summary of Results of Financial Analysis (USD, unless indicated as %)

Indicator	Pico- and Small Micro-Hydro Mini-Grid				Village-Scale Community PV		Family Compound-Scale PV Nano-Grid Installed across Village	
	5 kW	7.5 kW	10 kW	15 kW	5 kW	7.5 kW	2.4 kW	3.3 kW
Up-front cost	24,368	29,251	34,235	43,903	21,148	31,722	13,258	18,230
DCF	35,145	52,717	70,290	105,435	29,422	44,133	13,881	19,086
NPV (DCF minus up-front cost)	10,777	23,466	36,054	61,532	8,274	12,411	623	856
IRR	15%	18%	21%	24%	15%	15%	11%	11%
Parameters used								
Discount rate: 10%; Inflation rate: 2.5%								

Exhibit 18-2. Excel Computations for DCF, NPV, and IRR of 5 kW, 7.5 kW, 10 kW, and 15 kW Pico-/ Small Micro-Hydro Systems

	INVESTMT	REVENUE		1+inflatio	1.025		DF:	0.909091																			
YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
5 kW system																										
INV/REV	(24,368)	4,380	4489.5	4601.738	4716.781	4834.7	4955.568	5079.457	5206.444	5336.605	5470.02	5606.77	5746.94	5890.613	6037.878	6188.825	6343.546	6502.135	6664.688	6831.305	7002.088	7177.14	7356.569	7540.483	7728.995	7922.22
COSTS (Labor)		-1,200	-1230	-1260.75	-1292.27	-1324.58	-1357.69	-1391.63	-1426.42	-1462.08	-1498.64	-1536.1	-1574.5	-1613.867	-1654.21	-1695.57	-1737.96	-1781.41	-1825.94	-1871.59	-1918.38	-1966.34	-2015.5	-2065.89	-2117.53	-2170.47
Net CF	(24,368)	3,180	3259.5	3340.988	3424.512	3510.125	3597.878	3687.825	3780.021	3874.521	3971.384	4070.669	4172.436	4276.746	4383.665	4493.257	4605.588	4720.728	4838.746	4959.715	5083.708	5210.8	5341.07	5474.597	5611.462	5751.749
DCF	(24,368)	2890.909	2693.802	2510.133	2338.988	2179.511	2030.908	1892.437	1763.408	1643.175	1531.141	1426.745	1329.467	1238.821	1154.356	1075.65	1002.31	933.9708	870.291	810.953	755.6607	704.1384	656.129	611.3929	569.707	530.8634
		DCF of years 1 to 25:		**35144.87**		**NPV:**	**10,777**		**IRR:**	**15%**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!														
7.5 kW system																										
INV/REV	(29,251)	6,570	6734.25	6902.606	7075.171	7252.051	7433.352	7619.186	7809.665	8004.907	8205.03	8410.155	8620.409	8835.92	9056.818	9283.238	9515.319	9753.202	9997.032	10246.96	10503.13	10765.71	11034.85	11310.72	11593.49	11883.33
COSTS (Labor)		-1800	-1845	-1891.13	-1938.4	-1986.86	-2036.53	-2087.45	-2139.63	-2193.13	-2247.95	-2304.15	-2361.76	-2420.8	-2481.32	-2543.35	-2606.94	-2672.11	-2738.91	-2807.39	-2877.57	-2949.51	-3023.25	-3098.83	-3176.3	-3255.71
Net CF	(29,251)	4,770	4889.25	5011.481	5136.768	5265.187	5396.817	5531.738	5670.031	5811.782	5957.076	6106.003	6258.653	6415.12	6575.498	6739.885	6908.382	7081.092	7258.119	7439.572	7625.561	7816.2	8011.605	8211.896	8417.193	8627.623
DCF	(29,251)	4336.364	4040.702	3765.2	3508.482	3269.267	3046.363	2838.656	2645.111	2464.763	2296.711	2140.117	1994.2	1858.232	1731.534	1613.475	1503.465	1400.956	1305.437	1216.429	1133.491	1056.208	984.1935	917.0894	854.5605	796.2951
		DCF of years 1 to 25:		**52717.3**		**NPV:**	**23,466**		**IRR:**	**18%**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!														
10 kW system																										
INV/REV	(34,235)	8,760	8979	9203.475	9433.562	9669.401	9911.136	10158.91	10412.89	10673.21	10940.04	11213.54	11493.88	11781.23	12075.76	12377.65	12687.09	13004.27	13329.38	13662.61	14004.18	14354.28	14713.14	15080.97	15457.99	15844.44
COSTS (Labor)		-2,400	-2460	-2521.5	-2584.54	-2649.15	-2715.38	-2783.26	-2852.85	-2924.17	-2997.27	-3072.2	-3149.01	-3227.733	-3308.43	-3391.14	-3475.92	-3562.81	-3651.88	-3743.18	-3836.76	-3932.68	-4031	-4131.77	-4235.07	-4340.94
Net CF	(34,235)	6,360	6519	6681.975	6849.024	7020.25	7195.756	7375.65	7560.041	7749.042	7942.768	8141.338	8344.871	8553.493	8767.33	8986.514	9211.176	9441.456	9677.492	9919.429	10167.42	10421.6	10682.14	10949.19	11222.92	11503.5
DCF	(34,235)	5781.818	5387.603	5020.267	4677.976	4359.023	4061.817	3784.875	3526.815	3286.35	3062.281	2853.489	2658.933	2477.642	2308.712	2151.3	2004.62	1867.942	1740.582	1621.906	1511.321	1408.277	1312.258	1222.786	1139.414	1061.727
		DCF of years 1 to 25:		**70289.73**		**NPV:**	**36,054**		**IRR:**	**21%**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!														
15 kW system																										
INV/REV	(43,903)	13,140	13468.5	13805.21	14150.34	14504.1	14866.7	15238.37	15619.33	16009.81	16410.06	16820.31	17240.82	17671.84	18113.64	18566.48	19030.64	19506.4	19994.06	20493.92	21006.26	21531.42	22069.71	22621.45	23186.98	23766.66
COSTS (Labor)		-3,600	-3690	-3782.25	-3876.81	-3973.73	-4073.07	-4174.9	-4279.27	-4386.25	-4495.91	-4608.3	-4723.51	-4841.6	-4962.64	-5086.71	-5213.87	-5344.22	-5477.83	-5614.77	-5755.14	-5899.02	-6046.49	-6197.66	-6352.6	-6511.41
Net CF	(43,903)	9,540	9778.5	10022.96	10273.54	10530.37	10793.63	11063.48	11340.06	11623.56	11914.15	12212.01	12517.31	12830.24	13151	13479.77	13816.76	14162.18	14516.24	14879.14	15251.12	15632.4	16023.21	16423.79	16834.39	17255.25
DCF	(43,903)	8672.727	8081.405	7530.4	7016.964	6538.534	6092.725	5677.312	5290.223	4929.526	4593.422	4280.234	3988.4	3716.463	3463.068	3226.95	3006.931	2801.913	2610.873	2432.859	2266.982	2112.415	1968.387	1834.179	1709.121	1592.59
		DCF of years 1 to 25:		**105434.6**		**NPV:**	**61,532**		**IRR:**	**24%**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!														

BASIC DA	5kW	7.5 kW	10 kW	15 kW	Computation of costs of design for each system			Computation of social and environmental assessment costs for each system		
Equip/ins	21,500	24,950	28,500	35,300	Total budget for hydro design activity:		60,200	Total budget for S&E assess		12925
Design co	2,361	3,541	4,722	7,082	Total kW		127.5	Total kW		127.5
Social/en	507	760	1,014	1,521	Design cost per kW		472.16	S&E asses per kW		101.3725
Total inve	**24,368**	**29,251**	**34,235**	**43,903**						

System Size (kW)	Capacity Factor	kWh per day	Revenues per year in USD (@USD0.20 per kWh)
5	0.5	60	4,380
7.5	0.5	90	6,570
10	0.5	120	8,760
15	0.5	180	13,140

Exhibit 18-3. Excel Computations for DCF, NPV, and IRR of 5kW and 7.5 kW Village-Scale Community PV (without Mini-Grid) and for 2.4 kW and 3.3 kW in Total Across Village of Roughly 300 kW, 5 Building Family Compound-Scale PV Nano-Grids

	INVESTMT	REVENUE		1+inflation:	1.025		DF:	0.90909091																	
YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
5 kW system - community PV																									
INV/REV	-21,148	4,117	4220.13	4325.63	4433.77	4544.62	4658.23	4774.69	4894.06	5016.41	5141.82	5270.36	5402.12	5537.18	5675.61	5817.50	5962.93	6112.01	6264.81	6421.43	6581.96				
COSTS (Labor)		-1,200	-1230.00	-1260.75	-1292.27	-1324.58	-1357.69	-1391.63	-1426.42	-1462.08	-1498.64	-1536.10	-1574.50	-1613.87	-1654.21	-1695.57	-1737.96	-1781.41	-1825.94	-1871.59	-1918.38				
Net CF	-21,148	2,917	2990.13	3064.88	3141.51	3220.04	3300.54	3383.06	3467.63	3554.32	3643.18	3734.26	3827.62	3923.31	4021.39	4121.93	4224.98	4330.60	4438.86	4549.84	4663.58				
DCF	-21,148	2652	2471.18182	2302.69215	2145.69041	1999.39334	1863.07106	1736.04349	1617.67689	1507.38074	1404.60478	1308.83627	1219.59743	1136.44306	1058.95831	986.756607	919.477747	856.786083	798.36885	743.93461	693.211796				
		DCF years 1-20:		**29422.11**		**NPV:**	**8274.19**		**IRR:**	**0.15**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!													
7.5 kW system - community PV																									
INV/REV	-31,722	6,176	6330.20	6488.45	6650.66	6816.93	6987.35	7162.03	7341.09	7524.61	7712.73	7905.55	8103.18	8305.76	8513.41	8726.24	8944.40	9168.01	9397.21	9632.14	9872.94				
COSTS (Labor)		-1,800	-1845.00	-1891.13	-1938.40	-1986.86	-2036.53	-2087.45	-2139.63	-2193.13	-2247.95	-2304.15	-2361.76	-2420.80	-2481.32	-2543.35	-2606.94	-2672.11	-2738.91	-2807.39	-2877.57				
Net CF	-31,722	4,376	4485.20	4597.32	4712.26	4830.06	4950.82	5074.59	5201.45	5331.49	5464.77	5601.39	5741.43	5884.96	6032.09	6182.89	6337.46	6495.90	6658.30	6824.75	6995.37				
DCF	-31,722	3978.00	3706.77	3454.04	3218.54	2999.09	2794.61	2604.07	2426.52	2261.07	2106.91	1963.25	1829.40	1704.66	1588.44	1480.13	1379.22	1285.18	1197.55	1115.90	1039.82				
		DCF years 1-20:		**44133.16**		**NPV:**	**12411.28**		**IRR:**	**0.15**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!													
2.4 kW total in village - family compound-scale nano-grids																									
INV/REV	-13,258	1,976	2025.66	2076.30	2128.21	2181.42	2235.95	2291.85	2349.15	2407.88	2468.07	2529.77	2593.02	2657.84	2724.29	2792.40	2862.21	2933.76	3007.11	3082.28	3159.34				
COSTS (Labor)		-600	-615.00	-630.38	-646.13	-662.29	-678.84	-695.82	-713.21	-731.04	-749.32	-768.05	-787.25	-806.93	-827.11	-847.78	-868.98	-890.70	-912.97	-935.80	-959.19				
Net CF	-13,258	1,376	1410.66	1445.93	1482.08	1519.13	1557.11	1596.04	1635.94	1676.83	1718.76	1761.72	1805.77	1850.91	1897.18	1944.61	1993.23	2043.06	2094.14	2146.49	2200.15				
DCF	-13,258	1251.14	1165.84	1086.35	1012.28	943.26	878.95	819.02	763.18	711.14	662.65	617.47	575.37	536.14	499.59	465.53	433.78	404.21	376.65	350.97	327.04				
		DCF years 1-20:		**13880.55**		**NPV:**	**622.72**		**IRR:**	**11%**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!													
3.3 kW total in village - family compound-scale nano-grids																									
INV/REV	-18,230	2,717	2785.29	2854.92	2926.29	2999.45	3074.43	3151.30	3230.08	3310.83	3393.60	3478.44	3565.40	3654.54	3745.90	3839.55	3935.54	4033.92	4134.77	4238.14	4344.10				
COSTS (Labor)		-825	-845.63	-866.77	-888.43	-910.65	-933.41	-956.75	-980.67	-1005.18	-1030.31	-1056.07	-1082.47	-1109.53	-1137.27	-1165.70	-1194.85	-1224.72	-1255.34	-1286.72	-1318.89				
Net CF	-18,230	1,892	1939.66	1988.15	2037.86	2088.80	2141.02	2194.55	2249.41	2305.65	2363.29	2422.37	2482.93	2545.00	2608.63	2673.84	2740.69	2809.21	2879.44	2951.42	3025.21				
DCF	-18,230	1720.32	1603.03	1493.73	1391.88	1296.98	1208.55	1126.15	1049.37	977.82	911.15	849.03	791.14	737.20	686.93	640.10	596.45	555.79	517.89	482.58	449.68				
		DCF years 1-20:		**19085.76**		**NPV:**	**856.24**		**IRR:**	**11%**		NPV is positive (and IRR is greater than discount rate) - means investment is a good one!													

									Computation of costs of design for each system - community PV							Computation of social and environmental assessment costs for each system - community PV									
BASIC DAT	5 kW	7.5 kW	2.4 kW	3.3 kW					Total budget for village-scale community PV design activity:			7,950				Total budget for S&E assess			5,825						
Equipmt/i	20,000	30,000	12,000	16,500					Total kW village-scale community PV			60				Total kW			60						
Design	663	994	766	1,054					Design cost per kW			132.50				S&E asses per kW			97.0833333						
Social and	485	728	492	676																					
Total inve	**21,148**	**31,722**	**13,258**	**18,230**																					

System Size (kW)	Capacity Factor	kWh per day	Revenues per year in USD (@USD0.20 per kWh)
5	0.47	56.4	4,117
7.5	0.47	84.6	6,176
2.4	0.47	27.072	1,976
3.3	0.47	37.224	2,717

									Computation of costs of design for each system - family compound scale PV							Computation of social and environmental assessment costs for each system - family compound scale PV									
									Total budget for village-scale community PV design activity:			7,950				Total budget for S&E assess			5,100						
									Total kW village-scale community PV			24.9				Total kW			24.9						
									Design cost per kW			319.28				S&E asses per kW			204.819277						

Annex 19. Co-financing Letters

GOVERNMENT OF THE
REPUBLIC OF VANUATU MINISTRY
OF CLIMATE CHANGE
ADAPTATION, METEOROLOGY,
GEO-HAZARDS, ENVIRONMENT &
ENERGY & NDMO
PMB 9074, PORT VILA
VANUATU

GOUVERNEMENT DE LA
RÉPUBLIQUE DE VANUATU
MINISTÈRE DE L'ADAPTATION AU
CHANGEMENT CLIMATIQUE, LA
MÉTÉOROLOGIE, LES RISQUES
GÉOLOGIQUES, ENVIRONNEMENT &
ENERGIE & NDMO
SPR 9074, PORT-VILA, VANUATU

TEL : (678) 22068

FAX : (678) 22068

Date: 19th March 2018

Mr. Bakhodir Burkhanov,
Country Director,
UNDP Pacific Office
Suva, FIJI

Dear Sir/Madame:

RE: CO-FINANCING COMMITMENT FROM THE MINISTRY OF CLIMATE CHANGE AND NATURAL DISASTERS TOWARDS THE BRANTV PROJECT.

This letter is to confirm the co-financing support for the Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV) which is going to be implemented from 2018 to 2022. The BRANTV will address some of the major barriers which are hindering the full implementation of the National Energy Road Map (NERM) by means of demonstrating new system designs as well as boosting some initiatives which are not fully explored.

In this regard, we would like to confirm the Ministry's support for co-financing of the activities equivalent to USD 17,062,444 over the four-year duration of the project. The summary of this support is given below.

Type of co-financing	***Amount, US$***
Grant/Cash	16,348,000
In-kind	714,444

The financing to sustain project activities beyond the lifetime of the project at the national level will be absorbed by the Government through the Department of Energy to ensure sustainability and continuity of activities.

We look forward to collaborating with UNDP and we avail this opportunity to assure you of our full support and commitment.

Yours Sincerely,

Jesse Benjamin
Director General

REPUBLIC OF VANUATU
Director General of Climate Change Adaptation, Meteorology, Geohazards, Environment & Energy
Directeur Général du Climat Change Adaptation, Météorologie, Géorisques, Environnement et Énergie
REPUBLIQUE DE VANUATU

CC:

Mr. Antony Garae, Director, Department of Energy

GOVERNMENT OF THE
REPUBLIC OF VANUATU

MINISTRY OF TOURISM, TRADE
COMMERCE AND NI-VANUATU
BUSINESS

Private Mail Bag 9056
PORT VILA, VANUATU
Tel: 25674 Tel/Fax: 25677

GOUVERNEMENT DE LA
RÉPUBLIQUE DE VANUATU

MINISTÈRE DU TOURISME, DU
COMMERCE,
ET DES AFFAIRES NI-VANUATU

Sac Postal Privé 9056
PORT VILA, VANUATU
Tel: 25674 Tel/Fax: 25677

Mr. Bakhodir Burkhanov,

Country Director,

UNDP Pacific Office in Fiji,

Level 8 Kadavu House,

414 Victoria Parade,

Private Mail Bag,

Suva,

FIJI

Date: 22nd May, 2018

Dear Sir/Madame:

Re: Co-financing Commitment form the Ministry of Tourism, Trade, Commerce, and Ni Vanuatu Business towards the BRANTV project

This letter is to confirm the co-financing support for the Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV) which is going to be implemented from 2018 to 2022. The BRANTV will address some of the major barriers which are hindering the full implementation of the National Cooperative Policy 2017 – 2022 by means of demonstrating new system designs as well as boosting some initiatives which are not fully explored.

This will also enforce the implementation of the Memorandum of Understanding (MOU) signed between the Department of Energy and the Office of the Registrar of Cooperatives with regards to the Energy Road Map of Vanuatu.

In this regard, we would like to confirm the Ministry's support for co-financing of the activities USD 1 Million over the four-year duration of the project. This will be grant/cash co-financing.

The financing to sustain project activities beyond the lifetime of the project at the national level will be absorbed by the Government through the Vanuatu Cooperative Business network regulated by the Office of the Registrar of Cooperative and Business Development Services to ensure sustainability and continuity of activities.

We look forward to collaborating with UNDP and we avail this opportunity to assure you of our full support and commitment.

Thank you.
Yours Sincerely,

George Borugu
Acting Director General

CC:

Mr. Ridley Joseph, Registrar of Cooperatives

Mr. Tony Sewen, Chairman, Vanuatu Cooperative Leadership and Management Council.

United Nations Development Programme

Empowered lives.
Resilient nations.

9 March 2018

Letter No.: 307 /18
Ref. No: PRO/300/Vanuatu

Dear Ms. Dinu,

Subject: Confirmation of Co-financing for Vanuatu BRANTV Full Size Project

This is to indicate our commitment to collaborating with the implementation of the full-size project entitled Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV) for the period 2018 to 2021.

We are pleased to confirm our commitment to provide co-financing in the amount of US$100,000 towards the realization of objectives of the project over the four-year timeframe. This amount will be in the form of cash support from the UNDP Japanese Funding – Project for Strengthening Legislators Capacity in the Pacific Island Countries.

The Vanuatu component of the UNDP Japanese Funding – Project for Strengthening Legislators Capacity in the Pacific Island Countries will strengthen capacities to approve laws and regulations in Vanuatu, which will directly impact Outcome 2 of BRANTV project in its effort to enforce regulations under the Off-Grid Rural Electrification Policy in Vanuatu. Focus will be on the adoption and enforcement of: (i) regulations related to setting tariffs for village-scale off-grid RE power, (ii) regulations regarding the management and operations and maintenance (O&M) of village-scale off-grid RE power systems, (iii) regulations regarding the disposal of PV parts and batteries, (iv) regulations regarding the availability of replacement parts (including batteries) for household-scale PV and for village scale off-grid RE power systems (including PV and hydro), and (v) preferential import policies for off-grid RE parts and equipment or other preferential policies to promote off-grid RE.

Ms. Adriana Dinu
Executive Coordinator, UNDP-GEF
United Nations Development Programme (UNDP)
New York
UNITED STATE OF AMERICA.

We look forward to working with the GEF, and UNDP colleagues in addressing this important portfolio.

Yours sincerely

Bakhodir Burkhanov
Country Director, UNDP Pacific Office in Fiji and
Head of Pacific Regional Programmes & Policy