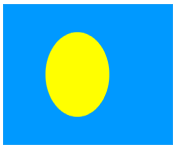



PALAU SUSTAINABLE ECONOMIC DEVELOPMENT THROUGH RENEWABLE ENERGY APPLICATIONS (SEDREA) PROJECT

# Final Report
# MID TERM REVIEW

Frank Pool, Independent Evaluation Consultant

31 January 2012

## Table of Contents

# 1. EXECUTIVE SUMMARY

The Palau Sustainable Economic Development through Renewable Energy Applications (SEDREA) project is a Global Environmental Facility (GEF) US$1.0 million[1] grant funded project with a scheduled three-year duration to July 2012.

The Palau SEDREA project was funded under the GEF-4 (Global Environmental Facility 4th replenishment) OPERATIONAL PROGRAM: OP #6: Promotion of the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs. The project was approved under the umbrella of then applicable GEF Strategic Program SO-5: Promotion of Renewable Energy for the Provision of Rural Energy Services[2]. The underlying analysis for the Palau-SEDREA project was undertaken in the earlier US$760,000 GEF funded regional Pacific Islands Renewable Energy Project (PIREP). The SEDREA project was designed in 2006 – 2007, the document (ProDoc) was finalised in December 2007, and national on-the-ground Palau SEDREA activities started with the project's inception workshop, which was held in June 2009. A SEDREA funded national project officer has been employed by the project since June 2010 and is based at the Palau Energy Office (PEO), which is also providing in-kind project co-funding.

In its nearly two years and a half years of project implementation to the time of the SEDREA Mid-Term Review (MTR), the Palau SEDREA project has used 75% of its available GEF funds (to 30 October 2011) primarily to:

- fund a tariff review to underpin grid-connected PV becoming cost-effective without subsidies;
- assess the RETs (renewable energy technologies) most relevant for Palau and their markets and relevant REFW (Renewable Energy Fund Window) finance potentials;
- undertake capacity assessment and development, and initial training of NDBP and other key stakeholders of the key attributes of RETs and the financial analysis of RET applications;
- design operating procedures and a marketing plan for bankable RET projects under the REFW;
- specify and purchase for initial demonstrations 30 standardised grid-connected modules and 37 off-grid PV modules, and provide training in their proper installation with local contractors.

The National Development Bank of Palau (NDBP) has committed to provide $1 Million of its own funds in loans to additional on-grid and off-grid PV (and SWH) systems once the demo systems have been deployed. EIB (European Investment Bank) funding to extend NDBP RE loans is under discussion.

The necessary demonstration and capacity building, and financing mechanism establishment groundwork has now clearly been effectively established under the Palau SEDREA project for the upcoming aggressive marketing of PV systems, with technical support to be provided by additional international consultancy support. NDBP, as the key local project implementation partner, remains strongly committed through its REFW financing mechanism and is actively supporting the project in its

[1] Including $25,000 for the project preparatory phase.

[2] The project was approved for inclusion in the GEF 2007 Pipeline on the basis of the earlier GEF-4 funding cycle's strategic objectives (SOs), which include SO-5. This SO-5 appears to have been a GEF-3 legacy Strategic Objective that was apparently not included in the later GEF-4 SOs which had an on-grid RE focus.

roll-out of the now proven PV modules that are already physically in Palau and which are now available for residential and commercial customers to install and connect to the electricity grid, as well as off-grid PV systems for customers. An extended MOU is now in place between NDP and PPUC to cover the grid connection of a total of 105 residential and seven commercial net-metered PV systems.

The REFW is now operated by NDBP alongside the Energy Efficiency Home Loans programme of NDBP (which is funded by the governments of Italy and Austria through IUCN) as a combined ELP (Energy Loans Programme). The ELP concept is now in the process of being replicated to ADFIP (Association of Development Financing Institutions in the Pacific) members, with a planning and training workshop held in Palau from 3-6 October 2011. So, based on its early promising results, the Palau-SEDREA project approach is already in the process of being replicated to the wider Pacific region through ADFIP. That this wider Pacific Islands replication is now under active development after only two and a half years since the SEDREA inception workshop is a very promising early result for the Palau SEDREA project.

A critical early Palau SEDREA project supported enabling activity that was undertaken and completed was the comprehensive electricity tariff review undertaken for the Palau Public Utilities Corporation (PPUC) to help set a more appropriate grid electricity tariff for grid-connected RE (PV and SWH) systems to compete with. This need for a comprehensive tariff review was consistent with the findings of other studies and assessments for Palau. The very thorough tariff review report undertaken for SEDREA clearly articulated that the main PPUC tariff issue that needed to be urgently addressed was that the residential electricity tariff had an extremely high initial tariff step of 500kWh/month – and that this initial residential tariff step was set at a level below the full cost of electricity supply. This means that the majority of residential electricity use in Palau is cross subsidised from commercial electricity users and from ongoing deferred operations and maintenance (O&M), in particular for the diesel generator sets that provide electricity for Palau. The majority of residential electricity use thus makes no contribution to any diesel generator O&M, and also makes no contribution towards eventual generation, transmission and distribution system equipment replacement. The SEDREA funded tariff review showed that unless this Palau residential tariff low cost initial step was reduced to a more normal circa 50kWh/month “lifeline” tariff initial step, then PPUC will inevitably struggle to be able to properly maintain its diesel generators, and hence the Palau grid electricity supply would once again become unreliable. This inevitable lack of reliability was dramatically demonstrated by the fire at one of the main electricity generation stations and rolling blackouts from 07 November 2011, along with a state of emergency declared by the President of Palau.

Unfortunately, although the PPUC fuel surcharge tariff component was increased, the main SEDREA funded tariff review recommendation to raise overall tariff levels (and in particular to implement a more realistic residential lifeline tariff cut-off level to around 50 kWh/month instead of the current 500 kWh/month level) was initially accepted by PPUC but the tariff increases were then subsequently abruptly reversed and have not yet been implemented (although this is now under active consideration again by the restored PPUC GM who was supportive of previous SEDREA recommendations to raise PPUC tariffs). Combined with the Palau government apparently being considerably in arrears in paying its electricity bills to PPUC, PPUC is now apparently in danger of being unable to pay for its necessary diesel supplies, let alone pay for critical ongoing maintenance for its diesel generators. With diesel fuel costs accounting for around 66 – 80% of PPUC’s operational costs, even the commissioning of the two new more fuel efficient 5MW generator sets for the main Koror-Babeldoab electricity grid (that is

currently underway) will not be enough for PPUC to break even on its operating costs from its income from the current inadequate tariff levels and with ongoing government non-payment of its power supply past usage. The current tariff also does not include a provision for the vital 24,000-hour major overhauls and eventual capital replacement of diesel generators and T&D (transmission and distribution) infrastructure. Not making any provision for generator and T&D O&M and eventual replacement is clearly not a sensible way to operate any power utility sustainably or reliably into the future, as it implicitly ensures an ongoing dependence on timely donor contributions for capital upgrades and replacement, alongside an inevitably ongoing unreliable utility power supply. This situation is one that only the government of Palau and PPUC management can fix. It is hard to see how the SEDREA project could have done more than it did to assist the move towards more sustainable PPUC electricity tariffs.

During the mid-term review mission, the then[3] PPUC CEO expressed the view that the SEDREA tariff review findings and recommendations were based on (unspecified) inaccuracies, and that therefore the tariff review should be undertaken again. No evidence was presented to support this view and there was no evidence of any significant inaccuracies with the tariff review apparent to the SEDREA mid-term reviewer. It is understandable that the (now) former PPUC management might argue that there were deficiencies in the tariff review and that this therefore meant that it should be repeated - to deflect attention from their own inaction in implementing the tariff review's tariff increases recommendations. It now seems that in light of the new change in management at PPUC (which is now back to Ken Uyehara, the GM at PPUC until April 2011 who was very supportive of the SEDREA tariff review and tried to implement its findings) that PPUC is once again pursuing the implementation of the SEDREA funded Tariff Review, and has already convened public hearings to discuss tariff changes since his appointment.

However, a new tariff review consultancy to encourage RE for Palau is now underway. On 26 November 2011, as part of the SPC/EU North-REP project, SPC issued a PPUC Renewable Energy Framework Consultancy with proposals to be received on 10 January 2012. This consultancy has a tariff review consultancy part entitled 'Review power utility tariff schedules to determine an appropriate tariff structure that will take into consideration for renewable energy generation connected to the PPUC grid". This is a very promising development and means that SEDREA does not need to fund any update of its earlier tariff study, as the new SPC/EU North-REP consultancy should cover this work.

The other main activity undertaken to date in the Palau SEDREA project has been the development, establishment and operationalising of the REFW at the NDBP. As articulated in the ProDoc, and in line with lessons learned with similar clean energy financing projects in the Pacific and elsewhere, the establishment of the REFW at the NDBP was a suitably deliberate and properly funded initiative that utilised appropriately experienced international consultants. The RE technology assessment undertaken by the international consultants confirmed that the most appropriate RE technologies to be covered by SEDREA would be grid-connected PV, solar water heaters (SWH) and perhaps stand-alone off-grid PV.

[3] Following the 05 Nov 2011 Aimeliik major power station fire and subsequent state of emergency being declared, the then PPUC CEO as well as the PPUC Board were suspended by the President of Palau, and they all subsequently resigned. The current Interim General Manager was the General Manager to April 2011 and hence during the SEDREA funded tariff review and was on track to implement its findings until he resigned when the (then) PPUC Board would not endorse the already agreed tariff increases recommended by the SEDREA funded tariff review.

This prioritised list of key RE technologies of relevance for Palau was clearly soundly based and appropriate, and should remain the focus of SEDREA support activities. The NDBP staff interacted with during the SEDREA review mission were clearly strongly supportive of the new RE business opportunities and appreciative of the training and technical support provided, so the SEDREA project to date has clearly been successful in identifying and supporting the necessary local capacity in a suitable Palau led RE financing provider (NDBP).

The NDBP has clearly provided a suitable strong focus on the establishment of the REFW, including through the purchase of five modules of 1700Wp grid-connected PV modules by NDBP for use at its own bank HQ site. Thirty grid-connected 1700Wp PV modules have been bought with GEF funds for use by NDBP in RE loans, with three residential PV systems already installed and working (comprising six modules). Under the initial NDBP/PPUC MOU, NDBP is now moving to install two more already approved on-grid PV systems (comprising 4 modules) and the first commercial on-grid PV system (comprising 4 modules), leaving 14 modules of its initial batch still to be marketed and installed.

Although strictly speaking most of Palau is rural[4], of Palau's 21,000 population an estimated 99% are already connected to one of the four PPUC electricity grids (ref. REFW RFP and TOR on July 2009, estimate of P Johnston in 2008, and 2005 Census – this is also consistent with earlier estimates of 97% Palau electrification in the 2004 PIREP report), thus suggesting that the market for off-grid electricity systems across Palau has been necessarily very limited since the earliest stages of consideration of the SEDREA project for Palau. After some delivery delays, 42 off-grid PV 270 Wp (Watt-peak) standard PV modules were delivered to NDBP. The 42 off-grid modules comprise 37 GEF funded modules and five extra modules provided in compensation by the supplier for delivery delays. Between one and four modules will be used per off-grid household depending on the level of electrical load to be met and the household's willingness to borrow the necessary funds from NDBP (minus the subsidy level provided).

One off-grid PV system has been sold and has been installed on a farm in a remote area of the main island of Babeldoab. A further off-grid module has been installed as a training and demonstration system at the NDBP main office. Both installed off-grid PV systems are apparently working well. It is not clear if PPUC have been fully involved in the off-grid electrification plans, although PPUC could be expected to be a strong marketing and technical support partner to potential un-electrified users who approach PPUC for electricity supply but where it would never be economic for such users or PPUC to pay for the necessary new grid extensions. This area of PPUC support for off-grid PV system systems is an area that the SEDREA project could usefully look into further. It is strongly recommended that strong marketing efforts now be undertaken without delay for the off-grid PV systems to sell and install the remaining 40 off-grid PV modules that are already in Palau and ready for installation.

Previous off-grid PV systems in Palau were donor provided at no capital cost to users, so it is not clear what the willingness or ability to pay for off-grid PV systems might be. It therefore appears that the relatively strong weight given to off-grid PV systems in the SEDREA design and initial implementation may be a function of the project initially falling under an off-grid RE strategic priority area for GEF

[4] According to the 2005 census, Koror State is the only urban place in Palau, so the other 15 States of Palau are therefore to be considered to be rural, see http://www.spc.int/prism/country/pw/stats/PalauStats/Publication/2005%20Census%20Monograph%20Final%20Report.pdf

funding. It is notable that the estimates for REFW PV system financing in the 3 years for the SEDREA project operation in the REFW RET market final report did not include any financing of off-grid systems. The SEDREA project should therefore be prepared to refocus on on-grid PV systems and SWH according to the observed realities in its initial limited sales of off-grid PV modules (the relevant military adage for this is "reinforce success and abandon failure").

SWH has been understood from the earliest project design stage[5] to be a key RE technology in Palau, given that (a) there were 1001 electric resistance water heaters installed in houses in Palau in 2005 (ref. 2005 census), although apparently many are not currently being used, along with around 1300 hotel rooms which would nearly all require a hot water supply, (b) electric resistance water heating is extremely expensive even at the current below real cost 500kWh/month initial residential tariff step, (c) appropriate mass produced SWH systems (in particular Chinese heat pipe evacuated tube (solar) collectors (ETC) and manifolds/tanks) are available and appropriate models exist that are suitable for use in Palau's predominantly mains-pressure plumbing systems, and (d) Palau has one of the highest per capita incomes of any Pacific island country and hot water demand in tropical countries is strongly related to income levels. Although SWH was identified as a key RE technology application to be supported under SEDREA, a three year market of 808 SWH loans was postulated for REFW funding, and a suitable SWH specification was developed, however no suitable standardised SWH units have yet been purchased with GEF funds nor by plumbers/suppliers for NDBP REFW loan funding, nor does the SEDREA supported marketing material explicitly mention suitable SWHs as being eligible for NDBP ELP loans.

Achieving 808 SWH loans under REFW in three years - when the existing baseline SWH market in Palau is probably no more than 100 systems – will clearly require active SEDREA assistance. It is therefore recommended that a high priority for SEDREA in its remaining project implementation period to July 2012 (or beyond if the project end date is extended) is to support the specific identification, purchase and installation of suitable standard demonstration SWHs (using heat pipe ETC collectors in mains pressure systems) in residential and commercial accommodation applications in Palau.

A key issue that needs to be addressed for SWH in Palau is that Palau utilises generally US-style mains pressure plumbing layouts. However, most of the inexpensive Chinese SWH designs that account for nearly 75% of global SWH sales and installations use low cost and low pressure flooded ETC tubes directly coupled with thermosyphon fed hot water tanks placed above the ETC tubes - the water that is being heated thus circulates by natural convection through the tubes from and back to the storage tank. Flooded ETC tubes cannot realistically be sealed at their point of entry to the hot water manifold or tank with mains pressure plumbing layouts, so they cannot be used directly with mains pressure hot water systems. Flooded tubes ETC systems also do not sustain their high performance over time - due to gradual mineral scaling of their inner tube inside surface. So heat pipe ETC with suitable mains-pressure thermosyphon tanks (or pumped SWH systems using separate primary heating loops and often using

[5] During the project design process, particularly when identifying the RET demonstrations; one of the proposed baseline activities by the GOP was its ongoing solar energy system rehabilitation program in island communities. The specific requirement that was proposed for the incremental activities was the upgrading of the existing hot water system of a hospital by supplementing it with solar water heaters. The incremental cost was to be for the supply and integration of the solar water heaters to the existing hospital system. However, it is not clear how such a hospital SWH system retrofit would link to residential and tourist SWH replications, which are very different markets and probably different SWH systems too.

storage tanks inside the house) need to be sourced for Palau, along with relevant associated US-plumbing specification pipework and electrical fittings. This should not be a major constraint as similar SWH issues have been addressed in other countries such as New Zealand, albeit with New Zealand not using US plumbing and electrical fittings.

This is an area that deserves increased focus in the remaining operation of the SEDREA project, and will almost certainly require consulting input to be obtained by the SEDREA project from a suitable international expert with experience in using Chinese or similar evacuated tube SWH technologies in mains pressure plumbing layouts. Effectively specifying, sourcing, encouraging and financing SWH should be a high priority in the remaining implementation period of the Palau SEDREA project. This should include sourcing SWHs that are compatible with US style mains pressure applications, training plumbers in their installation, ensuring that plumbers and/or hardware supply outlets stock appropriate systems, and using the REFW to fund the purchase and installation cost of appropriate standardised SWH systems. A market of 380 household and 430 commercial SWH systems within 3 years was assumed in the REFW design, but to achieve this will require an immediate strong effort by the SEDREA project on standardised SWH system identification, procurement, technical support, and marketing.

One key constraint facing the Palau SEDREA project in its implementation that has clearly caused major delays and a definite slackening of implementation impetus since March 2011 has been top management changes at both PPUC and NDBP.

In the case of PPUC, the departure of its former GM from April until November 2011 seems to have been directly related to the (previous) PPUC Board suddenly deciding to not fully implement the SEDREA tariff review recommendations that had previously been agreed to by the then PPUC Board - in particular to reduce the below-cost residential “lifeline” tariff initial step from 500 kWh/month to a more typical and justifiable circa 500 kWh/year, noting that PPUC has apparently run at an operating loss for the last 11 years. With the pre-March 2011 GM (Ken Uyehara) now back as the interim GM of PPUC, and the PPUC Board that would not endorse the tariff changes now having resigned; there is now supportive PPUC management in back in place for tariff review and the source of April-November 2011 delays at PPUC is now firmly in the past. The new PPUC Interim GM (Ken Uyehara) is once again pursuing the implementation of the findings of the SEDREA funded Tariff Review. Public hearings are currently being conducted, and the new Interim GM is informing the general public and government officials that had the SEDREA funded Tariff Review been implemented then PPUC would have savings of up to $6 million to date towards fixing PPUC’s long standing underfunding and its unreliability implications.

In the case of NDBP, the Bank President going on administrative leave may not be permanent, and is unrelated to SEDREA, and clearly does not represent any slackening of in principle support by NDBP as an institution for RE under SEDREA. The NDBP upper management change situation however seemingly has led to an unfortunate reduction in pro-active high level NDBP RE leadership, which is relevant to SEDREA in addressing the recent delays in implementing the SEDREA supported net-metered grid-connected PV installations using existing modules that were funded by GEF and have been physically in Palau and have been ready for installation since around April 2011.

A new MOU was initiated between NDBP and PPUC during the MTR (mid term review) mission in July 2011, with the impetus for the new MOU being led by the review mission. The new NDBP:PPUC MOU covers a further 100 residential and further five commercial RE net-metered grid connected systems. The fact that the SEDREA review mission had to initiate this extension of the existing MOU to cover further grid-connected RE systems illustrates the unfortunate reduction of high level Palau key shareholder leadership since the PPUC and NDBP leadership changes in March/April 2011, noting that supportive PPUC higher management is now back in place at PPUC with the return of the Pre March/April GM as interim GM at PPUC[6].

Even without aggressive marketing, round 25 residential customers (2 modules each) and 5 commercial prospects (probably 4 modules each) have apparently already expressed interest in grid-connected PV systems to NDBP. There is therefore little doubt that there is more than enough existing interest in further net metering PV installations to fully utilise the remaining available and unallocated 16 grid-connected PV modules already in Palau, even without waiting for any aggressive marketing results. Indeed, a potential new challenge for NDBP could be how quickly they can order and get delivered further standard on-grid PV modules once aggressive marketing starts and once more residential and commercial customers become interested in grid-connected PV for their buildings. With the approval of the extended and expanded grid-connected net-metered PV MOU by PPUC on 16 November 2011, a renewed focus on installing existing systems with existing interested clients, active marketing of new systems, and ordering more systems is now required from NDBP and the SEDREA project.

A net metering bill for grid connected RE installations was submitted to the Palau Senate in January 2009, and finally approved by the Palau House of Delegates during the review mission in July 2011. The bill now needs to be reconciled between the Senate and House versions and then considered and approved by the President of Palau. The most common view of the importance of the Net Metering Bill from most people interviewed during the review mission, was that it would be a critical legal underpinning of net metered PV in Palau and that it would ensure that all who wanted to avail themselves of net metered PV installations could do so. In contrast, the view of the former PPUC CEO/GM (who resigned in November 2011 after that disastrous power station fire and subsequent rolling blackouts) appeared to be that regardless of any enactment of a Net Metering Act, PPUC would still control the rate, technical requirements, metering and buy-sell financial terms of such new net-metered PV grid systems to maximize the benefit of such systems to PPUC.

A positive development at PPUC is that a renewable energy division (RED) was formed in 2010, which largely seems to be a result of the impetus to household grid-connected PV led by the SEDREA project. PPUC therefore seems to understand that grid-connected PV by households, donor provided projects, and IPPs is an inevitable future part of the electricity generation mix in Palau. It is thus a promising development that interconnection standards and draft model contracts for IPPs are included in the upcoming SPC/EU North-REP PPUC Renewable Energy Framework Consultancy.

[6] Note that in light of the November 2011 Aimeliik power station fire led electricity supply emergency, PPUC responsibility was turned over to Minister of Public Infrastructures, Industries & Commerce under which the new NDBP:PPUC net metering MOU was finally accepted and signed by both parties. The current PPUC Interim GM Ken Uyehara is aware of this and is in full support of this new MOU.

However, there seemed to be a desire by the former PPUC management to try to control the emerging grid-connected PV market. This attempt by the former PPUC management to control the development of non-PPUC grid connected PV seems to be apparent in: delays in implementing the full scope of the initial MOU between NDBP and PPUC to install five residential and two commercial customers' net metered grid-connected PV systems; that it took a direct approach by the PEO Director to the Minister of PPUC after 2 ½ months of delays for the new MOU for an additional 100 residential and 5 commercial grid-connected systems to be approved; a desire by PPUC to have two meters for net metered customers; some unofficial talk (by the now departed GM/CEO of PPUC) of applying different tariffs to imported and exported electricity by net metered customers; and PPUC deciding that any credit for surplus overall PV supplied to the grid would expire after 12 months rather than remain as an ongoing credit. There is also an (understandable) ongoing reluctance by PPUC to provide free ongoing technical support for donor provided PV systems that are installed with no reference to PPUC, for example for the 150 kW hospital PV system.

It is also a concern that the upcoming SPC/EU North REP PPUC Renewable Energy Framework Consultancy does not seem to mention the existence of SEDREA or SEDREA supported net-metered PV installations - or the Net Metering Bill that has been approved by the Palau Congress - or grid-connected residential or commercial net-metered PV as promoted by SEDREA. It is not clear if this lack of mention of SEDREA and other relevant related activities in the upcoming SPC/EU North REP PPUC Renewable Energy Framework Consultancy is just an oversight by the SPC/EU North REP project, or reflects a lack of coordination, or reflects a deeper PPUC lack of focus on these initiatives. So the SEDREA project will need to remain vigilant and pro-active to ensure that the SPC/EU North REP PPUC Renewable Energy Framework Consultancy and/or PPUC activities do not undermine the net-metered residential or commercial PV systems in Palau that SEDREA is promoting.

In summary, the SEDREA project has a generally sound problem definition and design and has made an impressive start with the development of appropriate technical specifications, the procurement of standard and appropriate PV systems, the development of a suitable RE funding mechanism (REFW), and the successful deployment of initial residential grid-connected PV systems through an appropriate and strongly committed local financing institution (NDBP). The early positive results of SEDREA are now in the process of being replicated throughout the Pacific through ADFIP and a partnership with IUCN with its Italian and Austrian funding and/or by the 11-country UNDP-GEF PIGGAREP project. An extended MOU covering an additional 100 residential and five commercial grid-connected PV systems was instigated by the MTR mission and was approved on 16 November 2011, and provides the necessary basis for the deployment of the existing 14 unallocated grid connected PV modules that have been purchased by SEDREA using GEF funds for NDBP REFW loans and that are already in Palau. A Net Metering Bill is nearing final approval and should help in the mass deployment of grid-connected PV systems in Palau. Progress with the off-grid systems has been slower, the challenge is now to get the remaining 40 existing systems successfully marketed and deployed. The next big challenge for SEDREA is to develop and standard specification and technical support for appropriate SWH systems to mirror the success start underway with grid-connected PV systems.

## Recommendations

In its remaining operations, it is recommended that the SEDREA project: -

1. Aggressively Market the Existing Off-grid PV Modules – clear out existing stock, discount if required, and only order more modules on firm orders and the payment of a cash deposit by recipients;

2. Aggressively Market On-Grid PV Systems – get loans and installations underway for the remaining existing modules in stock on Palau, as required update specification, then NDBP to order more modules for the additional 100 residential and 5 commercial systems approved in the updated MOU with PPUC;

3. New Focus Required on Solar Water Heaters (SWHs) – identify suitable mains pressure SWHs and US-style plumbing and electrical fittings, demonstrate these SWH systems in use in Palau, ensure that these SWH's are stocked for sale by plumbers/hardware outlets/NDBP, NDBP to then aggressively market SWH loans;

4. Provide Further Technical Support from REFW Consultants – this includes refresher training for on and off grid PV system installation, and remote technical support to NDBP and suppliers/installers;

5. Provide Model for REFW Replications Beyond Palau – in particular by SEDREA and NDBP through the demonstration of the modalities and early success of the Palau SEDREA/REFW RE financing model for the current initiative through ADFIP with PIGGAREP or other funding to be replicated to further Pacific Island countries;

6. Extend Project End Date to end of 2012 – to ensure that remaining project funds provide the greatest possible impact and to make up for unforeseeable delays in the SEDREA project implementation to date.

# 2. PROJECT/PALAU RENEWABLE ENERGY CONTEXT

Palau, alongside its fellow Pacific Island Countries (PICs), is very motivated to increase its use of renewable energy to manage the high, variable and unpredictable cost of imported oil products and LPG and the resulting energy security risks of this imported oil products dependency. Palau also wants to play its part in global efforts towards climate change mitigation. Palau has a population of around 20,000 people, of whom 90% live on the main two linked adjacent volcanic islands of Koror and Babeldoab, and on the nearby island of Peleliu – with all three main islands located within the one main Palau reef structure. Palau GDP at around $8000 per capita is one of the highest in the Pacific. Palau has been assessed in the UNDP 2011 Human Development Report— Sustainability and Equity: A Better Future for All report for 187 countries as having the highest HDI (Human Development Index) in the Pacific. Palau is ranked at 49, and along with Tonga (ranked at 90) they are the only two high human development index ranked countries in the Pacific.

Like nearly all other PICs, Palau is extremely vulnerable to the cost of fossil fuel imports, both directly for electricity generation and for transport uses, and indirectly and directly though tourism. In particular, global oil prices have a direct link to tourism, which is Palau's main source of income - the second largest source of income previously was funding from the US as part of the Compact of Free Association (COFA) between Palau and the US, but there are no new compact funds yet agreed to. The number of, and expenditure in Palau by, tourism arrivals in Palau are strongly dependent on the economic health of the countries where the tourists come from, and this economic health of tourist source countries is directly related to world fossil fuel, and in particular oil, prices. Tourism arrival numbers are also directly related to the cost of international flights to Palau, and the largest single component of the cost of flying is the price of jet fuel. Road transport in Palau is primarily by private motor vehicles (there are no buses). Marine transport in Palau includes the high power output petrol outboard motors used for tourist boats for sightseeing, diving and snorkeling at the world-renowned Rock Islands and other sites, which along with electricity use is part of the international oil price dependent cost structure of tourists whilst in Palau.

Palau has no currently known or usable indigenous fossil oil reserves[7], so all fossil fuels are currently imported. Palau's known and currently usable renewable energy resources are mainly solar based, and comprise: (1) grid-connected large donor provided PV systems; (2) commercially provided net-metered household and commercial PV systems; (3) providing hot water through SWH (solar water heaters) for tourist facilities and private homes; and (4) off-grid PV for the around 1% of the population that are not connected to one of the four Palau PPUC electricity grids. Even in most rural areas of Palau, nearly all households are already grid-connected, so off grid household numbers are clearly very small, and would seem to only be around 75 households in total - of which most would be in remote islands and most would be already served by off-grid PV systems provided by previous donor funded projects.

[7] The World Bank has supported preparatory work on the legal basis for oil and gas exploration and exploitation in Palau waters. An Oil and Gas Task Force was established, but it does not currently seem to be very active. See http://www.palaugov.net/PalauGov/OGTF/OGTF.htm

Palau does not have a large number of unutilized coconut trees like many PICs that could be used to provide coconut oil for transport or for electricity generation. Palau has large areas of regenerating land that could in principle be used to grow oil seed crops such as Jatropha, although (as is common in PICs) a lack of clarity around communal land ownership would present a significant challenge. In addition, the high income levels in Palau (one of the highest amongst PICs) makes the prospects of economic production of oil from coconuts, Jatropha or similar oil rich seed plants unlikely at current Palau income levels for such a labor-intensive imported oil-substitution option, even at current international oil prices of $100 – 120/bbl.

Palau is currently dependent on diesel for 99% of electricity generation for its four electricity grids, and with diesel accounting for 66 – 80 % of the cost of electricity generation, the cost of diesel is clearly the largest single factor in the unavoidably high cost of electricity supply to the approximately 99% of Palauan's that are already connected to one of the four PPUC electricity grids. The average electricity tariff in Palau is in the middle range of overall tariffs in applicable PICs, but in common with the situation in most PICs, the average tariff is inadequate to operate the electricity grids in Palau on a sustainable ongoing variable (fuel and routine and major overhaul engine O&M) cost basis, let alone to accumulate the necessary funds for eventual major diesel engine and transmission and distribution (T&D) capital rehabilitation work.

The Palau grid electricity systems have four particular factors that are holding back their ongoing financial viability: (1) all of the existing diesel generators are either considerably oversized (in the three smaller grids) and/or are very old and unreliable or are no longer able to be operating at all - which leads to excessive diesel use and an unreliable supply (two new 5MW sets currently being commissioned for the main grid will help but will not completely solve this problem); (2) the extremely high residential initial low cost (lifeline) tariff step of 500kWh/month means that nearly all residential grid electricity is supplied at below its real cost of supply; (3) non-payment of government electricity arrears and non-charging of streetlight use means that there is insufficient revenue for the electricity utility to pay for its diesel on time, let alone for the necessary major 24,000 hour maintenance overhauls of its generator sets and other major scheduled O&M costs – noting that a lack of funds for necessary maintenance caused a diesel spill in July[8] at the at the main Aimeliik power plant, the same power station that later suffered a catastrophic fire on 05 November 2011; and (4) fuel cost surcharges (to reflect increases in diesel costs) are generally applied late and generally do not fully reflect fuel price increases.

The total grid-connected PV capacity in Palau is currently estimated to be 550 kWp, of which 98% is from previous donor grant funded projects. Indicatively, up to 2MW (20% of Sunday midday electricity demand) of dispersed PV capacity should be able to be grid connected to the main Koror-Babeldoab electricity grid before there are likely to be any need to consider grid stability issues (as per advice of international solar energy technical expert Dr Herb Wade)[9]. Donors have provided off-grid PV solar home systems in the past to the outer islands and remote parts of Babeldoab, but probably less than half of these donor-provided off-grid PV systems are still operating[10]. The rehabilitation of some systems

[8] See http://kshiro.wordpress.com/2011/07/14/palau-oil-spill-taints-peleliu-mangroves-water/

[9] Note that as part of the SPC/EU North REP project, on 26 Nov 2011 SPC issued a PPUC Renewable Energy Framework Consultancy. This consultancy among other issues includes "…a grid stability study to assess the technical limits and maximum amount of renewable energy that can be integrated into a grid according to technology type, capacity and location on grids'.

[10] Reference, Chapter 4 RENEWABLE ENERGY EXPERIENCE, PIREP Palau Key Energy Issues Assessment Report - Herb Wade et al

in Sonsorol and Tobi islands was undertaken without reference to the Palau Energy Office (PEO) and these expensive and excessively complex PV off-grid systems are not expected to keep working for 20 years, as would now be expected for properly specified and installed off-grid PV systems as are now well proven in thousands of successful applications in the Pacific. Donors have also provided stand-alone PV streetlights and wharf lights in the past, but with no provision to cover maintenance costs (e.g. for replacement batteries), as would be expected many of these systems are now no longer operating. Such donor-provided one-off PV systems are of course much appreciated in principle by the recipients as they are provided at no cost to the beneficiaries, but they often have major issues that arise once they are operating, and they are generally not realistically linked to any replication towards the development of a sustainable RE market in Palau.

The potential market for on-grid PV systems under the SEDREA project is around 1 MW of capacity or 600 standard PV modules at 1.7kW each (out of a potential market of 4308 Palau grid-connected households at 1 – 2 modules per house, and 864 commercial businesses at 1-4 modules per business), leaving say around 450kW for future additional donor provided systems before grid stability issues need to be seriously considered. Beyond this PV limit of around 2MW (20% of Sunday mid-day system demand) there may be a need to either utilise diesel generators that have enhanced rapid load-following ability, or to add some short-term electricity storage capacity such as battery banks or flywheels. At 1.7 kW per SEDREA on-grid module, and with 2 modules per residential on-grid system and 4 modules per commercial on-grid system, the current updated MOU between NDBP and PPUC for 105 residential and seven commercial net-metered on-grid systems is highly unlikely to lead to any grid stability issues. In any case, consultants in the upcoming SPC issued PPUC Renewable Energy Framework Consultancy that is being funded under the SPC/EU North REP project will study this grid stability issue.

In addition to the high profile PV option, there is an even larger and more immediate market in (lower profile) SWH (solar water heating). The potential market for SWH in Palau is around 1300 residential and 1300 tourist related systems – and for reference in the 2005 census there were only 100 residential hot water systems using electricity, although many were disconnected when oil and hence electricity prices spiked upwards in 2008. So there is certainly a large potential market for SWH in Palau.

All grid electricity in Palau is provided by the government-owned PPUC (Palau Public Utilities Commission). PPUC operates four grids which operate with common tariffs, reflecting a cross subsidy from the main grid to the three smaller grids. The four grids comprise one grid for the main linked islands of Koror and Babeldoab, and separate stand-alone grids to Palau's three main occupied outer islands of Peleliu, Anguar, and Kayangel. PPUC's mandate is to cover its variable operating costs, but it has not been achieving even this for many years, as it has run at an operating loss for the last eleven years. This under-charging by PPUC then makes the RE alternatives of grid-connected PV and SWH less cost-effective than they would otherwise be, in particular for residential users as the excessive first residential tariff step of 500 kWh/month covers 75% of residential electricity usage. This then means that grid-connected PV requires initial subsidies to be profitable investments with a positive cash flow for electricity users from day one, in particular for Palau households where the excessive lifeline tariff step of 500 kWh/month undermines the economics of grid-connected residential PV systems. Moving

– Apia, Samoa: SPREP, 2005

the low cost lifeline tariff level down to a more common 50kWh/month, and increasing tariffs to fully cover fuel and O&M costs, and ideally adding a capital charge as well, would be the largest single measure that could be taken to make RE cost-competitive in Palau, especially for grid-connected PV. This issue of appropriate tariffs to encourage RE (amongst other reasons) will be reviewed under the upcoming SPC issued PPUC Renewable Energy Framework Consultancy being funded under the SPC/EU North REP project.

Palau has an Energy Policy and a Strategic Energy Plan that were both completed recently with non-SEDREA support (October 2009), and both of which say most of the right things in energy policy and energy strategy terms. Having a suitable energy policy and strategic plan is clearly a necessary starting point for moving towards a more sustainable energy future for Palau. However, as is common in most PICs, tangible implementation of any energy policy and strategic plan is generally problematic in practice in Palau. In Palau, amongst other reasons the peak government agency, the Palau Energy Office, has only one permanent staff member (the Director), who is kept busy just responding to and coordinating with the various donors operating in the Palau energy space. So while there is a great interest in principle in increasing the use of renewable energy (RE) in Palau, as in all PICs, the practical impact of RE policies and targets in isolation is often modest in practice as the policies and targets are either ignored by political leaders or by relevant government agencies. As is common in all PICs, there is simply not sufficient local capacity to follow up on any national energy policies and targets, there is inadequate national funding compared with other pressing priorities, or donors do not fund the necessary actions - and the national energy policies and targets then don't get reflected in national planning and budgeting exercise and hence do not get translated to actual national programs or installations on the ground. So suitable energy policies and strategies are a "necessary but not sufficient in themselves" component of RE – in other words the lack of suitable energy policies and strategies can be a barrier to the uptake of RE, but having suitable energy policies and strategies is at best an enabling factor that can assist subsequent and separate implementation focused tangible RE measures - but the simple existence of energy policies and plans does not necessarily lead to their implementation.

In practice, the primary tangible support and implementation means for Palau (as in wider PICs) RE policies and targets is the wide range of donor hardware funding and 'software' including capacity building support programmes available. However, the RE donor support available generally focuses on specific project based planning, analysis and the supply of (often inappropriate) RE equipment – and not always on required key "soft" components of proper electricity grid tariff studies[11], the specification and importation of proper competitive and internationally procured RE equipment, the establishment and ongoing support of sustainable financing mechanisms, training in RE equipment installation, and ongoing support of private sector delivered standardised and appropriate RE equipment, and so forth.

Coordinating donor support and funding and implementation actions into one integrated RE and EE (energy efficiency) programme is still unfortunately rare in PICs, the notable exception to this in the Pacific to date is the Tonga TERM (Tonga Energy Road Map) and similar exercises that are underway in the Cook Islands and Vanuatu.

[11] Note that UNDP in addition to Palau has supported comprehensive tariff reviews in Tuvalu, Solomon Islands and Pohnpei in FSM

It should be noted that RE hardware provided by donors, for a variety of reasons, is often more expensive than proper internationally competitively procured hardware, is generally more complex and costly to maintain than best current practice, and is often initiated and procured without building on local capacity and lessons learned. The negative Palau experience with the PV systems provided in the early 2000's in Sonsorol and Tobi islands (see PIREP Palau report) is therefore unfortunately common.

At its time of its background analysis, inception, design and approval (2004-2008) the main RE project under preparation for Palau was the UNDP-GEF Sustainable Economic Development through Renewable Energy Applications (SEDREA) Project. The preparatory phase for the Palau SEDREA project was the US$760,000 UNDP/SPREP-GEF regional medium scale project (MSP[12]) called the Pacific Islands Renewable Energy Project (PIREP)[13] that was implemented from May 2003 to mid-2006 and which provided an unusually thorough analysis basis for the Palau SEDREA project, as well as for the regional PIGGAREP project and for the ADMIRE project in FSM. Under PIREP a very extensive research, review and consultation process was undertaken in each of its fifteen Pacific Island Countries (PICs). PIREP produced very useful national energy assessment reports and three excellent summary reports covering the potential role of demonstration projects, renewable energy (RE) financing systems, and RE technical support programmes. In addition, PIREP also produced a particularly useful and insightful regional synthesis of the fifteen national assessment reports.

PIREP led to three successor RE implementation projects. The largest PIREP successor project was the five-year duration GEF US$5.25 million grant funded Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP) for eleven PICs[14] that came under the GEF Strategic Priority 4 (SP-4) and focused on the commercial provision of RE for productive uses.

Palau (and separately the Marshall Islands through its ADMIRE - Action for the Development of Marshall Islands Renewable Energies project) developed their own single country oriented RE projects following on from the PIREP project.

In the Palau SEDREA project design stage, local stakeholder consultations were undertaken[15]. Together with the stakeholders, the project log frame was developed using the LFA (Logical Framework Analysis) process. During the SEDREA project preparation the potential stakeholders of the projects were identified. Prior to conducting the logical framework workshop, meetings and discussions were held with important players in the energy sector to assess their understanding of the RE issues, and to get their views and opinion about the role they would or could play in removing the barriers to renewable energy. During the stakeholders' workshop (October 26 – 28, 2005, Koror, Palau), the preliminary project ideas were presented and discussed. The following are the stakeholders that were consulted during the project design:

[12] Note that having a MSP for a project preparatory phase is usually only undertaken for very large budget GEF projects or for regional projects such as PIGGAREP facing particularly complex and deep-seated barriers

[13] Covering Cook Islands, Fiji, Federated States of Micronesia, Kiribati, Marshal Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu

[14] Comprising Cook Islands, Fiji, Kiribati, Nauru, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu

[15] Reference, personal communication, Manuel Soriano

- Bureau of Public Works/Energy Office
- Office of Environment Response and Coordination
- Palau Public Utilities Corporation
- Ministry of Finance
- National Development Bank of Palau
- Bureau of Budget and Planning (formerly the Bureau of Planning and Statistics)
- Palau Community Action Agency

The Palau SEDREA project was developed as a GEF Medium Scale Project (MSP) with $1.0 million funding (including $25,000 for its project preparation).

SEDREA was developed under the GEF-4 (Global Environmental Facility 4th replenishment) OPERATIONAL PROGRAM: OP #6: Promotion of the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs. The project was approved under the umbrella of the (subsequently superseded) GEF-4 Strategic Program SO-5: Promotion of Renewable Energy for the Provision of Rural Energy Services[16]. The stated focus of the project design for SEDREA's GEF-4 funding was on supporting enabling activities that remove barriers, in this case to develop and transform the markets for renewable energy (RE) in Palau so that over the long term they will be able to grow and operate efficiently toward a less carbon- intensive path. So the off-grid focus of SEDREA seems to have been to some extent a legacy of an early GEF-4 Strategic Objective (which carried over from GEF-3) and this SO-5 was then not later included in the full GEF-4 funding cycle objectives. So it seems that the SEDREA objective on off-grid RE was at least partly a result of unfortunate timing as a legacy of the GEF-3 (2002-2006) cycle and being too early in the GEF-4 cycle (2006-2010) for the full GEF-4 strategic objectives to have yet been fully established.

The Palau SEDREA project was designed in 2006 – 2007, the project document (ProDoc) was finalised in December 2007, the GEF CEO approved the SEDREA project in July 2008, the delegation of authority for the UNDP Multi-Country Office (MCO) Fiji to sign the ProDoc was provided on 22 Dec 2008 and the initial (2009) Annual Work Plan (AWP) was signed by UNDP and the Government of Palau (GOP) in December 2008 authorizing the start of the project's implementation. A key enabling policy step to SEDREA objectives, the draft Net-Metering Bill, was introduced to the Palau Senate in January 2009.

Formal national on-the-ground Palau SEDREA activities started with the project's inception workshop, which was held in June 2009. Initial SEDREA project activities started with the PPUC Electricity Tariff

[16] The SEDREA project was approved for inclusion in the GEF 2007 Pipeline on the basis of the early GEF-4 strategic objectives, which included SO-5. Thus SO-5 appears to have been a GEF-3 legacy SO that was apparently not included in the later GEF-4 formal SOs, which had an on-grid RE focus. The actual project design was completed before GEF-4, based on the strategic priorities that were established to form the basis for GEF's approach to the climate change focal area at the heart of the GEF-4 Replenishment agreement. The original PIF, which is in the earlier format (3 October 2006), was prepared and submitted for re-pipelining in November 2006. It was included in the GEF CY 2007 Pipeline on the basis of the earlier GEF-4 strategic objective on promoting renewable energy for the provision of rural energy services. However, GEF later determined that "For GEF-4, with respect to the strategic objective entitled "Off-grid Renewable Energy, ……this strategic objective [SO-5] will not be considered a priority given the level of support available and the renewed importance being placed on reducing overall GHG emissions." See para 12, Annex II, FOCAL AREA STRATEGIES AND STRATEGIC PROGRAMMING FOR GEF-4, GEF/C.31/10, May 11, 2007 at http://iwlearn.net/publications/gef-policies-and-programmes-documents/C.31.10%20Focal%20Area%20Strategies.pdf

Review and the initial NDBP Renewable Energy Fund Window (REFW) consultancy, where the respective RFQs were advertised in late July 2009, with both project activities being well underway by December 2009.

A SEDREA funded national project officer has been employed by the project since June 2010, and this SEDREA national project officer is based at the Palau Energy Office (PEO), which is providing in-kind project (co-funding) support. Other major sources of planned co-funding were the investment of $1 million of NDBP funds for RE installations to follow the RE FSM (full scale models) to be demonstrated by the SEDREA project, and $2.3 million in co-funding from the EU RE (North Pacific ACP RE and EE Project – aka North–REP) project. The expenditure side of the SEDREA project has been directly managed from the UNDP MCO in Fiji from July 2010, as this speeds up contract and financial management compared to operating contract and financial management through the Palau government financial systems with (quarterly) advances coming from UNDP. This provision of implementation support by UNDP, including direct payment of SEDREA expenditure, was requested by the government of Palau and agreed to by UNDP in July 2010. The provision of direct implementation support by UNDP was designed to speed up project expenditure compared to the previous practice (before July 2010) of UNDP making advance payments to PEO, which then undertook the necessary contractual management and then made the relevant payments.

All GEF Medium Sized Projects (MSP) and Full Scale Projects (FSP) are subject to mid-term and final evaluations. This SEDREA mid-term review (evaluation) covers the period of SEDREA operations to the end of July 2011 with some updates to November 2011 (two to nearly 2 ½ years of full SEDREA operations) of SEDREA's three years of scheduled operation (see March 2011 TOR for this MTR review in Annex H).

For this SEDREA MTR (mid term review), discussions as to the project background and context were held and a wide range of project documents were provided on 18 July 2011 at meetings at the UNDP Fiji MCO in Fiji. From 20-25 July 2011 a wide range of evaluation mission interviews and discussions were held with key project Stakeholders in Palau, and a preliminary report-back presentation was provided to key stakeholders in Palau (see Annex G for an updated copy of the preliminary findings' report-back presentation). The Palau mid term review mission was combined with a mission to Palau by the Regional Technical Advisor (RTA) for Energy, UNDP Pacific Center in Fiji, and the interactions and insights obtained from combining these two missions, and from subsequent email exchanges, have proved to be invaluable for the successful undertaking of this MTR.

The review interviews held, and the combined MTR and UNDP RTA missions taking the lead in urging an extension to existing the NDP MOU with PPUC from the initial five residential and two commercial systems) to a proposed additional 100 residential and five commercial grid-connected PV systems, and observing the subsequent delays in this MOU being agreed to by PPUC (it was finally agreed to by the PPUC Minister and not the PPUC Board) was extremely useful to understand the former PPUC Management (April to November 2011) and PPUC Board's (to November 2011) ambivalence to non-PPUC grid-connected PV, and also to implementing any tariff recommendations made for PPUC to implement.

This MTR (Mid Term Review) started by examining the project's development history to review the project (as approved) against its background context and project analyses, and then reviewed the alignment of its activities as undertaken with the overarching stated project goal and objectives. The MTR then looked closely at the various project related documents and outputs to ascertain how well the various activities were undertaken compared to what was expected. The MTR then finished by looking at the current project status, the remaining project budget and the remaining project duration - to develop recommendations for the best use of remaining project budgets and timescales. The MTR also looked at the quality and completeness of project reporting through its APR/PIRs (Annual Project Reviews/Project Implementation Reports) and the alignment of its activities with its original and updated project descriptions.

This mid term review report has reviewed a wide range of project related documents (see Annex C), and has greatly benefited from the very helpful input received from the project stakeholders at the evaluation mission interviews and in subsequent email exchanges. Feedback on the draft report was received from Manuel Soriano (Regional Technical Advisor - Climate Change, UNDP Regional Centre in Bangkok – and who was involved in the project's design stage, Thomas Jensen (Regional Technical Advisor for Energy, UNDP Pacific Centre, Fiji), Nyk Kloulubak (Energy Planner, Palau Energy Office and National Project Officer of SEDREA project), Emma Mario (Energy and Environment Cluster Team Leader, UNDP Pacific Centre, Fiji), and Karla T. West (Commercial Loan Officer, Energy Loan Program Manager, National Development Bank of Palau. Feedback on the SWH systems recommended for Palau under the REFW consultancy input, and the reasons for the choice of specifications, was very helpfully received from Dr Herb Wade. The feedback provided to the draft report from the above people was very helpful and greatly appreciated, but the analysis and conclusions reached and any remaining errors or omissions remain the responsibility of the author alone.

# 3. THE PROJECT AND ITS DEVELOPMENT CONTEXT

## 3.1 Stated Purpose(s) of the SEDREA Project

The logical starting point for analysis of the Palau SEDREA project and its development context is to review its original stated GEF funding purpose, and then look at any evolution in this stated purpose as the SEDREA project moved through its GEF funding approval steps, into its implementation phase, and finally look at where it is recommended to go with its remaining operational timescale and funding.

The original SEDREA project purpose is to be found in its GEF CEO Endorsement Request (CER) and its then back-to-back Project Document (ProDoc). The CER and ProDoc together form the underlying rationale of the SEDREA project's GEF grant core funding. The GEF CEO signed the project approval on 22 July 2008. The applicable CER and ProDoc versions at the time of GEF CEO approval would seem to be those provided to this review (the MTR) and dated 19 December 2007. In the CER and ProDoc the stated Strategic Program for the project was the then SO-5: Promotion of renewable energy for the provision of rural energy services[17].

Under the approved CEO Endorsement Request (CER)'s Heading E: Project Management Budget/Cost, the justification given, presumably for the $50,000 travel budget proposed, states "Justification: Palau is made up of several outer islands. The project office is in the capital city of Koror, while the main project beneficiaries are in the rural communities in the outer islands. Traveling to these islands for purposes of project management will involve considerable amount of financial resources. Within the islands, travel expenses are also high. Project coordination and management in the outer islands would require office facilities and equipment. As with the travel budget, with the remoteness of many of the outer islands/atolls, communication facilities have to be provided and budgets. Overall, the allocated GEF contribution for project management office facilities/equipment and travel expenses is regarded as very modest, considering the expensive inter-island travel that will be involved."

In addition, Part II.A of the Project Rationale states "the proposed SEDREA Project will …. create a conducive environment for investments in RETs on the power generation at the utility level, encourage application of household and village level RET applications especially in areas that cannot be served by the grid". Under Part II.C of the CER for Project Consistency with GEF Strategies and Strategic Programs it is stated "The project will result in increased utilization of RE for economic and social development in the rural outer islands of Palau." So it is clear that the original stated project design intent for SEDREA was primarily aimed at promoting the uptake of RE in the outer islands of Palau, both for local electricity grid applications and for the off-grid electrification market.

However, it is interesting that the CER in Part IV: Explain the Alignment of Project Design With the Original PIF (Project Information File) states " The actual project design was completed before GEF-4,

[17] This project was approved for inclusion in the GEF 2007 Pipeline on the basis of the earlier GEF-4 strategic objectives, which include SO-5. SO-5 was also the strategic objective stated for the RMI ADMIRE project document, which has strong parallels with the Palau SEDREA project, although RMI has many populated electrified outer islands and Palau has only a few significantly populated islands, which are nearly all electrified. SO-5 was from GEF-3, and was used in early GEF-4 planning but not used in the main GEF-4 funding regime.

based on the strategic priorities that were established to form the basis for GEF's approach to the climate change focal area at the heart of the GEF-4 Replenishment agreement. The original PIF, which is in the earlier format (3 October 2006), was prepared and submitted for re-pipelining in November 2006. It was included in the GEF CY 2007 Pipeline on the basis of the earlier GEF-4 strategic objective on promoting renewable energy for the provision of rural energy services."

So it appears very likely that at least part of the reason why the SEDREA project was ostensibly aimed at promoting RE in the outer islands of Palau was to align the then proposed SEDREA project with an early GEF-4 strategic objective for core SEDREA project GEF funding purposes. However, this SO-5 objective was not subsequently included in the main GEF-4 funding cycle's Strategic Objectives (SO).

It is important to clarify this issue of the overall purpose of the SEDREA project, as the Outer Islands of Palau only have 438 households (335 in the three main outer islands that have extensive local electricity grids) out of the total number of Palau households of 4744 (reference Household Income Expenditure Survey published in 2006). The (oversized) installed electricity generation of the outer islands of Palau is only 2.2MW compared to 18.1MW on the main integrated Koror-Babeldoab electricity grid. Furthermore, the number of un-electrified houses in the whole of Palau is only in the order of 75 households (see Final RET Market Report for Palau REFW). So even if the entire outer islands electricity grids and all 75 un-electrified houses was expected to be converted to utilise 100% RE, it is hard to see how 3.1MW of additional RE capacity in Palau is to be influenced by SEDREA if primarily located in the outer islands of Palau, as was claimed to be the expected project outcome in the CER and ProDoc. This limited potential for off-grid PV should have been known at the early design stages of the SEDREA project, as the predecessor UNDP-GEF PIREP project to SEDREA, states in its July 2004 report (PIREP Palau Report, Section 3, 1$^{st}$ para) "There is little potential for solar photovoltaics other than for connection to the PPUC grid".

By December 2008 in the UNDP Country: Palau Project Document of the 2008-12 CPAP (Country Programming Action Plan) the language around the purpose of the SEDREA project had notably shifted towards RE being used to substitute for diesel used in grid electricity generation, namely in the CPAP description "On the overall, the project is intended to contribute to, at least in the reduction of the growth rate of GHG emissions from the diesel-based power generation in Palau."

By July 2009 the purpose of SEDREA had further evolved towards an explicit primary focus on grid-connected electricity applications, with evidence being the PPUC tariff review study consultancy TOR where it was stated, "The objective of the project is the reduction of fossil fuel consumption in power generation….".

However, although it was estimated that only 75 households were not connected to one of the four electricity grids in Palau, so this minimal market potential was clearly known by that point, the focus on off-grid systems continued in practice in the Palau SEDREA project's implementation, and a year later 42 off-grid PV modules were delivered (37 purchased using GEF funds, five more were provided at no cost to compensate for delivery delays), with one to four modules to be used by each off-grid household depending on the level of electricity supply required and the willingness of these off-grid households to access NDBP loans for off-grid PV systems.

A rationale provided for the purchase by the SEDREA project's GEF funds of 37 modules of off-grid PV systems was that it was expected that people would move to the sparsely inhabited central part of Babeldoab island, partly based on the Capitol complex (completed in early 2008) that had been built in the middle of Babeldoab with a US Compact funded new tar sealed road (completed in 2007) connecting it to the main Palau urban area in Koror and southern Babeldoab 45 km away. However, this expected population shift has not yet occurred, so purchasing off grid PV modules for houses that have not yet been built seems a bit of backwards logic. It could also be that the continued off-grid hardware focus was a legacy of the original project focus on rural energy services. There could also have been a desire by the Government of Palau (GOP) to focus on rural households, or to provide new off-grid systems to replace earlier old and/or inappropriate replacement off-grid PV systems. However, it seems most likely that the continued focus on off-grid PV systems was primarily simply because it was in the project document, that PIREP and REFW evidence to the contrary was just ignored as off-grid PV was in the CER and ProDoc, and as such off-grid electrification continued to be implemented regardless of any new indications to the contrary that there was only a minimal off grid electrification market in Palau.

It is notable that the REFW RET Market Final Report by ReEx Asia and Dr Herb Wade did not include any off-grid PV systems in its estimates of REFW funding needs (see the report's Section 6.3 Conclusion – Summary of Total Financing Requirements). So although 37 off-grid PV modules were purchased by SEDREA using GEF funds, no loans were actually expected to eventuate from the sale of the systems purchased. In fact the REFW RET Final Market Report actually states this explicitly, in Section 6.1 (2) under the heading "To provide electricity for houses too distant from PPUC grid to connect economically" it states, and "Though this category has been identified as a source of demand for REFW loans, the demand is expected to be low. The need for non grid-connected solar PV financing in Koror and Babeldoab will be relatively small as compared to the need from grid-connected PV. We expect the demand for this sector to remain small and would assume it to be close to zero."

The legacy of the original design's initial high focus on off-grid systems seems to still be evident in the relative weight given in SEDREA project equipment expenditure on off-grid and on-grid PV modules. The SEDREA project spent $130,000 of its limited GEF funds on the purchase of 37 off-grid modules of 270Wp capacity (9.6 kW total capacity) for a total maximum potential replication market of only 75 households – even at two modules for every one of the possible 75 off-grid houses in Palau this only gives a total maximum potential off-grid PV market of 40.5kW. Yet the SEDREA project spent only double the off-grid module equipment amount ($270,000 of GEF funds) for 30 modules of 1700Wp on-peak PV modules (68kW total capacity) for a market of 4669 households (4383 on the Koror-Babeldoab grid alone) – with a potential real implementable market of at least 1 MW before any electricity grid spinning reserve or grid stability issues can be expected, and this is assuming that a further 450kW of donor provided PV capacity is also provided separately to the SEDREA project. Note that 16MW of PV is theoretically possible if all 4669 grid connected houses installed two 1.7kW (3.4kW total per house) PV modules - but noting that this more than 100% of peak load PV provision would then require massive electricity storage to be actually successfully connected to the real world diesel based Palau electricity grid(s).

So GEF funded equipment expenditure on off-grid PV equipment was at least a factor of 10 times higher than on on-grid PV systems when considered against their potential total markets.

Meantime, the SEDREA project did not spend any of its GEF equipment funds on solar water heaters (SWH), although the potential SWH market is estimated to be nearly 1300 houses and 1300 hotel rooms representing a realizable Palau market opportunity in installed RE capacity terms that is larger than the realizable on-grid PV potential - *around three times larger in realistic SEDREA project electricity substitution MWh terms according the ReEx Asia REFW RET Market Report's Section 6.3 Conclusion – Summary of Total Financing Requirements*. This promising SWH market was known at the SEDREA design stage as the PIREP July 2004 Palau report identified a useful market for SWH – in Section 3, 1st para it said "Solar water heating is clearly cost effective and a number of units are in use on houses and tourist facilities". Yet somehow the larger and more cost-effective SWH market kept slipping below the SEDREA project implementation radar. This neglect of SWH is unfortunately a common energy project phenomenon as RE projects are often fixated on providing electricity by shiny new PV systems, while less "sexy" but far more cost-effective SWH options are effectively ignored.

## 3.2 Links to PIREP and Other Relevant Analyses/Conclusions

The preparatory phase for the Palau SEDREA project was the Pacific Islands Renewable Energy Project (PIREP) covering 15 Pacific Island Countries (PICs). PIREP was implemented from May 2003 to mid-2006.

Under PIREP a comprehensive research, review and consultation process was undertaken in Palau, and a very useful Palau national energy assessment report was produced in July 2004. An additional three regional reports covering the potential role of regional demonstration projects, suggested regional renewable energy (RE) financing systems, and suggested regional RE technical support programmes were also produced for the fifteen applicable PICs covered under PIREP.

The PIREP Palau national report very usefully covered the mixed history of off-grid PV in Palau in its two implementation phases to date, and summarised this Palau PV history (to mid 2004) as follows - "Solar lighting systems were installed in the 1980s on Kayangel, Sonsorol, Tobi and parts of Babeldaob. There were institutional problems that prevented their long-term survival though a few systems have been sustained by individual households. The main problem was that services were too limited, the cost of service high for the limited services that could be provided and the structures for maintenance and repair were inadequate.

In recent years, much larger systems have been installed on the two islands that have not received diesel generation: Sonsorol and Tobi. The systems are large enough to operate refrigerators, washers and videos as well as lights and entertainment appliances. Unfortunately the installations are poorly designed for the Palau environment and inadequate support structures were included in the institutional design so the projects are not doing well."

So the PIREP report had already highlighted the critical importance of establishing proper: institutional settings, design, specifications, financing systems, technical support and maintenance for any future PV systems in Palau.

As already stated, the PIREP Palau July 2004 report (PIREP Palau Report, Section 3, 1st para) stated, "There is little potential for solar photovoltaics other than for connection to the PPUC grid." In addition,

the 2005 PIREP PIC-wide Demonstration Project Report (Section 1.1 Concept) stated, "The third group of PICs includes the Cook Islands, Nauru, Niue, Palau, Samoa, Tokelau, Tonga and Tuvalu. These countries have a high rate of electrification…[and] can benefit relatively little from additional off-grid electrification programmes".

So the original aim of the off-grid PV systems for Palau under SEDREA may have been to finally demonstrate how to properly implement off-grid systems in Palau, or it may have been to provide an alternative to the poorly designed donor-provided off-grid PV systems on Sonsoral and Tobi. However, it is clear that it was already well known in 2004 in the PIREP SEDREA predecessor project that there was little potential market for the off-grid PV systems being highlighted for SEDREA in its subsequent project design and focused on in the SEDREA implementation to date. This then violates a clear rule for demonstration projects, namely that there must be a sizable market directly related to where the results of a successful demonstration project can be scaled up by a large factor in subsequent replication projects - otherwise what is the overarching development purpose for the time and money spent on the demonstration project? For the known limited off-grid PV market in Palau there clearly was not a sizable available off-grid electrification market for any success of the off-grid PV module demonstrations to build on in any subsequent replications even up to full 100% penetration of the available market.

The PIREP Palau report identifies a highly cost-effective potential for SWH, but the PIREP analyses were unclear of the specific size of the market for water heating in Palau. However, the 2005 PIREP PIC-wide Demonstration Project Report includes Palau in the list of countries with high income levels where SWH could be expected to be a significant RE growth market opportunity, and the report also identifies a range of financing, marketing, system specification, installer training and capacity building measures that would clearly be required to help develop SWH markets in countries including Palau. So the omission of specific mention of SWH in the FSM (full scale model) demonstration RE technology aspects in the SEDREA design is at odds with the findings of the predecessor PIREP project. It may be that the funds in the SEDREA implementation devoted to off-grid systems just did not leave sufficient funds to undertake full scale demonstrations of standardised residential and tourist facility focused SWH in Palau, but if so, this or any other underlying reason should have been made clear in the SEDREA project design. More likely, the SEDREA project design and implementation fell into the common trap of overly fixating on (shiny) PV systems at the expense of (boring) SWH systems. This is in spite of SWH worldwide clearly providing a greater RE contribution than PV[18].

The PIREP 2005 summary Financing Mechanisms for RE report by Dr Herb Wade stresses the importance of careful financing mechanism design, suitable capacity building, and the need for clarity and realism of what the purpose of the proposed financing mechanism is expected to achieve. These are all highly relevant points for the development of the SEDREA REFW (Renewable Energy Fund Window) at NDBP, and are suitably reflected in the SEDREA REFW consultancy TOR.

It is very relevant that the PIREP 2005 summary Financing Mechanisms for RE report under Section 4

[18] Solar Heat Worldwide - Markets and Contribution to the Energy Supply 2009, EDITION 2011, Werner Weiss | Franz Mauthner, AEE INTEC AEE - Institute for Sustainable Technologies A-8200 Gleisdorf, Austria, IEA Solar Heating & Cooling Programme, May 2011

"Proposed Finance Mechanisms For The Pacific Island Countries" states that "The problems that are faced [include] that there is little experience with renewable energy development in the PICs that is not of a demonstration or pilot nature that has been based on grant funding. Thus there is little experience with commercial, sustainable financial mechanisms for the development of renewable energy resources".

So the PIREP project report explicitly warns of the risk of promoting RE by fully grant funded demonstration or pilot projects. To quote the SEDREA ProDoc on p25 "It was observed that most [RE] systems are grant-funded and therefore, unclear ownership of the systems lead to poor management and maintenance of the systems after installation".

The PIREP RE Financing Mechanisms report discusses at length the need for providing support for RE financing mechanisms using local existing financing providers such as national development banks. This PIREP financing emphasis is reflected in the SEDREA project design, where it seems clear that what was envisaged for the equipment purchase funds in component 2 was that GEF funds were to be used to subsidise the cost of the demonstration project equipment, but not to fund this equipment on a 100% grant funded basis.

However, in practice the SEDREA equipment purchase funds were used to fully fund 30 modules of on-grid PV and the 37 modules of off-grid PV. Such full (GEF) donor funding of hardware does not seem to have been envisaged in the SEDREA project's envisaged approach as reflected in the ProDoc or CER, nor in the REFW Phase 1 design where subsidised loans at a decreasing subsidy level funded by grant funding was clearly envisaged[19]. The idea adopted in the SEDREA implementation seems to have been to have the GEF resources that paid for the initial consignment of off-grid and on-grid PV systems to be returned to the REFW for NDBP to use as a revolving fund as the initial REFW loans (excluding subsidies) are paid back by the initial loan recipients.

This 100% grant funding of initial SEDREA RE equipment may have been seen at the time as a pragmatic step to get the SEDREA project's standard hardware systems on the ground as soon as possible in Palau, and to avoid needing to deal with the complex issues of shared risk of loan default guarantees and other similar issues, but taking the decision to 100% grant fund the equipment now means that the on and off-grid PV equipment is sitting in containers at the NDBP offices waiting for installation and that NDBP has none of its own funds invested in the equipment to provide a direct financial incentive for NDBP to recover its own funds by getting the available modules sold without delay. So the critical moral hazard aspect here is that although NDBP clearly wants to sell the equipment and obtain a financial return on the 100% grant provided PV equipment, the equipment does not actually represent NDBP funds, so any delay is not critical to NDBP management reporting to its Board on the use of its investment funds, as NDBP has none or its own funds directly invested in the PV modules sitting outside its office in shipping containers.

[19] The REFW-1 Final Design and Operating Procedures report in section 4.5.5 for on-grid PV systems states "Although the initial subsidy percentage will be set to make the solar electricity equivalent in price to that from the PPUC, it is planned that subsidies will decrease over time and be phased out completely within a few years, the exact time for the phasing out will be a function of initial market acceptance and the level of grant funding that can be raised by the NDBP for covering subsidies"

In summary, the PIREP country reports and synthesis reports clearly articulated that an integrated range of RE support activities (specifically strategically chosen demonstrations, technical support and financing mechanisms) would be the most effective way to facilitate the greater uptake of RE in PICs. The Palau SEDREA design (which was one of the key outputs of PIREP) follows this general PIREP recommended approach, although there are some unanswered questions about: (1) the rationale for the strong stated project design emphasis on off-grid PV; (2) the lack of explicit design and standardised equipment purchase emphasis on SWH; and (3) that the equipment purchases in the SEDREA design were meant to subsidise the purchase of RE equipment and not to just to 100% grant fund the initial demonstration RE equipment with the non-subsidy part of the loan repayments to go back to a sort of REFW revolving fund -as happened in practice, with its inevitable weakening of incentives to the recipient of the 100% grant funded equipment (NDBP) to get the equipment installed and in use as soon as possible.

## 3.3 Purposes of Proposed Demonstrations

The primary proposed means for the Palau SEDREA project to achieve its objectives was stated to be the use of RE demonstration projects - with their hardware costs to be (partly - in the SEDREA design) covered by the SEDREA project's GEF grant funding. The context of the demonstration projects was stated in the relevant PIREP report's title, which was "Demonstration projects to showcase the business angle of renewable energy service delivery in the Pacific Islands." Thus the PIREP focus of any proposed demonstration projects was proposed to be on demonstrating how certain RE technologies could be deployed in a way that showcased a particular RE application's uptake business angle that could then be subsequently replicated in similar applications - and not just the common (mis)use of "demonstrations" in the Pacific as a fully grant funded project that will allegedly showcase the "commercial provision of RE" - whatever that is supposed to mean in a context where electricity tariffs generally do not fully cover fuel costs, let alone equipment costs - and where the recipient of the RE equipment did not pay anything for the RE equipment provided either.

The purpose of the SEDREA demonstration projects was therefore clearly envisaged to be fundamentally different from the many "demonstration projects" that litter the Pacific RE landscape. In many, if not most cases, Pacific demonstration projects parachute some well meaning RE technology into some apparently worthy recipient client's site, and then somehow this RE demonstration installation is supposed to demonstrate something sustainable – although in practice the client generally has no idea of how to operate or maintain the system, and the local utility is understandably at best ambivalent about the shiny new piece of RE equipment that they will be expected to interconnect to their grid and help sort out ongoing technical issues for, all without receiving any payment and with their electricity sales reduced by the output of the new RE equipment. Palau has its share of such donor-led RE "demonstrations", with more envisaged by various donors, including several large grid-connected PV installations in public facilities and solar PV street and wharf lights, which even if successful in a technical sense will clearly not lead to any subsequent commercially focused replications.

As the SEDREA ProDoc states on p25 under the "Lack of confidence in RE technologies" barriers to RE in Palau "Generally, there is no confidence in RE technologies yet, because of most RE systems in previous projects were not successful."

So the purpose of the SEDREA demonstrations is therefore to use (real) demonstrations to showcase a useful and replicable business angle for RE in Palau. This was explicitly expressed in the SEDREA project ProDoc on p25 as follows "there are substantial structural and market-oriented gaps and barriers that need to be overcome through the implementation of sustainable and replicable RE systems in Palau. The technology delivery and financing mechanisms thus developed and established will serve as models for the proliferation of an RE industry in Palau. The main strategy of the GEF alternative is increasing the entry of productive uses of energy (PURE) under SP-4 PURE priorities and enhance financial viability of mechanisms through sustained income from these activities under SP-2 as well. As can be seen in the project design below, the PURE-related activities have been incorporated. These include: Activity 2.4 (RET Full Scale Model Demonstration on technology delivery, financing mechanisms and productive applications) and Activity 3.4: (Assessment of power generation potential, productive uses and value-added applications of RE resources for RE project pipelining). The financing mechanisms also require income generation through PURE to ensure long-term viability of the RE projects. To demonstrate other PURE possibilities, the project also includes power sales through feed-in to the grid using net-metering…"

## 3.4 GHG Reduction Target of SEDREA

The SEDREA design had a very ambitious direct project reduction target of: 7,900 tons of $CO_2$ from a total of 4.6 MW RE capacity that was expected to be installed during the SEDREA project implementation; a direct post-project reduction target of 53,000 tons of $CO_2$ from replication projects of about 19.6 MW capacity (installed during the 5 years after the SEDREA project end); and an indirect savings target of 31,800 tons of $CO_2$ from an additional unspecified extra capacity - for a total project $CO_2$ reduction of 92,700 tons.

However: (1) the main Koror-Babeldoab grid's weekday peaks were just under 12 MW total in mid 2009 and even counting the additional 5.855 MW from privately owned generators (as at 18 Sept 2009 according to the SEDREA REFW Final RET Market Report) this still only gives a Palau-wide peak demand of under 20 MW; (2) there has been no electricity demand growth for some time in Palau (in fact there was a 6% reduction in total PPUC output from 2004 to 2008); and that (3) no storage for intermittent PV generation is envisaged. So this means that the wider SEDREA GHG reduction targets are based on more than 100% of RE penetration of the daily main Palau electricity grid peak loads without any storage – which is clearly not physically possible.

So instead of only focusing on the specific GHG reductions, it is more useful to consider the SEDREA project as an enabling outcomes-focused project that would lay the groundwork for removing the barriers to RE in Palau and elsewhere to subsequent more commercially focused grid-connected PV and SWH. This wider view of the value of SEDREA is supported by its early apparent impact in serving as the model for Pacific wide replications of the SEDREA project approach through the ADFIP initiative that is currently underway.

# 4. FINDINGS AND CONCLUSIONS

## 4.1 Sources of Evidence

The SEDREA MTR findings and conclusions are based on: (1) reviews of SEDREA's design documentation (ProDoc, CER and UNDP Country Program Action Plan (CPAP) 2008-12 for Palau); (2) SEDREA's past and current activities (in particular the draft APR/PIR to July 2011[20] and REFW reports; and annual Financial Reports; 2009 and 2010 Combined Delivery Reports, Quarterly Progress Reports; and 2009, 2010 and 2011 Annual Work Plans); (3) reviews of the proposed SEDREA activities to its scheduled project end in 2012 (2011 Annual Work Plan, MTR interviews/discussions and subsequent email exchanges); (4) interviews and interactions with SEDREA stakeholders during the 20 – 27 July 2011 review mission to the UNDP MCO in Fiji and to Palau (and in subsequent email exchanges); (5) review of the extensive SEDREA documentation made available to the review; and (6) SEDREA related information already available to the reviewer from public sources and other projects (see Annex C for this report's references).

In particular in terms of the SEDREA project context, background and options at the time of its design the PIREP (PIREP was the GEF funded SEDREA design stage, along with that for the PIGGAREP regional project and the ADMIRE project in RMI) summary documents provided: very useful and relevant RE situation analyses for the RE baseline situation and future prospects in the wider Pacific and in Palau; made many very pertinent analyses and conclusions of the deep seated nature of the barriers facing RE projects' ongoing sustainability; highlighted the limited baseline role of the private sector in RE provision in PICs; stressed the dominant role of donors providing equipment; and highlighted the explicit and implicit subsidies that generally lead to electricity tariffs not reflecting full commercial supply costs; and overviewed the generally serious design, technical, operational and local capacity development deficiency causes of failure of most past RE demonstration projects[21]. Similar analyses are found in PREFACE and PIEPSAP project reports, and reports on the baseline energy situation and options for progress in PICs (including but not limited to Palau) from UNDP and ADB.

## 4.2 Deployment of Inputs (Expenditure) To Date

The applicable starting point for consideration of the SEDREA project's performance in utilizing its available inputs (in particular its core $975,000 of GEF grant funds) is to compare the actual SEDREA expenditure against both initial budgets and then updated budgets. The relevant budget starting points can be found in the SEDREA Project Document (ProDoc) in the Final Country Programming Action Plan (CPAP) for 2008 – 2012 and the GEF ProDoc of December 2007 that was used as the basis for the GEF grant funding of SEDREA. Note that the later CPAC ProDoc utilises an identical SEDREA project budget to the prior GEF CER/ProDoc budget. Hence the relevant ProDoc and CPAP baseline SEDREA budget for Year 1 is $262,500, for Year 2 it is $383,250, and for Year 3 it is $329,250 - comprising the $975,000 of GEF grant funding available for the SEDREA project's implementation.

[20] No previous APR/PIRs were made available to the MTR review

[21] See paragraph 4, p1, Renewable Energy Support Programme for the Pacific Islands, PIREP, by Herb Wade, ISBN: 982-04-0305-7, published by SPREP, 2005

The applicable GEF budget breakdown by year and activity in the December 2007 ProDoc is as follows from its Annex C: Project Budget and Work Plan. The applicable budget table in the CPAP ProDoc (one year later than the original ProDoc) is identical per component and per year.

| Project Outcomes/Atlas Activity | Year 1 | Year 2 | Year 3 | Totals |
|---|---|---|---|---|
| Component 1: RE Policy and Institutional Capacity Building | 63,000 | 30,000 | 22,000 | 115,000 |
| Component 2: RE Technology Delivery and Financing Mechanisms | 57,500 | 208,000 | 214,500 | 480,000 |
| Component 3: RE Technology Development and Industry Support | 57,000 | 61,500 | 6,500 | 125,000 |
| Component 4: RE Information, Training and Advocacy | 63,750 | 50,500 | 53,000 | 167,250 |
| Project Management Office | 21,250 | 33,250 | 33,250 | 87,750 |
| **GEF Funding Totals** | **262,500** | **383,250** | **329,250** | **975,000** |

In SEDREA's actual initial start up phase of 6 months covering from the beginning of July to the end of December 2009, US$96,276.83 was spent by a combination of UNDP and the Government of Palau on the project (reference 2009 SEDREA CDR), compared to a revised budget of $192,575 for the 12 months of calendar 2009 (reference - 2009 AWP signed on 04 December 2008 by UNDP MCO and the Minister of State of the Government of Palau). So the July – December 2009 SEDREA project expenditure for 6 months was suitably close on a pro-rata basis to that budgeted for a full 12-month Year 1.

For calendar 2010 the revised SEDREA budget was $287,500 (as per 19 November 2009 signed AWP), and this was apparently later revised to $408,987.00 (as at May 2010 AWP). It appears that the actual expenditure in calendar 2010 was $156,949.11 (reference 2010 SEDREA CDR – Combined Delivery Report). So in 2010 the SEDREA project expenditure was well below projections. An overview of relevant SEDREA commitments and activity suggests that most of this shortfall in expenditure in 2010 was due to timing issues of payment, as well as payment delays as the modality of UNDP needing to pay the Palau Energy Office before any payment could be made for project expenditure by PEO, was instead changed to the direct payment of applicable project expenses by UNDP Fiji MCO from July 2010. It appears that this movement to direct payment of project expenses by UNDP Fiji MCO was undertaken from June 2011 at the request of PEO to expedite the more prompt payment of SEDREA expenses, given the lack of capacity in the Palau government to make timely payments on behalf of the SEDREA project (refer 2011 Q1 Narrative Report by PEO to UNDP Fiji MCO of 07 June 2011).

For calendar 2011 the initial updated SEDREA budget was $353,141 (reference AWP 2011 signed 21 February 2011), and on 02 May an additional $120,000 was added to the 2011 SEDREA budget (reference revised 2011 AWP 2011) to give a revised budget of $473,141. Actual expenditure from January to October was $468,895.08 (reference 2011 CDR dated 03 November 2011). So in the second full year of SEDREA operation, and with direct payment of expenses being done from the UNDP Fiji MCO, budgets and actual expenditure were now very closely in agreement.

For calendar 2012 the SEDREA budget was $325,885.17 as at May 2010. The remaining unallocated funds as at 31 October 2011 were $252,878.58. So as of 31 October 2011, cumulative overall expenditure on the SEDREA project was ahead of the May 2010 budget projections for the remaining project funds for 2012.

So the overall inputs (expenditure) review assessment of SEDREA to 31 October 2011 is that: (1) the project had a broadly appropriate breakdown of budgeted expenditure between years; (2) initial revised project budgets were broadly appropriate and realistic; (3) the delays in expenditure appear to be primarily of a payment timing and delays in payment nature (since corrected by a change to direct payment by UNDP Fiji MCO rather than payment from the Palau Energy Office); and (4) with nine months of SEDREA operations remaining as at 01 November 2011, the remaining unallocated funds of $252,878.58 (representing 26% of the project GEF funds) are an appropriate pro-rata residual amount for the project to have yet to expend in its remaining operations to its scheduled July 2012 end date (25% of project's three year scheduled duration). However, given the recommended refocus on SWH, and the need to catch up with some delays in the REFW development and initial implementation phase the project end date it is recommended that the project end date be extended by 5 months from July 2012 to December 2012.

## 4.3 SEDREA Outputs and Achievements

The Palau SEDREA project has clearly implemented a well-integrated suite of relevant and timely tangible activities in its nearly two and a half years (of its three years scheduled project duration, i.e. 75% of the project's scheduled duration has now elapsed) of project implementation to date. The Palau SEDREA project had expended 75% of its available GEF input funds to 31 October 2011. The SEDREA project has made a considerable use of consultants, especially international consultants, and the consultants chosen were clearly experts in their fields who have clearly done an outstanding job in developing the project to where it is now. Two sets of consultants have done most of the work on the project (tariff review and REFW development), and their work was reasonably independent so cross reference of their results was not particularly to be expected. The REFW consultants used in phase 1 and phase 2 were the same, and the key technical expert had also led to predecessor PIREP project, so integration of findings and lessons learned has been extremely effective in producing the required key project outputs.

In summary, the Palau SEDREA project's key outputs and achievements to date have been to:

(1) promptly recruit and deploy suitably experienced consultants to undertake a PPUC (the Palau electricity utility) tariff review to underpin necessary tariff adjustments (increases) that would make grid-connected PV cost-effective without subsidies in Palau post SEDREA project end;

(2) promptly recruit and deploy suitable consultants to identify appropriate RETs (renewable energy technologies) comprising on and off-grid PV as well as SWHs, determine the size of the RET markets, and estimate realistic NDBP REFW loan requirements covering on-grid PV and SWHs;

(3) in anticipation for the passage of the net metering bill and to avoid delay in implementing the FSM demonstrations, the SEDREA funded REFW Phase 1 (REFW-1) consultants drafted in April 2010 and in July 2010 obtained PPUC agreement to an initial set of four residential and two commercial grid-connected PV systems. This initial NDBP-PPUC MOU has just now (as at 16 November 2011) been extended to cover an additional 100 residential and an additional five commercial grid-connected PV systems;

(4) recruit and deploy suitable consultants to specify, set up contracts for the supply of standardised modules of suitable RE equipment, and provide classroom and on-site hands-on training in the proper installation of both on-grid and off-grid PV systems. Purchase 30 standardised grid-connected modules and 37 off-grid PV modules for initial demonstrations (full scale models – FSM as mentioned in the SEDREA project design) and get these modules delivered to Palau and ready for deployment by local contractors (noting that no standardised SWH systems have been purchased by SEDREA to date);

(5) successfully establish and support the development of the RE Fund Window (REFW – now called RESP (Renewable Energy Subsidy Program and marketed by NDBP alongside the EESP (Energy Efficiency Subsidy Program as the NDBP's combined ELP (Energy Loan Program)), train NDBP staff, and implement initial RE loans under the REFW. The REFW is now marketed by NDBP as the second component of the NDBP's ELP (Energy Loans Program);

(6) support the installation training and the successful installation and commissioning of initial on-grid PV systems of two SEDREA funded systems with NDBP loans in private houses (and one at NDBP paid for by NDBP itself) and off-grid systems (one at a private house with an NDBP loan and one at NDBP as a demonstration and teaching unit). No SWH loans have yet been made by NDBP under the REFW/ELP (as at July 2011);

(7) provide the necessary basis for NDBP to aggressively market the remaining on and off grid PV modules that are now in Palau, using installers already trained by the SEDREA project.

In detail, the current status of the SEDREA project's key outputs is:

(1) <u>PPUC Tariff Review.</u>
The PPUC tariff review was initiated in July 2009 and it was completed in February 2010, which represents an acceptable timeframe for such a study. The PPUC tariff study is a comprehensive body of work and has clearly highlighted: the excessive cross-subsidy that exists with the current initial low tariff step of 500 kWh/*month* for residential consumers (lifeline tariffs in the Pacific are normally around a more justifiable 500kWh/*year*); the need for more timely and full fuel cost surcharge adjustments; and the need for a proper ongoing O&M funding (including for major 24,000 hour generator overhauls and also for a formal capital charge so that PPUC accumulates suitable funds for major generator overhauls and replacements), as well as for transmission and distribution system maintenance. The recommended tariff changes were initially accepted by the PPUC Board and were acceptable to the public (although of course tariff

increases are never popular), but the tariff increases were then reversed with no apparent explanation being given, the then PPUC CEO (Ken Uyehura) then resigned. The then (April 2011) PPUC Chairperson (Rukebai K. Inabo) took over as the PPUC CEO/GM until November 2011 when she resigned along with the PPUC Board. The former GM (Ken Uyehura) is now the Acting GM of PPUC, and the issue of tariff increases and the removal of the excessive initial residential tariff low cost step is now being seriously considered again by PPUC[22].

It is noteworthy that on 05 November 2011 there was a fire at the PPUC power plant in Aimeliik (one of the two main Koror-Babeldoab grid power stations), destroying one of the four generators and the facilities' controls. This removed from operation around half of the main Palau grid's power generating capacity. The main islands of Koror and Babeldaob were then put under severe power rationing, and the President of Palau declared a formal State of Emergency. There were then also major problems with water and sewage pumping on Koror-Babeldoab from a lack of available electricity supply. It appears that electricity supply may be restored after about a two week emergency, but even when supply is restored there will then still be minimal spare capacity to cover any generator scheduled maintenance, let alone provide any spare capacity for any unscheduled outages. Although this precise Aimeliik power plant accident probably could not have been predicted, running down maintenance year after year through lack of available funds with the ongoing use of inadequate tariffs would clearly have increased the risk of some form of electricity supply crisis, as subsequently unfortunately occurred. Until the issue of inadequate tariffs and excessive cross subsidies to residential consumers is addressed, electricity supplies in Palau will remain unreliable, and perversely the installation of grid connected PV that would reduce the demands on the unreliable PPUC system will also be held back by the low payback of PV systems when competing with inadequate tariffs, especially the below cost 500kWh/month residential first tariff step.

During the MTR mission in July 2011, the former (April-November 2011) PPUC CEO/GM (Rukebai K. Inabo) hinted at (unspecified) inadequacies in the SEDREA funded PPUC tariff review, and suggested that it would be desirable for the PPUC tariff study to be repeated with additional SEDREA funding. However, the MTR reviewer could see no significant inadequacies in the SEDREA project's PPUC tariff study's methodology, analysis or conclusions. It would therefore only seem to be useful to update the PPUC tariff study if there were sufficiently credible assurances at the highest political level that tariffs would be actually significantly adjusted this time as a consequence of any updated tariff study. The original SEDREA funded tariff study is entirely adequate to cover the relevant tariff issues in general and to highlight what needs to be done to resolve PPUC's ongoing precarious financial and unreliable electricity supply issues for Palau. In any case, on 26 Nov 2011 as part of the SPC/EU North REP project, SPC issued a PPUC Renewable Energy Framework Consultancy. This consultancy among other elements includes "Review power utility tariff schedules to determine an appropriate tariff structure that will take into consideration for renewable energy generation connected to the PPUC grid". Hopefully the new SPC/EU North REP funded PPUC tariff review will come up with similar recommendations to the SEDREA tariff review. However, ultimately it is a political decision that must be made by the PPUC Board and the applicable Minister and the President of Palau to get PPUC tariffs on a

[22] See http://www.pidp.org/pireport/2011/November/11-23-17.htm

proper sustainable basis or to chose to continue to run an electricity grid system with large unpaid government electricity use arrears, and worn out inefficient old diesel generators - that inevitably will continue to give a system of excessive fuel use and questionable reliability.

(2) Identifying Specific Applicable RE Technologies and RE Market Sizes

Recruitment for consultants for the REFW design (Phase 1) started in July 2009 and the resulting REFW Phase 1 (RFW-1) work was completed in December 2009 with three reports produced on REFW Design and Operating Procedures, Marketing Plan and Bankable Projects, and RET Technologies and Market Assessment. Two appropriate RET technologies/markets were identified for Palau in the REFW Phase 1 "Report on the Renewable Energy Technologies Appropriate for REFW Finance and the Market for those Technologies in Palau" (REFW-1 RET Technologies and Markets report) produced by the SEDREA funded consultants in October 2009. This report overviewed the available RE technologies and their pros and cons and their underlying economics, and concluded that the two key RE markets in Palau were: (a) on-grid PV for residential and commercial premises, and (b) SWHs for residential and hotel/tourist accommodation. These REFW-1 reports identified key RE technologies and markets completely replaced the initial demonstration technologies and locations proposed in the SEDREA design, as in most cases the originally proposed demonstrations in the design phase were only tenuously linked to the expected wider replication expected during and after the SEDREA project's operations. The new proposed key RE technologies and markets seem to be very soundly based and appear to have been very appropriate options for support under the SEDREA project's initiated standardised equipment purchasing and REFW financing mechanism in Palau.

The REFW-1 RET Technologies and Markets report (of October 2009) highlighted that the size of the existing off-grid PV market in Palau was expected to be less than 75 households, with some of these households already covered with existing (no cost to recipients as they were donor provided) off-grid PV systems and some of these households would probably not able to afford or be creditworthy enough to get electricity for the houses that are also often too distant from the applicable PPUC grid to be economically connected to the grid in the absence of donor funding for this purpose. The RET report stated "Though this category has been identified as a source of demand for REFW loans, the demand is expected to be low. The need for non grid-connected solar PV financing in Koror and Babeldoab will be relatively small as compared to the need from grid-connected PV. We expect the demand for this sector to remain small and would assume it to be close to zero."

However, the REFW-1 Design and Operating Procedures report of November 2009 under section 4.5.2 states "There could be a reasonable demand for off grid systems as new housing grows in Babeldoab. PPUC only offers 300 feet of interconnection and beyond this the cost is high. The high connection costs provide added incentives for households and businesses that are located beyond 300 feet to install and utilize RETs for their energy needs. Smaller-scale solar PV of below 1 kWp can provide for the basic needs of most typical off-grid households and rural business set-ups."

It is not clear if this different conclusion of a promising market for off-grid PV systems is based

on a serious new analysis undertaken between October and November 2009, or if it is perhaps a rationalization of why off-grid systems were to be purchased by the SEDREA project as the GEF funding rational for SEDREA was aimed at off-grid RE, or if it represents an expectation that people will move from their homes in the major urban center of Palau in Koror to the unpopulated center of Babeldoab, including those who work in the new Capitol complex built in the middle of nowhere in Babeldoab. Perhaps this expected demand might have justified a few off-grid systems being purchased, but to purchase 37 off-grid modules seems excessive for such a tentative future market niche.

Hence, it is thus still unclear why US$130,000 (13% of the total project GEF budget) was spent purchasing 37 off-grid PV modules, and it is also not clear how these now existing off-grid PV modules are expected to be sold when all previous off-grid systems were provided by donors at no cost to the off-grid users. It is also not clear how even if the 37 modules are sold, how this off-grid RE FSM (full scale model) demonstration can be expected to lead to replications when there is a minimal if any existing market opportunity for off-grid systems in Palau, given that replication from project-supported demonstrations is one of the stated primary design intentions of the SEDREA project.

The REFW-1 RET Technologies and Markets report also highlighted that SWH was an appropriate technology with an excellent market potential in Palau. It was suggested that some SWH systems be purchased and demonstrated as FSM demonstrations to overcome the many technical barriers to their mass uptake in Palau with REFW loans. This purchase of standardised SWH systems to address the known existing technical barriers for SWH has not yet happened under the SEDREA project. Developing a SWH standard specification under SEDREA has not led to any SWH loans, so clearly there are a still a range of significant barriers to SWH uptake that prevent their mass deployment to the REFW-1 consultants' assessment of a achievable 3-year SEDREA SWH market of 428 systems out of a total potential SWH market of 2569 SWH systems (in October 2009 RET technologies and Markets Report). This SWH standard module procurement, installer training and successful NDBP REFW financing is then is an area that still urgently needs to be addressed in the remaining budget and time availability of the SEDREA project.

(3) Establishing Legal Basis for Net Metering PV Connections

A Palau Net Metering Bill (see Annex D) was introduced to the Palau Senate in January 2009, was approved by the Senate, and was approved by the Palau House of Delegates (the lower house of Congress) in July 2011 during the SEDREA MTR review mission. There now needs to be a reconciliation meeting between the two houses of the Palau Congress to agree on a joint version of the bill, as the House of Delegates version has some minor changes from the previously approved Senate version. The jointly agreed version from the Palau Congress then has to be considered and hopefully signed by the President of Palau in due course. The proposed Net Metering Bill establishes the principle of net metering, but is silent on the exact technical and financial details of how this net metering is to be implemented.

However, the Net Metering Bill unfortunately leaves open the possibility for a future PPUC to undermine the intent of the Bill by imposing onerous technical and financial connection requirements, as has already partly happened with PPUC deciding that any net customer credit will only remain valid for a year from a users generation exceeding their total electricity use, which was not the original intention at all. So the Palau Net Metering Bill is a very useful policy development, but even when signed into law in itself it will be no guarantee that a future PPUC will actually tangibly support residential and commercial premise installed net-metered PV in Palau in practice. It should be noted that the 26 Nov 2011 SPC/EU North REP PPUC Renewable Energy Framework Consultancy does not once mention the SEDREA supported residential or commercial net-metering of PV activities, or even the Palau Congress approved Net-Metering Bill – which is a very worrying lack of integration of existing grid-connected PV efforts in Palau with PPUC plans as evidenced by the upcoming Renewable Energy Framework Consultancy of SPC/EU.

With the Net Metering Bill approved by the Palau Senate, but with then still no clear timetable for it to be approved by the House of Delegates, reconciled between any different versions, and then considered and approved by the President, there was then still no legal basis for the installation of initial demonstration of the on-grid PV systems that were to be specified, purchased by the SEDREA project, and be the subject of NDBP REFW loans to residential and commercial users. Therefore, under its REFW-2 phase that was underway from the last week of March 2010, the SEDREA funded consultants drafted in April 2010 and after several follow-ups produced an agreed revised version in July 2010 and obtained agreement and respective signatures in August 2010 to an initial set of four residential and two commercial grid-connected PV systems (the August 2010 NDPB:PPUC signed MOU is in Annex E).

At the time of the MTR mission in July 2011, three residential grid-connected PV systems (of two modules each) had been installed with NDBP REFW loans and were working successfully. At the instigation of the MTR mission, this NDBP-PPUC MOU was proposed by NDBP to be extended to cover an additional 100 residential and five commercial grid-connected PV systems. At 16 November 2011, through the intervention of the Director of the Palau Energy Office talking to the PPUC Minister, this extended MOU was finally agreed to by the Minister for PPUC. On the instigation of the MTR mission, the update to the NDBP:PPUC MOU (see Annex F) has also usefully clarified some of the outstanding technical and financial issues around the operation of grid-connected PV systems and thus serves as model of future net-metering technical and financial arrangements in Palau.

The fact that it took four months and a direct high level intervention from the PEO Director to the PPUC Minister to get the extended NDBP-PPUC on-grid net metered system MOU approved clearly illustrates the ambivalence at best (and hostility at worst) of the now former PPUC CEO (Ms Inabo) and/or Board to grid connected PV, regardless of the fact that such net-metering will be legally authorized in the net metering bill when the bill is finally passed into law. This reinforces the impression gained during the MTR mission of the desire by some in PPUC to control net metering in practice. The former PPUC CEO (Ms Inabo) even stated during the MTR mission conversations that even if the net metering bill is passed into law PPUC will still set the rules as they see fit around what installations would be connected and that any connections

would be under financial terms that would be set by PPUC. This of course is contrary to the stated intentions of the net metering bill. So although PPUC has formed an RE Division and is now focusing on the practical technical issues of grid interconnection, it was still clearly at best (in July 2011) ambivalent toward consumer owned and net-metered PV being connected in a net-metering fashion to the main PPUC grid, and presumably the other three smaller PPUC grids as well.

(4) Establishment and Supply of Standard Specification RE Systems

With the initiation of Phase 2 of the REFW consultancy in March 2010, work was then undertaken to establish suitable detailed specifications for the on and off grid PV modules that were supplied through an open international tender process, and that were subsequently purchased with GEF funds. The REFW-2 consultants also produced a basic SWH performance specification, but no SWH units were purchased for demonstration deployment and also no technical assistance or training was provided to potential SWH importers and installers on how to overcome the known and extensive barriers to SWH uptake in Palau.

The on and off grid PV specifications clearly made full use of the REFW-2 consultant's wealth of experience in international PV system technical success factors, including but not limited to in the Pacific Islands. Following a tender evaluation process, the SEDREA project used its GEF funds to purchase 30 standardised grid-connected modules and 37 off-grid PV modules for initial demonstrations (also known as full scale models – FSM as mentioned in the SEDREA project design). These on and off grid PV modules were then delivered to Palau, with an additional five off-grid modules being supplied at no cost to compensate for delivery delays.

It should be noted that although the project design and REFW analysis and literature talked about REFW funds being used to subsidise RE system costs to residential and commercial system purchasers with this subsidy then reducing to zero, in fact the initial 30 grid-connected modules and 37 off-grid PV modules were fully paid for by the GEF funds of the SEDREA project. These $400,000 of 100% donor funded PV modules will then be sold by NDBP (at a lower subsidised cost than the modules were purchased for by GEF funds) and repaid to NDBP from the loans entered into by the purchasers. It does not appear that subsequent PV modules will be subsidised, unless NDBP obtains further funding by some other donor or uses the loan repayments from the "free" initial modules to subsidise subsequent systems'' costs.

So although the REFW analysis talks about subsidies of 10 – 60% for different types of RE loans under the REFW from NDBP, to be phased out over the three years of the SEDREA project, in practice NDBP have been provided with 100% donor funded initial PV modules and it is unclear if any subsequent on and off grid modules will be subsidised and/or who will provide such subsidies.

In the meantime NDBP has 100% donor funded PV modules sitting in shipping containers outside its HQ building, so although if they are sold this will be a nice source of revenue for NDBP that costs it nothing except time to provide, conversely if the PV modules are sold at a slower pace than expected it is not NDBP's own funds that are invested in the modules

continuing to sit outside NDB HQ in shipping containers. This 100% donor funding of the initial shipment of PV modules presumably was administratively simpler than providing a partial subsidy as recommended in the REFW consultants' reports and as detailed in the SEDREA design. However, 100% donor funding creates risks as to the incentives on NDBP to see the units installed, and in particular creates a new unresolved issue as to the source of funds for the subsidies envisaged for subsequent PV systems. NDBP has promised to provide up to $1 million in funds for RE loans under the REFW but this promised $1 million in subsequent RE funding seems to depend on NDBP obtaining back-to-back soft loans from other new external sources.

(5) Establishment of RE Fund Window at NDBP

A critical component of SEDREA activity was the establishment and mobilization of a Renewable Energy Fund Window (REFW) at the designated Palau RE financing provider, in this case the National Development Bank of Palau (NDBP).

Developing a new financing mechanism is a complex task, and the likelihood of delays in the establishment of any new RE fund, and the risk of unforeseen factors stalling the disbursement of loans under any new financing facility is high. This high risk of delays in the establishment phase or in making loans under new financial mechanisms previously led GEF to as a general rule no longer fund the development of new financing mechanisms and to GEF only supporting the expansion of existing effective financing mechanisms[23]. However, the magnitude of the task to successfully develop and successfully deploy in practice the new REFW was recognized in the SEDREA project and hence two comprehensive REFW consultancy phases were undertaken and a number of suitable reports produced covering a wide range of the key aspects involved.

The SEDREA project clearly recruited international consultants with the necessary mix of RE technical and RE fund establishment skills required. The REFW consultancy work seems to have covered all the key necessary issues, with the exception of the continued high focus on off-grid PV systems - for which there seems to be an at best limited market (as already discussed). There was also a lack of emphasis on the larger and more economic market of SWH which was probably at least partly due to the distraction of the ongoing strong focus on off-grid PV systems. The concepts of graduated subsidies that would be gradually phased out as experience of successful RE deployment was gained and as the economics of grid connected PV improved as a result of tariff increases from the PPUC tariff study was sound and appropriate. However it is hard to see how the concept of reducing subsidies can be achieved in practice with 100% GEF grant funding of the initial on and off grid PV modules and no GEF funds remaining to subsidise the purchase any subsequent PV modules. The REFW is now call RESP (Renewable Energy Subsidy Program), but where are the funds to come from for future subsidies (the S in RESP)?

The SEDREA REFW Phase 2 consultancy work had a strong and appropriate emphasis on the training of NDBP staff in the detail of how to establish and operate the REFW, and suitable support seems to have been provided to NDBP staff for the realization of the initial loans under

[23] However, recently UNDP were informed by GEF-Sec that it is perfectly acceptable and in fact encouraged to use GEF funding as seed money to set up a sustainable financial mechanism

the REFW. Suitable capacity was established in NDBP to support the installation of initial on-grid PV systems (two SEDREA funded systems each of two modules with NDBP loans in private houses and one five-module on-grid system at NDBP paid for by NDBP itself) and off-grid systems (one at a private house with an NDBP loan and one SEDREA funded system installed at NDBP as a demonstration and teaching unit). However, the initial NDBP:PPUC net metering MOU covered four residential PV systems, and two commercial systems, and it seems that there was already a demand for PV systems well in excess of this number of available on-grid systems. So it was not clear to the July MTR mission what the cause of the delay was in fully utilizing the full capacity of the NDBP:PPUC MOU that had been in place since July 2010 and of the PV modules that have been on Palau since early 2011. No SWH loans have yet been made by NDBP, reflecting the unresolved technical issues that still exist around SWH in Palau. It is now clear that developing a standard specification for appropriate SWH systems for use by hardware suppliers in Palau is not enough as none of the hardware suppliers in Palau has been able to source systems compliant with the standard SWH specification form their regular SWH or plumbing equipment suppliers. Hence it is now clear to NDBP that intervention from the Palau SEDREA project is needed for international procurement of suitable SWH systems and comprehensive technical and training support to local plumbers and hardware suppliers is needed – as has been successfully demonstrated with on and off grid PV systems already under the SEDREA project.

The REFW is now being marketed by NDBP as the second component of the NDBP's ELP (Energy Loans Program) alongside the Energy Efficiency Home Loans programme of NDBP (which is funded by the governments of Italy and Austria through IUCN) as a combined ELP (Energy Loans Programme). This combined marketing aspect is a positive development. The ELP concept is now in the process of being replicated to ADFIP (Association of Development Financing Institutions in the Pacific) members, with a planning and training workshop held in Palau from 3-6 October 2011. This is a very positive development and clearly reflects the thorough analysis and comprehensive capacity development that was undertaken in the two SEDREA REFW consultancy phases.

(6) PV System Installation and Maintenance Training

The REFW-2 consultants used the five on-grid PV modules purchased by NDBP for installation on their own bank premises, and delivered in October 2010 in advance of the 37 GEF SEDREA funded modules, to provide a mix of classroom hand-on on-site training in the proper installation of the on-grid PV systems. This on-grid PV system installation and trouble shooting training seems to have been well-received and broke new ground in Palau by training local contractors in how to install and trouble-shoot grid PV systems, which was a critical and timely development as previous donor funded PV systems had not utilised local contractors. By the end of the REFW-2 final mission in February 2011, the off-grid PV systems had not yet been delivered to Palau, which meant that on the ground training on the specific systems involved could not be provided during the REFW-2 consultancy final mission in late February 2011. There are now three on-grid systems (each of two modules) provided with NDBP loans in private houses and one system of five modules at NDBP paid for by NDBP. There are two off-grid systems installed, one at a private house with an NDBP loan and one at NDBP as a demonstration and teaching unit. No SWH loans have yet been made by NDBP under the REFW/ELP.

(7) Groundwork Now Established for Accelerated PV Deployment

The necessary groundwork has clearly now been effectively established under the Palau SEDREA project for an upcoming phase of aggressive marketing of on and off grid-connected PV systems, with technical support to be provided by additional international consultancy support (as recommended in this MTR report). NDBP, as the key local project implementation financial mechanism partner, remains strongly committed through its REFW (Renewable Energy Fund Window) funding mechanism and is actively supporting the project in its roll-out of the now proven on and off grid-connected PV modules that are already physically in Palau and available for residential and commercial customers to install and connect to the electricity grid, as well as the off-grid PV systems that are also proven and available in Palau for customers to purchase and get installed by suitably trained contractors.

## 4.4 SEDREA Demonstration Projects

As discussed in Chapter 3 (The Project and Its Development Context) the Pacific is littered with well meaning 100% donor funded RE "demonstration" projects. At best, such projects will actually work in some sort of sustainable fashion for their design life. At worst, such projects are excessively complex, are too expensive (for the useful energy produced) to ever be replicated, use RE equipment that is not fully compatible with Pacific tropical conditions, or use equipment that is hard or even virtually impossible to maintain, and/or use equipment that is often provided to recipients without providing the recipients with the necessary technical skills to operate and maintain it. Palau has its share of such questionable donor led RE (PV) "demonstration" projects. More donor provided RE systems are apparently planned for Palau.

The SEDREA project at its design phase was rather unclear on what its proposed demonstration projects were supposed to "prove", and how these demonstration project results were then supposed to lead to post-project replications, as can be seen from its original list of tentative demonstration projects, all of which had very questionable replication modalities and potentials.

In the SEDREA implementation phase, in particular during the REFW-1 consultancy work, the purpose of the SEDREA demonstrations was usefully clarified. On-grid net metered PV and SWH were identified as the most promising RE technologies for Palau, and the demonstration approach was chosen to be the use of a range of equipment cost subsidies that would be reduced to zero as the economics improved (esp. for grid-connected PV as electricity tariffs were expected to rise following the SEDREA funded PPUC tariff review) and as specifiers/importers/installers learnt how to configure already cost-effective and technically well-developed RE systems into systems that worked in practice in Palau conditions (as was expected for SWH). However, the SEDREA demonstration aspect's relevance took a bit of a step backwards when 37 off-grid PV modules were 100% GEF funded in the expectation that people might in future go to live in the center of Babeldoab and at the same time would not be able to afford the full cost of new PPUC grid connections - while the largest single RE market on Palau, SWH, did not get any demonstration systems funded - with the not unexpected result that no SWH loans have yet

materialized as the barriers to SWH have not yet been removed - and in the meantime a shipping container full of off grid PV modules still sits outside the NDBP headquarters waiting to be sold.

However, at least by Pacific Islands demonstration projects' standards, the SEDREA demonstration projects have many positive basic attributes, including that: -

- The demonstrations were explicitly targeted to foster uses of enhanced renewable energy supply where there are potential unsubsidised post project replication markets- noting that the rationale for the off-grid market was at least plausible in theory, it was just not terribly likely to happen in practice but at least the issue of a suitable post-demonstration replication market for off-grid PV systems had been explicitly considered;

- The demonstration projects were carefully selected to use fully proven/reliable technologies and components and systems with a good potential to keep on working sustainable post-project, and hence to lead to post project replications that would also be sustainable;

- That replication projects could realistically be envisaged to be viable without further donor funding, and could realistically be installed and maintained by newly trained personnel in Palau who would treat RE supply, installation and maintenance as integral expanded parts of their existing business models;

The demonstration projects undertaken under SEDREA therefore were based on a sound and explicit intervention logic, and could realistically be in-principle be expected to be sustainable post-project end. This use of sound demonstration project intervention logic and the consideration and existence of potentially suitable post-project end replications is rare in Pacific RE projects.

## 4.5 Assessment of Actual vs Planned Outputs and Expenditure

The SEDREA project's annual CDRs (Combined Delivery Reports) provide an annual breakdown of expenditure by component and by what budget code the expenditure was for, but do not provide a useful description of what the expenditure actually funded in tangible hardware or soft elements terms, nor a description of which of the applicable specified activities in the project design the expenditure was related to.

The PEO provided project Quarterly Narrative Reports appear to give a useful description of the activities that were underway and the scheduled expenditure for that quarter, but do not provide a description of the actual expenditure in that quarter. It is also not clear if these narrative reports are completely accurate as to the timing or exact status of key events. For example, the 07 June 2011 Q1 2011 Narrative Report from the PEO states that "the proposed net metering bill ….. has finally been passed by both houses of the congress and signed by the President", whereas the MTR mission of July 2011 found that the net metering bill had just been signed (in July) by the House of Delegates but had not yet been reconciled between the Senate and House of Delegates versions, and hence could not have been considered by the President for signing, let alone signed.

The project quarterly financial reports provide a list of payments, but provide little detail on what the expenditure was actually for. There were no obvious anomalies apparent in the financial reports. Where there was confusion in the financial reporting it seems to primarily due to a lack of detail as to what activity was funded and when and what components it was supposed to fall under and what the expenditure was actually attributed to. The financial reporting makes much more sense now that UNDP is directly project managing the SEDREA project expenditure and reporting on its own expenditure and on SEDREA activities.

So in the SEDREA project reporting system, it is hard to see what any expenditure was actually for in tangible activity or hardware terms, when it was made, and how it linked (if at all) to the original design activities. So it was not possible in this review to compare actual SEDREA project expenditure by ProDoc planned activity, let alone to compare proposed versus actual timing by activity. It is also effectively impossible to verify expenditure by component by the intent of that component – that is to check if it is properly coded compared to what was envisaged for that component. The ProDoc budgets are identical between the GEF approved ProDoc version and the later UNDP CPAP ProDoc, with only some minor changes in the wording of the project activities, so there is no issue of comparing results against different versions of proposed SEDREA components and activities.

In terms of the SEDREA project M&E system, the reporting undertaken was generally adequate to enable progress to be tracked against the planned outputs. The M&E design and that M&E undertaken was generally suitably SMART (Specific, Measureable, Achievable, Realistic and Time-Bound). The project activities linked together in a coherent integrated approach that was designed and implemented towards achieving a single overarching purpose, namely to develop a suitable RE industry in Palau that would make a measurable impact and would be sustainable post-project end.

Component 1: RE Policy and Institutional Capacity Building

This component was originally allocated $115,000 of GEF funding, with all but $8000 allocated for national and international consultants. This component aimed to build on the existing energy-related policies and guidelines in Palau, particularly in connection with renewable energy. It was to involve the provision of technical assistance in the formulation of policies and support activities that would encourage the wide use of REs in Palau.

This component comprised the following activities:

*Activity 1.1: Review of existing energy-related policies and pronouncements*
*Activity 1.2: RE Electricity Generation and Market Policy Study*
*Activity 1.3: RE Electricity Pricing and Financial Incentives Study*
*Activity 1.4: Detailed study and documentation of energy supply and demand and market experience and trends in Palau*
*Activity 1.5: Formulation of the national energy policy integrating the RE policy and development strategies and implementing rules and regulations*
*Activity 1.6: Organizational development study and strengthening of the PEO*

*Activity 1.7: Formulation and implementation of the national energy policy and national energy plan incorporating RE and EE*
*Activity 1.8: Conduct of Stakeholder Consultation Workshop for the endorsement and approval of the First Ten Year National Energy Policy and Plan (2008-2017)*
*Activity 1.9: Monitoring and evaluation of the National Energy Policy and Plan implementation*
*Activity 1.10: Review and development of sustainability measures for the RE Policy and Program*

Actual expenditure on this component was $93,688.82 in 2009, $32,183.21 in 2010, and $159,029.00 from Jan to Oct 2011 = $284,901.03 (compared to the budget of $115,000).

The main output under this component seems to be the SEDREA funded PPUC tariff study, which was completed in February 2010. It may be that the 2011 expenditure for this component does not really belong in this category as it includes $157,287.68 spent on "Intl Consultants-Sht Term-Tech" (Jan to Oct 2011 CDR), while it is not apparent that any major relevant activity has occurred under this component since the completion of the PPUC Tariff Study in February 2010.

With a National Energy Policy and a Strategic Energy Plan completed in October 2009, there was no need for the SEDREA project to do any more work in these areas, and so the main actual SEDREA activity undertaken under this component was the PPUC tariff study under activity 1.3. Under activity 1.3, there was also the analysis of the subsidies required for early RE equipment installations. It was properly assumed that subsidies will be required until greater economies of scale and actual operating experience of RE equipment in use was achieved (noting that it was assumed that no subsidies were required for SWH), and until the PPUC tariffs (especially the below cost residential tariff of up to 500 kWh/month) were increased to a level that grid connected PV residential and commercial net-metered systems would be cost effective without any subsidies.

Some work was also undertaken in strengthening the PEO, in particular in hiring a second staff person to assist the overworked Director whom was previously the only person working at the PEO.

So the majority of the other activities under component 1 were not actually undertaken, and this in retrospect was a wise decision as most of them where no longer needed with the passage of the National Energy Policy and a Strategic Energy Plan being completed in October 2009 from other donor project assistance. The policy and capacity building focused SPC/EU North REP project for Palau is now covering a wide range of renewable energy policy and analysis elements, so SEDREA can continue to focus on the REFW implementation and RE hardware and installation support where SEDREA has its main strength and where SEDREA is adding particular value to the enhanced uptake of RE in Palau.

Component 2: RE Technology Delivery and Financing Mechanisms

This component was allocated $480,000 of GEF funding, of which $200,000 was for "REFW Financing" and $205,500 was for "RET Facility/Equipment for FSM Demonstration" activities, with the remainder being budgeted primarily for national and international consultants. This component concerned the development of an REFW at NDBP and the provision of incremental funds to serve the purpose of

introducing and showcasing, on a demonstration basis, innovative technology delivery of RE-based energy systems.

This component comprised the following activities:

*Activity 2.1: Capacity building in RET Financing*
*Activity 2.2: Establishment of the RE Fund Window*
*Activity 2.3: Design and implementation of the REFW financing schemes*
*Activity 2.4: Evaluation of the performance of the REFW financing schemes*
*Activity 2.5 RET Full Scale Model Demonstration on technology delivery, financing mechanisms and productive applications*
*Activity 2.6 Provision of Assistance Services to REFW financing applicants*
*Activity 2.7 Establishment of a M&E system for REFW financing program and performance of various RET Projects. M&E of RE project implementations*

According to SEDREA project financial reports, expenditure on this component was $2,588.01 in 2009, $95,564.59 in 2010, and $278,706.62 from Jan to Oct 2011 = $376,859.22 (to 31 October 2011) – compared to the initial stated budget for this component of $480,000.

However, according to other sources (personal communication with UNDP Regional Technical Advisor for Climate Change) the actual expenditure on this component to 31 October 2011 was US$575,811, of which US$399,470.00 had been spent on equipment and apparently US$176,341 has been spent on consultancy services.

However, regardless of the accuracy of the SEDREA project financial reports, it is clear that nearly $400,000 has been spent by the SEDREA project's GEF funds in covering 100% of the cost of purchasing 30 on-grid PV modules and 37 off-grid PV modules. So it is clear that the $200,000 budgeted for "REFW Financing" funding has been spent on purchasing equipment, in addition to the $205,500 explicitly earmarked for this purpose. It makes no sense for both budget items to have been intended for equipment purchase, so the REFW financing item was presumably intended for financing support, not a second equipment purchasing code. In addition, the contracts for the supply of PV equipment were made by the NDBP, but the equipment was fully funded by SEDREA. The REFW-1 reports are all predicated on subsidies being available (at various levels) and being phased down to zero over the three years of the SEDREA project when sustainable RE markets would have been established due to SEDREA activities – presumably this was to be supported by the "REFW financing " budget. So the 100% funding of PV modules instead of being spent on a mix of equipment subsidies and REFW funding support therefore represents a major change from the project's design in its early implementation.

All the activities under component 2 except for the last M&E system establishment and operation activity have been substantially undertaken. However, with only two on-grid PV and one off grid PV systems having received REFW loans by the time of the July 2011 MTR mission, an elaborate or formal M&E system to track loans made had not yet been required. This M&E system for REFW loans is now something that needs some attention as the aggressive marketing phase of the REFW is undertaken.

Component 3: RE Technology Development and Industry Support

This component had an allocated $125,000 of GEF funding, primarily for international consultants, to establish a dependable and diversified RE industry in Palau. The planned activities of this component included:

*Activity 3.1: Conduct RE resource inventory*
*Activity 3.2: Development of RE resource assessment procedure*
*Activity 3.3: Design and implementation of capacity building program for RE resource survey and assessment and application*
*Activity 3.4 Assessment of feasibility of other upcoming RETs and their applicability*
*Activity 3.5: Assessment of power generation potential, productive uses and value-added applications of RE resources for RE project pipelining*
*Activity 3.6: Assessment of local capabilities for rendering RE consultancy services and project development support*
*Activity 3.7: Assessment of Feasibility of the local manufacture and/or importation of selected RE equipment and components*

Reported expenditure on this component was nil in 2009, nil in 2010, and nil in Jan to Oct 2011 = nil to 31 October 2011. However, the REFW-1 consultants in their work funded under Component 2 in fact undertook much of the work envisaged under this component 3. So it appears that some relevant actual expenditure was not allocated to this component code. In practice, the relevant activities under this component, in particular the identification of the most appropriate RE technologies for application in Palau, has been successfully undertaken under SEDREA, and no further work is required under this component.

Component 4: RE Information, Training and Advocacy

This component had an allocated $167,250 of GEF funding, including $35,000 of (national) travel. The expected outcome was improved confidence and interest of Palauans on RE. The activities of this component included:

Activity 4.1: Establishment of the RE Center
Activity 4.2: Establishment of a comprehensive energy database
Activity 4.3: Establishment and operation of the integrated Energy Information Exchange System
Activity 4.4: Conduct of RE training courses including those designed in the other Components
Activity 4.5: Design and conduct of an RE training curriculum in schools
Activity 4.6: Conduct of information campaigns and awareness on RETs and application benefits in the main and outer islands

Expenditure on this component was nil in 2009, $14,875.55 in 2010, and $4,870.78 from Jan to Oct 2011 = $19,746.33.

Some RE information activities were undertaken by the SEDREA project, but the envisaged RE center, database or schools curriculum has not been undertaken. It is not recommended that scarce remaining SEDREA project funds be spent in this information area in the remainder of the SEDREA project's duration as these activities are not required for the effectiveness of the main SEDREA project outputs of sustainable RE full scale model (FSM) demonstrations and subsequent replications in Palau. The ongoing high international oil prices (except for a brief reduction from late 2008) and the partial reflection of higher oil prices to higher electricity tariffs (notwithstanding that electricity tariffs and especially the initial 500 kWh/month residential tariff step are still too low) has provided a strong and unequivocal rationale for RE in Palau, and there is a strong focus of the SPC/EU North REP project in this area, so significant SEDREA project expenditure is no longer required in this area.

Component 5: Project Management (Office)

This component had an allocated $87,750 of GEF funding, including $63,000 for a national expert for three years, and $34,500 for an international expert for the last two years of the project implementation.

Expenditure on this component was nil in 2009, $14,325.76 in 2010, and $26,288.68 from Jan to Oct 2011 = $40,614.44. The variation from projected funds is presumably from an international expert's input not being utilised as anticipated. The project recruited a suitable national expert to work on the project, with some delays due to local recruiting procedural requirements that could not have been reasonably avoided by the SEDREA project. It is not recommended that an international expert be recruited at this late stage of the project, as the sort of person that could be found at the budget level available and specified in the ProDoc would not be a good use of limited project funds. Rather, a more immediate and cost effective strengthening of technical support for the project would be if missions by the UNDP RTA could be funded by the SEDREA project for the UNDP RTA to go to Palau at regular intervals (say every two months at most) to help keep the momentum of the project moving and to ensure that suitable pro-active project management is undertaken by the PEO, and accurately recorded as appropriate. In particular the draft APR/PIR drafted in July 2011 by the UNDP RTA finally gives a comprehensive consolidated report of project activities undertaken compared to planned activities and their timing, and the total project's expenditure to date. No previous APR/PIR were made available to the MTR, and this is probably a reflection of the openly acknowledged lack of capacity of the PEO to provide the level of reporting expected, in spite of what were clearly strong efforts with their limited resources available.

The project risks have generally been well managed, to the extent that they can be controlled by the project. The delays in the net-metering bill, the sudden and unexpected reversal in implementing the recommendations of the PPUC tariff review, and the loss of momentum from management changes at PPUC and NDBP could not have been predicted, nor reasonably been managed by the SEDREA project, as these are political factors that can only be addressed within the Palau political system itself, over which of course the SEDREA project has no control. The recommendation to focus on SWH in the remaining project time available has the considerable benefit that it will enable the project to operate in an area where political considerations are minimal, as no grid connection issues or need for new energy policies are involved.

As the project has ended up being primarily focused on grid-connected PV on the main grid electricity supplied islands of Palau (and soon to be followed by a focus on SWH), the issue of the use of innovative ICT technologies is not as relevant as it would be in an environment where off-grid RE is being deployed, such as in the ADMIRE project RMI, or in a regional project covering multiple Pacific countries such as PIGGAREP. However, an appropriate use of ICT is evident in the project, although more physical travel by the UNDP RTA to Palau would clearly greatly assist the project maintaining momentum, as personal reviews and assistance are no substitute for the use of ICT technologies in all cases.

The project's logical framework has proven to be generally appropriate, with the exception of component 1 where the policy issues had been broadly achieved by other projects and hence were not required to be implemented by the SEDREA project in practice.

Risk management has generally been appropriate with the activities with the greatest uncontrollable risks planned out in detail before the formal project start and initiated promptly after the inception workshop. In particular the project made a fast start with the PPUC tariff review, as this would set the economic basis of any grid connected RE equipment to be demonstrated and replicated in the project. The project also moved promptly under the REFW Phase 1 consultancy work to recruit suitable international consultants to identify the most appropriate RE equipment to be deployed in Palau under the project, and then to specify, and procure such standard RE modules. The project promptly and appropriately started and progressed through the establishment of the REFW financing mechanism, training of bank staff and installers, and the development of an initial MOU between NDBP and PPUC when the Net Metering Bill encountered delays progressing through the Palau Congress.

The projects' Annual Work Plans (AWPs) provided a suitable description of the activities and their proposed expenditure was suitably compatible with the project original logical framework.

The project expenditure seems to have been generally cost effective and to have used suitably qualified and experienced consultants. The only significant area where project cost-effectiveness was questionable was in purchasing $130,000 of off-grid PV modules, but as previously explained this overly strong focus on off-grid systems was a long standing systemic project miss -focus issue dating back to its design phase and not a project management issue per se. The 100% funding of the initial modules of on and off grid PV modules instead of the design subsidy approach was probably an honest pragmatic attempt to simplify an already complex project approach, but as already explained it does introduce a potential risk to the project from a lessened impetus to NDBP to aggressively market the PV modules sitting in shipping containers outside its headquarters as the modules do not represent a direct NDBP financial investment as they are 100% SEDREA project funded using GEF grants funds.

# 5. LESSONS LEARNED

## 5.1 Need Firmly Reality-based View of Baseline RE Situation and Opportunities

Under PIREP (the preparatory phase GEF funded project to the Palau SEDREA project, as well as to the regional PIGGAREP and RMI ADMIRE projects) an extensive exercise was undertaken from 2003-2005 to understand the development context, the then current energy supply and demand situation, and what was needed to be done to achieve sustainable RE capacity and demonstrations and post-intervention RE replication across the applicable 15 PICs (Pacific Island Countries), including Palau. It was clear from the PIREP reports that the population of Palau was already then around 95% grid connected in 2004, and that many or most of the non-grid connected households in Palau had already received 100% donor funded PV systems. So the limited market, and potential for a low willingness to pay for off grid PV systems in Palau were already explicit at the PIREP project formulation stage of the Palau SEDREA project.

However, when the Palau SEDREA project was being formulated, the project focus then somehow shifted to fostering the RE uptake in the outer islands and rural communities of Palau, ignoring the then known fact that there were by then very few un-electrified households and communities still remaining in Palau. In practice, the project design focus on off-grid electrification may have been influenced by the desire to fund the Palau SEDREA project under the then GEF-4 STRATEGIC PROGRAM "SO-5: Promotion of renewable energy for the provision of rural energy services" umbrella.

Once the SEDREA project was being implemented, within 3 months of the start of project operations the REFW-1 consultants had reiterated that there was expected to be a minimal off-grid RE market (around 75 households in total) and that there was therefore essentially no realizable market for off-grid RE systems in Palau. The argument for implementing off-grid RE system demonstrations (to lead to future replications) was then shifted to an expectation that significant numbers of Palauan's would move to the undeveloped center of Babeldoab Island and would not want to pay full new electricity feeder line connection charges to the PPUC grid, so these new households would then want to instead utilise off-grid PV systems. This assumption flies in the face of the lack of actual growth in such off-grid households in Babeldoab since the Capitol complex and the compact road had previously been completed, and no reason was given as to why this existing situation would somehow change in the future. US$130,000 of scarce SEDREA project funds were subsequently spent purchasing 37 off-grid PV modules where there would seem to be at best a minimal market for householders to purchase such modules, and where most of the off grid households in remote islands had previously received PV systems that were 100% grant funded, so their willingness to pay for such systems would have to be questionable at best.

The SEDREA project therefore continued to focus attention and resources on a limited off-grid PV market, and at the same time the SEDREA project essentially ignored the largest and most cost-effective realizable RE market in Palau which was clearly identified as being standardised solar water heaters (SWH) for residential and tourist facilities. By October 2009 the REFW-1 consultants had already analyzed and reported on the large SWH market size and highlighted the fact that SWH were already economic without any tariff changes or subsidies but were being held back by a complex set of non-

financial barriers. However, the project continued to blindly follow a plan (for off-grid RE equipment purchase) when it was already clear that there were larger and easier to realize RE opportunities elsewhere on Palau, in particular in SWH.

A project design has to start with a working hypothesis, but this working hypothesis needs to accurately reflect what is known or can reasonably be surmised at the time. In addition, designing a project to focus on available funding categories, and then continuing to fund work in that category even when it is known there is a minimal market is always going to run directly head on into the hard rock of reality sooner or later. SEDREA made both mistakes, and now there is US$130,000 of off-grid PV modules sitting in shipping containers outside NDBP in Palau with a questionable market niche, a questionable willingness to pay by potential users, and a minimal replication potential from the demonstration units even if they are successfully sold, installed and sustainably operated. This is where wishful thinking gets a project - into having RE equipment in stock that will be hard to sell, let alone replicate.

## 5.2 Demonstrations Need to Directly Target a Specific Replication Hypothesis

SEDREA's main stated barrier removal mechanism was that the successful RE deployment in Full Scale Model demonstrations in Palau would open the way for post-project replications without subsidies or further technical assistance. To quote from the ProDoc "Activity 2.4: RET Full Scale Model Demonstration on technology delivery, financing mechanisms and productive application……. The purpose of this activity is to demonstrate effective RET delivery mechanisms as well as the appropriate financing mechanisms in acquiring the RETs. …. The financial plan for the FSMs will follow a cost-sharing arrangement that will be developed under this activity using the GEF incremental funds in the REFW as a share in the investment costs. While the NDB is prepared to put up the REFW initial fund, it needs confidence building and risk abating mechanisms, as such it required that the incremental GEF money be placed to support the first batch of financed RE projects (FSMs and direct lending). … There will be no dole-outs in order to avoid loose ownership and responsibility arrangements which, experience tells, could only lead to mismanagement and unsustainability of installed facilities."

The above definition of the purpose of the SEDREA demonstrations in the project design makes it clear that the project funds were designed to share in the investment costs, not provide a 100% funded batch of initial RE equipment while NDBP puts in no initial funds. Indeed, the PV module equipment supply contracts are stated to be with NDBP, suggesting that NDBP was intended to have a sense of ownership of the initial equipment, and presumably SEDREA GEF funds were intended to be used as a subsidy in the purchase of the initial stock of PV modules. In addition, the REFW-1 consultants reports were based on subsidies being given on a sliding scale by RE technology, application and timescale throughout the SEDREA project.

However, with the project having instead having actually funded 100% of the initial PV module order cost, NDBP now has nearly US$130,000 of off-grid PV modules in storage that have not cost NDBP anything to buy. This 100% project funding of the initial PV modules inevitably reduces the urgency that NDBP will feel in deploying the PV modules, as the modules sitting outside the NDBP HQ do not

represent a NDBP tangible cash investment. In addition, it is unclear who will subsidise the subsequent large number of PV modules that were envisaged by the REFW-1 consultants to be deployed over a three-year deployment period.

So it is important that a demonstration project actually demonstrates the proposed operational modality that it wishes to prove and see replicated, and not some simpler modality that may be more administratively simple to fund but has different incentives on key players than the modality being demonstrated. Therefore projects such as SEDREA need to be clear as to what their project supported demonstrations are supposed to achieve and only support demonstrations that will directly support the particular project's intervention logic.

# 6. RECOMMENDATIONS

At 31 October 2011 the SEDREA project was 75% into its planned three-year operational phase and its expenditure was 74% of its total GEF budget. The remaining unallocated GEF funds of $252,878.58 are a useful remaining budget for the nine months remaining until the project's scheduled July 2012 end date. The MTR analysis has revealed a number of areas where the project could make some useful adjustments to improve its project effectiveness and leave a more comprehensive and more sustainable post project end legacy. A number of recommendations are therefore made as follows: -

## 6.1 Aggressively Market Existing Off-Grid PV Modules

The SEDREA project has already spent US$130,000 (13% of the project budget) on fully funding 37 PV modules for a potential Palau market of around 75 off-grid households and perhaps some off-grid tourist facilities. However, most of the off-grid households already have donor provided PV systems that were provided at no cost to the households.

It is recommended that the existing off-grid PV modules be aggressively marketed without delay. The active assistance of PPUC should be sought in marketing off-grid PV systems to potential customers who enquire about new grid connections but for whom it is not economic for PPUC to connect to the grid. Off-grid PV modules should be strongly discounted if required to get the existing stock of off-grid modules out of their shipping containers and installed and in use for off-grid households or tourist facilities in Palau. It is recommended that any new off-grid PV modules only be purchased from suppliers on the receipt of firm orders and the actual payment of a suitable cash deposit.

## 6.2 Aggressively Market On-Grid PV Systems

The main focus of the SEDREA project to date has been on the on-grid PV systems. With the approval by the Minister for PPUC of an additional 100 residential systems and an additional five commercial PV systems to be net-metered grid connected, this represents an additional authorized market of around 220 on-grid PV modules assuming two modules per residential customer and four modules per commercial customer. This now represents a new authorized market of over $1 million of on-grid PV systems in Palau.

It is therefore recommended that aggressive marketing of on-grid PV systems be pursued without delay to clear out remaining existing stock at NDBP and order new stock as soon as possible. In parallel with the initial aggressive marketing campaign, it is recommended that the former REFW consultants be retained to update the on-grid PV module specification as required. It is then recommended that NDBP orders additional modules to meet the expected new demand from the new authorised market of the additional 100 residential and 5 commercial systems in the newly approved updated MOU with PPUC.

## 6.3 New Focus Required on Standardised Solar Water Heaters (SWH)

The REFW-1 consultants identified a market of around 1300 residential houses and a further 1300 tourist accommodation units where SWHs would be already economic with an around one year simple payback at current Palau grid electricity tariffs and without subsidies. A suitable description of what needs to be done to overcome the barriers to SWH in Palau already exists in the REFW-1 consultants RET Technologies and Markets Final Report. A suitable standard SWH specification suitable for Palau conditions and plumbing systems also already exists. These documents could be used to develop a suitable RFQ for the supply of suitable demonstration SWH systems for Palau. The approach of relying on local hardware suppliers sourcing appropriate SWH systems was a reasonable approach to trial but has clearly not worked and needs to be changed to a more pro-active approach led by the SEDREA project – and this new approach is supported by NDBP.

It is therefore recommended that the use of suitable standardised mains pressure heat pipe evacuated tube collector (ETC) SWH systems be demonstrated in a number of residential and tourist focused SHW applications in Palau – such demonstrations would need to start with the development of a detailed RFQ for supply, evaluation of tenders, training for installers and plumbers, and technical support during and after commissioning. Following suitable demonstration results, it is recommended that the SEDREA project and NDBP ensure that plumbers or hardware outlets (or NDBP itself if required) stock these then demonstrated standardised SWH systems for sale and for financing with aggressively marketed NDBP loans in this SWH space to residential houses and to tourist facilities.

## 6.4 Provide Further Technical Support from REFW Consultants

With the SEDREA project currently scheduled to end in July 2012, and with around $250,000 of its budget still remaining to be utilised, time is running short for high quality spending of the remaining

SEDREA project budget in the now eight months to the scheduled end of the SEDREA project. During the MTR review mission in July 2011, a high priority use for the remaining SEDREA funds was widely agreed to be to provide further technical support on RE system specification, purchase, installation and troubleshooting.

It is therefore recommended that additional technical support be retained without delay by the SEDREA project to support the remaining SEDREA project's implementation, in particular refresher training for PV system installation and remote technical support to suppliers/installers for on and off grid PV systems (the support required for SWH is really a whole new task that needs its own separate focus). NDBP have suggested that training be provided to more potential installers as the current three companies that are "certified" NDBP installers may also contribute to delays in installations once the rate of RE installations ramps up to its full potential rate. Ideally the previous REFW consultants would be directly retained under an extension to their previous contracts to reduce recruitment delays and to utilise the REFW consultants' valuable prior SEDREA project experience on PV systems in Palau.

## 6.5 Support Replications Beyond Palau

The SEDREA REFW approach of gradually phasing out RE subsidies alongside loans by a local national development bank for well tested standard RE equipment modules provided along with strong technical support for the funding mechanism and for the RE equipment is very innovative in a small island context. The SEDREA REFW seems to be a useful model for replication to further Pacific and other island nations. With IUCN support, as well as potential PIGGAREP funding, an initiative through ADFIP is currently underway to extend the SEDREA approach throughout the Pacific. It is recommended that the SEDREA project support this replication approach through ADFIP.

## 6.6 Extend Project End Date

The SEDREA project is currently scheduled to end in July 2012. Given the unforeseeable project delays from the lack of implementation of the PPUC tariff review recommendations to date, the slow but steady and still promising progress of the net metering bill, delays in obtaining a signed updated MOU between NDBP and PPUC for the installation of increased numbers of grid-connected PV systems, the loss of momentum from management changes at NDBP and PPUC, and the lack of success of the financing-only model for SWH to date, there is an argument for extending the project end date so that corrective actions identified in this review and the consequential recommendations can be properly implemented by the new project end date. NDBP concur that with the timing of the program nearing a close, they support the need for extending the closing date of the program so that the SWH component of the program can be fully addressed.

It is therefore recommended that an extension of the project end date by say six months be considered, in particular to facilitate the implementation of the other recommendations of this MTR (Mid Term Review).

# Annex A: List of Abbreviations and Acronyms

| | |
|---|---|
| ACP | Asia, Caribbean, Pacific (region) |
| ADB | Asian Development Bank |
| ADFIP | Association of Development Financing Institutions in the Pacific |
| ADMIRE | Action for the Development of Marshall Islands Renewable Energies (project) |
| AWP | Annual Work Plan |
| CDR | Combined Delivery Report |
| CEO | Chief Executive Officer |
| CER | CEO Endorsement Request (of GEF) |
| COFA | Compact of Free Association (between Palau and the USA) |
| CPAP | Country Programming Action Plan (of UNDP) |
| CY | Calendar Year |
| EU | European Union |
| EC | European Commission |
| EE | Energy Efficiency |
| EIB | European Investment Bank |
| ELP | Energy Loans Program (of NDBP) |
| ETC | Evacuated Tube (Solar) Collectors |
| FAO | Food and Agriculture Organisation (of the UN) |
| FSM | Full Scale Model |
| FSM | Federated States of Micronesia |
| FSP | Full Scale Project (of GEF) |
| GDP | Gross Domestic Product |
| GEF | Global Environmental Facility |
| GHG | Greenhouse Gases ($CO_2$ and other emissions such as methane) |
| GOP | Government of Palau |
| HQ | Head Quarters |
| IUCN | International Union for the Conservation of Nature (an international organisation) |
| IPPs | Independent Power Producers |
| HDI | Human Development Index |
| KWp | KiloWatt (peak) |
| M&E | Monitoring and Evaluation |
| MCO | Multi-Country Office (of UNDP) |
| MOU | Memorandum of Understanding |
| MSP | Medium Scale Project (of GEF) |
| MTR | Mid Term Review |
| NDBP | National Development Bank of Palau |
| North–REP | North - Renewable Energy Pacific (project) |
| O&M | Operation and Maintenance |
| PEO | Palau Energy Office |
| PIEPSAP | Pacific Islands Energy Policy and Strategic Action Planning (project) |

| | |
|---|---|
| PICs | Pacific Island Countries |
| PIGGAREP | Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project |
| PIF | Project Information File (of GEF) |
| PIREP | Pacific Islands Renewable Energy Project (GEF/UNDP/SPREP) |
| PMO | Project Management Office |
| PPUC | Palau Public Utilities Corporation (the electricity utility) |
| PREFACE | Pacific Rural/Renewable Energy France-Australia Common Endeavour (project) |
| ProDoc | Project Document |
| PURE | Productive Uses of Renewable Energy (the objective of GEF SP-4 projects) |
| PV | Photovoltaic |
| RED | Renewable Energy Division (of PPUC) |
| RESCO | Renewable Energy Service Company |
| RE | Renewable Energy |
| REFW | Renewable Energy Fund Window (of NDBP) |
| RET | Renewable Energy Technology |
| RFQ | Request for Quotation |
| RMI | Republic of the Marshall Islands |
| RTA | Regional Technical Advisor (of UNDP) |
| SEDREA | Sustainable Economic Development through Renewable Energy Applications (for Palau) |
| SHS | Solar Home Systems |
| SO | Strategic Objective (of GEF) |
| SPREP | South Pacific Regional Environment Programme |
| SWH | Solar Water Heater |
| TERM | Tonga Energy Road Map |
| T&D | Transmission and Distribution (for electricity grids) |
| UNDP | United Nations Development Programme |

# Annex B – People In Palau Interviewed for MTR

| | |
|---|---|
| Gustav N Aitaro | Director, Bureau of International Trade – Technical Assistance, Ministry of State, Republic of Palau |
| Regis Akitaya | Chairman, Senate Committee on Youth Affairs, Social Welfare and Culture, The Senate, Eighth Olbiil Era Kelulau (Palau National Congress) |
| Lentcer P. Basilius | Delegate and Chairman of the Committee on Energy, Communication, and Transport, House of Delegates, Eighth Olbiil Era Kelulau (Palau National Congress) |
| Tmetuchl Baules | Public Information Officer, PPUC |
| Tito Cabunagan | Electrical Engineer, PPUC |
| Greg Decherong | Director, Palau Energy Office |
| Jennifer Koskelin Gibbons | Executive Director, Palau Chamber of Commerce |
| Ted J. Glenn | Technical Assistance & Planning Services (REFW consultant to NDBP) |
| Rukebai K. Inabo | CEO/GM, PPUC (from April to November 2011) |
| Thomas Lynge Jensen | UNDP/GEF, Regional Technical Advisor for Climate Change Mitigation in the Pacific, UNDP Pacific Centre (PC) |
| Dermot Keane | Managing Director, Sam's Tours |
| Nyk Kloulubak | Energy Planner, PEO (National Project Officer, SEDREA project) |
| Tony Polack | Energy Specialist (Palau), North – REP Project, SPC |
| Casimir Rewengisau | Masons Hardware (ELP contractor) |
| Ken Sugiyama | Country Development Manager (Palau), UNICEF/UNDP/UNFPA |
| Cliff Terry | Architect – President, TRB Architects |
| Ulai Teltull | Operational Manager and Acting President, NDBP |
| Caleb Udai | President, NDBP (on administrative leave) |
| Ken Uyehara | Former PPUC CEO (to April 2011) and Interim PPUC GM (from November 2011) |
| Karla T. West | Commercial Loan Officer, NDBP |
| Victor M Yao | Minister of State, Government of Palau |
| Clarinda Ziegler | Loan Officer, NDBP |

# Annex C: Relevant Documents Reviewed

- EC North-REP EU Ambassador Visit to Palau Press Release Aug 2011
- EC North-REP Project Description for FSM+Palau+RMI -2009
- EC North-REP RE&EE Project Brochure - for EUR 2.47M Palau Funding
- EC North-REP EE&RE Project for EUR 2.47M Palau Funding
- GEF Focal Area Strategies & Strategic Programming for GEF-4 - May 2007
- GEF-4 Climate Change Strategy & Programs - Hosier - May 2007
- Grid Connected PV Q&A - PPA Magazine - Herb Wade – 2011
- Palau 2009-10 Energy Policy final draft - Oct 2009
- Palau 2009-10 Strategic Energy Plan final draft - Oct 2009
- Palau ELP Expansion to ADIFP Members - IUCN Proposal Herb Wade - June 2011
- Palau Energy Sector Review 1st Draft - G Zieroth & K Kesolei - June 2009
- Palau Solar Water Heater Specifications - Herb Wade - Oct 2010
- Palau PPUC State of Emergency Presidential Declaration 07 November 2011
- Palau Senate Net Metering Bill No 08-17 - Jan 2009
- Palau Tops HDI in Pacific - in PR HDR Pacific 2011
- Palau UNDP AWP 2010 Signed 19 Nov 2009
- Palau - Privatization and Corporatization Options for Palau Public Utilities Corporation, Working Paper 4, PINZ for ADB, June 2008
- Palau SEDREA MSP Request for GEF CEO Endorsement, PIMS 3093 - June 2008
- Palau-SEDREA 20080722 GEF CER Signed & UNDP Delegation Of Authority to Fiji MCO RR @ 22 Dec 2008
- Palau-SEDREA 20081228 ProDoc CPAP Final
- Palau-SEDREA 20090706 Inception Workshop Summary Record
- Palau-SEDREA 20090723 REFW-1 Consultancy RFP & TOR
- Palau-SEDREA 20091015 REFW-1 - RET Technologies & Markets Final Report - ReExAsia & Herb Wade
- Palau-SEDREA 20091130 REFW-1 - Final Design & Operating Procedures
- Palau-SEDREA 20091211 REFW-1 - Final Report on Mktg Plan & Bankable Projects
- Palau-SEDREA 20091224 PPUC Tariff Review Stakeholder Workshop Report
- Palau-SEDREA 20100113 PPUC Tariff Review - Final Report - by Ridgeway & Empower for UNDP
- Palau-SEDREA 20100225 Amendments to PPUC Tariff Base Review Final Report - Ridgeway Consultants
- Palau-SEDREA 20100427 Palau Government Owes Utility USD3.7M
- Palau-SEDREA 20100505 REFW-2 - Final Debriefing Notes Mission #1
- Palau-SEDREA 20100505 REFW-2 - RET Standard Configurations & Purchasing Guide - ReExAsia & Herb Wade
- Palau-SEDREA 20100523 PPUC Tariff News
- Palau-SEDREA 20100813 REFW-2 - Final Debriefing Notes #2 inc Draft NDBP-PPUC MOU
- Palau-SEDREA 20100817 NDBP-PPUC On-grid PV MOU#1 – signed
- Palau-SEDREA 20100928 Supply of 37 Sets of 270Wp Off-grid PV Systems Contract w NDBP Contract 2 for $130k

- Palau-SEDREA 20101028 Supply of 30 Sets of 1700Wp Grid Connected PV Systems NDBP Contract for $270k
- Palau-SEDREA 20110221 AWP 2011 for $618k – signed
- Palau-SEDREA 20110322 MTR Consultancy TOR
- Palau-SEDREA 20110502 Revised 2011 AWP SEDREA
- Palau-SEDREA 20110718 Jan-June 2011 Project Expenditure Summary @ $466k
- Palau-SEDREA 20110726 ELP On-Grid PV Installations Performance Data Report from NDBP
- Palau-SEDREA 20110817 Annual Project Report - draft TJ
- Palau-SEDREA 20111106 EESP&RESP Updates by NDBP Presented in Suva
- Palau-SEDREA 20111117 PPUC-NDBP MOU Amendment # 1 - as signed
- PIC Regional Energy Overview to Mid 2004
- PIREP Demo Projects
- PIREP Financing Mechanism for RE
- PIREP Palau Key Energy Issues Assessment Report - Herb Wade et al – Apia, Samoa : SPREP, 2005
- PIREP RE Technology Support Programme - Proposed
- PIREP Regional Overview
- PPUC Privatisation & Corporatisation Options for PPUC - TA 4929 PAL - PINZ for ADB - June 2008.pdf
- SEDREA AWP 2010
- SEDREA CDR 2009
- SEDREA CDR 2010
- SEDREA CDR 2011 Jan – Oct
- Evaluation of the Role and Contribution of UNDP in Energy and Environment – UNDP Evaluation Office - August 2008
- PIEPSAP End of Project Report: Concept, Results, Lessons Learnt, and Outlook, August 2008
- Review of the PREFACE Project – Executive Summary – Wade, Lambert and Ferguson – September 2009

# Annex D: Palau Senate Net Metering Bill – 2009 Draft

EIGHTH OLBIIL ERA KELULAU

First Regular Session, January 2009 Senate Bill No. 8-17

A BILL FOR AN ACT

To amend 37 PNCA, Public Utilities, to include a Palau Net Metering Act that will facilitate a system of customer based renewable energy generation to produce energy for the customer's own use, with excess electricity running to the provider, and for other related purposes.

THE PEOPLE OF PALAU REPRESENTED IN THE OLBIIL ERA KELULAU DO ENACT AS FOLLOWS:

**Section 1.** General Purpose.

This Act requires electric service providers to make a net metering program available to customers by which customers may establish a renewable energy-powered customer generation system to produce electricity for their own use and to supply excess electricity to the electric service provider. The Act requires the electric service provider to offset charges for electricity by the amount of electricity supplied by the customer from the customer generation system and requires the electric service provider to give the customer credit for electricity generated by the customer that exceeds the amount supplied by the electric service provider. The Act requires the customer to meet certain safety requirements with respect to the customer generating system. The Act prohibits the electric service provider from imposing additional charges or fees to customers participating in a net metering program unless specifically authorized herein.

**Section 2.** Legislative Findings.

The Legislature finds that allowing net energy metering for eligible customer-generators is in the public interest in order to:

(a) Encourage investment in renewable energy resources;

(b) Stimulate economic growth;

(c) Reduce demand for electricity when alternative energy is available.

(d) Enhance the continued diversification of the energy resources used in Palau;

(e) Reduce fossil fuel imports for electricity generation and increase energy independence; and

(f) Reduce carbon emissions and benefit Palau's environment.

1

**Section 3.** Short Title.

This Act shall be known as the "Palau Net Metering Act of 2009."

**Section 4.** Definitions.

As used in this Act:

(a) "Net energy metering" means measuring the difference between the electricity supplied to a customer through the electricity grid and the electricity generated by an eligible customer-generator and fed back to the electric grid over a 12-month period. Net energy metering shall be accomplished using a single meter or a set of meters capable of registering the flow of electricity both into and out of the electricity grid from the customer's premises.

(b) "Net metering time period" is defined as the designated 12 month period during which the PPUC measures the net amount of kilowatt-hours to be billed or credited at a customer's premises. The time period is to be designated by the PPUC and shall be the same for all customers.

(c) "Net-metering amount" is defined as the difference between the electrical energy flowing from the PPUC grid into a customer's premises and the electrical energy flowing from the customer's premises into the PPUC grid over a 12 month net metering time period. According to the conditions that prevail at the premises, the net metering amount may represent a net energy flow from the grid to the premises in which case a charge is made to the customer for that energy or a net energy flow from the premises to the grid in which case a credit is provided to the customer for that energy.

(d) "Average fuel cost for energy delivery" is defined as the average cost of the fuel and lubricating oil used to generate one kilowatt-hour of electricity during the net metering time period. That is determined by dividing the total cost of fuel and lubricating oil used by the PPUC during the net metering time period by the total kilowatt-hours sold to all customers during that same net metering time period. For customers who are classed as net metering customers but who are not connected for net metering for a full 12 month net metering time period, the average fuel cost for energy delivery for those customers shall be that of the 12 month net metering time period within which the partial year of connection falls.

(e) "Eligible customer-generator" means a residential, commercial, government or industrial customer of the PPUC, who uses renewable energy sources for generation of electricity that are connected to the PPUC grid and may at some time send electricity into the PPUC grid.

(f) "Net metering system" means a facility for generation of electricity that:

(1) Is connected to the PPUC electric distribution system;

(2) Is intended primarily to offset the customer's own electricity requirements;

(3) Is located on the premises owned or operated by the customer; and

(4) Employs a renewable energy source as defined in subsection (h) of this section.

(5) The facility is smaller than 5 kW maximum generation for a residential installation unless a larger size is specially approved by the PPUC for connection.

(6) For a commercial or industrial installation, the facility cannot generate in excess of the maximum kilowatt demand for the site unless a larger size is specially approved by the PPUC for connection.

(g) "Renewable energy source" is specifically defined within this Act to include energy derived from solar power, water power or wind power. Other forms of renewable energy may be allowed by the PPUC on a case by case basis upon application by a customer, through Executive Order or through amendment of this Act.

**Section 5.** Metering.

Consistent with the other provisions of this Act, electric energy measurement for net metering systems shall be calculated in the following manner:

(a) The PPUC shall measure the net electricity produced or consumed during the customer's billing period using multiple meters or a single meter designed for net metering use;

(b) If the electricity supplied by the electric company exceeds the electricity generated by the customer's renewable energy system that is fed into the electric distribution system during the billing period then the customer shall be billed for the net electricity supplied by

the electric company, in accordance with normal metering practices;

(c) If electricity generated by the customer exceeds the electricity supplied by the electric company:

(1) The customer shall be credited for the excess kilowatt-hours generated during the billing, period, with this kilowatt-hour credit shown on the following month's bill as an offset for kilowatt-hours supplied from the grid for that month;

(2) At the beginning of the 12 month time period designated for net metering calculation, any remaining unused kilowatt-hour credit accumulated during the previous year shall revert to the customer-generator in the form of monetary compensation at the average fuel cost for the generation of the credited kilowatt-hours during the time period designated for net metering calculation; and

(3) When a customer leaves the PPUC system, that customer's unused credits for excess kilowatt-hours generated shall be paid to the customer at the rate required above.

**Section 6.** Implementation. The PPUC:

(a) Shall develop a standard contract providing for net energy metering, and shall make this contract available to eligible customer-generators, upon request;

(b) Shall prepare appropriate technical standards for grid connection of renewable energy systems and shall inspect and provide a license for those renewable energy installations that meet those technical standards and the other provisions of this legislation. Issuance of a license will be solely to show that the PPUC has approved the interconnection of the customer's renewable energy system and the PPUC grid and will not in any way imply liability or approval by the PPUC for any part of the renewable energy system, its design or its method of implementation. Technical standards imposed will be based solely on those necessary to ensure safety of PPUC personnel and for maintenance of PPUC power quality. Standards and technical requirements shall be consistent with existing technical practices for similar types of installations in the United States, Australia

or the European Union. The licensee will be required to inform the PPUC of any proposed technical changes to the renewable energy system that affects either the maximum power output or the components that provide the interconnection between the renewable energy system and the PPUC grid and will, under the licensing agreement, not make those changes without PPUC approval.

(c) Shall, at its own-expense; make available to each of its eligible customer generators who have installed a net metering system the meter (or set of meters) that is needed to determine the net flow of electricity both into and out of the electricity grid;

(d) Shall, at its own expense, annually inspect grid-connected renewable energy installations to ensure that unauthorized changes have not been made and to ensure that the grid interconnection arrangements remain adequate for maintaining safety and power quality.

(e) May, at its own expense, and with the written consent of the customer, install one or more additional meters to monitor the flow of electricity in each direction. The additional metering shall be used only to provide the information necessary to accurately bill or credit the customer generator or to collect renewable energy generating system performance information for research purposes; and

(f) Shall not charge the customer any additional standby, capacity, interconnection, or other fee or charge that is greater than such fees charged to all members of that customer class.

**Section 7.** Total Capacity.

The PPUC may establish a maximum limit for the installed capacity of renewable energy systems connected to the PPUC grid for each technology of renewable energy system. The limit shall be reviewed annually and adjusted in accordance with changes in renewable energy technologies and in accordance with the current operating conditions of the PPUC.

**Section 8.** Credits. 37 PNC §415 is hereby amended as follows:

"**§ 415.** Credits from P.U.C. for privately purchased electrical transformers and cables.

The Public Utilities Corporation shall credit from future electric utility charges the

actual cost, including freight and insurance, incurred by any non-governmental electric utility customer, or incurred by any state government customer prior to the transfer of the Aimeliik power plant to P.U.C., to purchase transformer(s), cables and meter bases necessary to connect such customer to the electric power distribution poles; provided that the customer is not entitled to such credit unless he has obtained written confirmation from the P.U.C. that the types of transformer(s), cables and meter bases are suitable to connect the customer to the electric power distribution system and that the proposed cost therefor is reasonable. This credit does not apply to the purchase of net metering equipment. A state government may only receive credits pursuant to this section after the governor of that state, the Minister of Resources and Development and a P.U.C. representative meet, and if the Minister and P.U.C. representative agree in writing, together with proper documentation of the purchase, that the requested credit is appropriate."

**Section 9.** Regulations.

Within 90 days of the effective date of this Act, the Board of the PPUC shall promulgate rules and regulations necessary or appropriate to effectuate the provisions of this Act. Such regulations shall be exempt from the notice and hearing requirements set forth in 37 PNC §413(a), and shall be promulgated in accordance with the Administrative Procedures Act, 6 PNC Chapter 1. Such rules and regulations shall have the force and effect of law.

**Section 10**. Effective Date.

This Act shall take effect upon its approval by the President of the Republic of Palau, or upon it becoming law without such approval.

Date: 1-28-09

Introduced by: /s/
Regis Akitaya, Senator

/s/
Adalbert Eledui, Senator

# Annex E: NDBP–PPUC Net Metered PV Initial MOU

## MOU between PPUC and NDBP

### Background

As part of the SEDREA project funded by UNDP/GEF, the National Development Bank of Palau (NDBP) is establishing the NDBP Energy Loan Program (ELP) to provide affordable capital for renewable energy projects.

Work undertaken on the project to date has identified that the installation of solar photovoltaic (PV) systems on both residential and commercial grid-connected properties can offer a reduction in overall energy costs, provided a subsidised loan program is available for the purchase of these systems.

To ensure the viability of this program, a net metering approach, under which PV generated electricity can be supplied to the PPUC grid during the day time when (residential) usage is low, is an essential element.

Although a net metering bill is under consideration by the government, it has yet to be passed into law. This MOU is designed to set out an interim agreement to allow effective net metering activities to enable NDBP to launch the pilot phase of its ELP.

This MOU is written expressly for the Pilot Project Phase only. The Pilot Project Phase envisions at least 2 businesses and 4 houses being equipped with Solar PV grid-connected systems of 2.2kWp (220 kwh/month of electricity production) to 11kWp (1,100 kwh/month of electricity production). These Pilot Projects will be existing PPUC non pre-paid meter customers. The future roll-out of the ELP is expected to serve less than 1% of PPUC current customers with the funds currently available for the program. Based on similar Solar PV programs in many parts of the world, this will not affect the grid stability.

### Proposal

#### For NDBP

NDBP will offer a subsidised loan package to qualified borrowers to purchase modular solar PV systems for both residential and commercial usage

The systems will be offered in nominal 2.2kWp modules, anticipated to generate up to 220 kWh of electricity per month. The current average consumption for households in Palau is some 500 kWh per month.

Under the loan arrangements to be offered by NDBP it is proposed that funding, provided on a 20 year tenor, will cover the purchase, installation, initial 5 year maintenance and insurance for the modular system. A provision will also be made for a sub loan to allow funded replacement of the inverter, should this be necessary during the period of the loan. The intention is that the structure of the loans under the ELP will ensure that the monthly net energy costs for participants will be below their current expenditure (and future anticipated costs).

Under continuing support from the SEDREA program, there is an active training program that will provide support to local technical staff as they gain experience in installation of the PV systems. The use of a standard module is designed to simplify installation. External specialist support will be available in Palau to oversee initial installations and then on an intermittent basis over the first twelve months of the ELP operations. The frequency of visits will be adjusted as experience shows what level of support is required to maintain the highest standards of installation.

It is anticipated that all modules and installations will reflect the highest standards in terms of design and execution suitable for the harsh tropical environment in which they will be expected to perform for a minimum of 20 years. Only systems which have clearly demonstrated performance in similar conditions will be considered for funding.

It is NDBP's intention to purchase modules and manage the pilot phase of the program, with support from specialists provide with SEDREA support. Discussions with local vendors indicate that they are willing to act as importers and vendors of acceptable equipment and materials to maintain the longer term program underwritten by ELP funding.

The specialists working with NDBP will collaborate with PPUC to determine and document acceptable standards for the installation of the solar modules and their interconnection to the PPUC grid.

### For PPUC

PPUC has indicated that it is supportive of the net metering proposals and in particular sees the value in a pilot phase of the program as proposed by NDBP.

PPUC has a renewable energy group with whom the NDBP and its specialist will interface to develop appropriate standards that will allow a safe and effective interconnection of solar power into the PPUC grid.

It is expected that PPUC will need to install a second meter on properties where net metering is planned to determine the kWh of electricity passed from the property into the grid.

The net metering concept, on which the financial viability of the ELP is dependent, will see PPUC adjust the monthly billing to reflect a credit for the kWh of solar power dispatched to the grid. It is not anticipated that any self-generation system will have a net annual credit. If this were to be the case, PPUC proposes that such a credit would be carried forward but no cash payment will be payable.

## Agreement

Based on the proposal for the implementation of the pilot phase of the ELP as outlined above it is agreed that:

NDBP and PPUC recognise the mutual benefit of the installation of modular PV systems to provide a secondary source of electricity generation and help reduce energy costs for individual consumers.

NDBP responsibility

NDBP assures PPUC that the quality of the equipment and the installation of that equipment meet the highest industry standard. PPUC bears no responsibility or liability for the installed equipment from the roof to the meter nor responsibility for care and maintenance of that said equipment.

ELP funds are also covering the cost of routine maintenance and repairs after installation for a period of 5 years from the day of the installation which will be performed by an approved and certified service provider.

Interconnection

NDBP acknowledges that the interconnection of the self-generation facilities that the ELP solar PV program will allow must be implemented in a way that does not undermine the safety, security or integrity of the PPUC distribution system. Therefore NDBP will follow the well-established US electrical standards for Solar PV interconnection and will submit to PPUC a Manual for Interconnection Standards & Procedures.

NDBP insures that funds from the ELP program will cover the cost of the meter, its installation and labor for the interconnection. PPUC shall not bear those costs.

PPUC responsibility

PPUC only responsibility lies from the meter to the grid.

PPUC's maintenance and reading of the new meter dedicated to the Solar PV system and associated billing shall be covered by a monthly capacity charge (US$3 for households and US$11 for businesses).

PPUC shall adjust its billing system to charge the Pilot Project Customers according to the following formula:

- Net kWh Consumed = $(OM_{end\_of\_month}-OM_{beg\_of\_month})-(NM_{end\_of\_month}-NM_{beg\_of\_month})$
  With OM & NM being the reading of the Original Meter and New Meter respectively
- PPUC latest tariff rates applied to the Net kWh Consumed
- $Total\ bill = Capacity\_Charge_{OM} + Capacity\_Charge_{NM} + Net\_kWh\_Consumed * Tariff$

Long-term Partnership

NDBP and PPUC will cooperate to gather and review statistics for the further development of the program.

NDBP will keep PPUC fully informed of the progress in preparing and implementing the planned pilot phase. NDBP will be running a media campaign to promote the ELP and will consult with PPUC during its preparation to ensure that both party's interests are reasonably represented.

## Timing

The present schedule is that the delivery of the first systems is expected in August 2010 with installations beginning in September 2010.

The signing of this MOU is essential to allow NDBP to move forward with the next steps in the ELP program confident that it has PPUC's support and willingness to accept an interim net metering arrangement on which the success of the ELP is dependent.

Signed by:

FOR PPUC:

Rukebai K. Inabo, Chairperson PPUC Board,

8/6/10

Ken Uyehara, CEO/General Manager

8/6/10

Yukiwo Dengokl, Legal Counsel

FOR NDBP:

Ringsang Rechirei, Chairman

8/17/10

Kaleb Udui Jr. President

# Annex F: NDBP-PPUC Net Metered PV Extended MOU

NDBP-PPUC MOU
for the Grid Connected Solar PV Systems
Amendment No. 1

To amend the number of houses and commercials envisioned to participate in the Pilot Project Phase.

Current numbers expressed in the first page of the MOU are as follows:

"...The Pilot Project Phase envisions at least 2 businesses and 4 houses being equipped with Solar PV grid-connected systems of 2.2kWp (220kwh/month of electricity production) to 11kWp (1,100 kwh/month of electricity production)."

Replace above language with the following:

The Energy Loan Program will move forward with installations:

a. Residential On-Grid Solar PV Systems additional 100 installations.
b. Commercial On-Grid Solar PV Systems additional 5 installations.

If the installed systems meet the technical requirements of the PPUC Manual for Interconnection Standards and Procedures they will be connected to the PPUC grid. PPUC will do annual inspections and certify in writing that each system continues to meet the technical requirements set out in the PPUC Manual for Interconnection Standards and Procedures. If the technical requirements continue to be met as set out in the PPUC Manual for Interconnection Standards and Procedures and if consumers continue to pay their power bills then the Solar PV Systems will continue to be connected to the grid.

All other MOU terms to remain the same:

Signed by:

For PPUC:

11/16/11

Minister Jackson Ngiraingas
Ministry of Public Infrastructure,
Industries & Commerce

For NDBP:

Joshua Koshiba Chairman
NDBP Board of Director

Ulai Teltull
NDBP, Acting President

## Annex G: Mid Term Review Summary Presentation

# Palau - Current Renewable Energy Situation

- 99% of Palau has grid electricity - which is 99% diesel based
- New more fuel efficient 2*5MW diesels being commissioned
- Diesel is an uncontrollable cost/risk at 66-80% of PPUC costs
- SEDREA tariff review completed, only fuel surcharge increased
  - Government & PPUC in serious/terminal payment arrears
  - Still unaffordable 500kWh/month residential 'lifeline' tariff
  - Crises will reoccur until tariffs raised & govt arrears paid
- Electricity used for water heating – but SWH has 1 yr payback
- Net metering bill important, progressing - but not yet signed law
- NDBP EE Home Loans underway and making an impact
- Renewable Energy Division (RED) established at PPUC

2

## Overall Key Project Design Features

- SEDREA a $1M 3 yr GEF grant project
- Key design feature is development and operationalising a Renewable Energy Fund Window (REFW) at NDBP
- SEDREA not a standard donor grant funded project with: - hand-over and forget demo projects never replicated; studies and policies without tangible implementation funding; unfunded mandate action plans; aspirational road maps; general awareness & capacity building
- Key is post-project sustainable commercial-focussed loans & local vendors supplying RE & ongoing O&M support
- Step-by-step approach towards available standard, robust, proven, long-life, and locally maintainable RE systems
- Grid-connected net-meterd PV & solar water heating (SWH) are hedge for Palauans against future oil price rises

3

# Current Achievements/Status

- ProDoc Dec 07, UNDP-GOP signed Dec 08, inception workshop June 09
- REFW (now part of ELP) est. & underway at NDBP since Mar 2011
- NDBP has committed $1 million of its own funds to REFW
- Full specification for on-grid PV, off-grid PV, & partial SWH specification
- 30 on-grid 1700Wp PV units bought for resale + 5 bought by NDBP
- 37 off-grid PV 270 Wp sets bought = 42 sets in Palau ( with 5 extra free)
- 3 PV and SWH installation training sessions held & very appreciated
- NDBP site has 5 on-grid modules & 1 off-grid PV module – all operating
- 3 on-grid user residential PV systems installed & working (6 modules)
- 1 off-grid PV installed and working (1 module)
- Net-metering NDBP-PPUC MOU's in place for 104 grid-connected residential systems and 7 commercial systems
- From March loss of momentum from PPUC & NDBP mgmt. changes

4

# Recommendations

1. NDBP to Aggressively Market Existing Off-grid PV Modules
2. NDBP & PPUC to Aggressively Market On-Grid PV Systems
3. New SEDREA Focus Required on Solar Water Heaters (SWHs)
4. SEDREA to Provide Further Technical Support from (Previous) REFW Consultants
5. SEDREA to Update PPUC Tariff Study Only If Findings Will Be Fully Implemented This Time Around
6. SEDREA to Support PV Interconnection & IPP Standrad Contract Terms Technical Studies
7. SEDREA/Palau to Support Replications Beyond Palau
8. Extend Project End Date to End 2012

5

# Annex H: Terms of Reference of SEDREA MTR




***Terms of Reference for the Mid-Term Review***

**Title:** Consultant for UNDP/GEF SEDREA Project Mid-Term Review
**Project:** Sustainable Economic Development through Renewable Energy Applications (SEDREA) Project
**Duration:** 20 days
**Supervisor(s):** UNDP Multi Country Office; UNDP Asia Pacific Regional Centre in coordination with national executing agency
**Duty Station:** Palau

## 1. Introduction

### 1.1. Country Context

Palau has no known indigenous conventional energy resources that it can utilize to meet its energy needs. Basically, the country utilizes imported petroleum fuels to meet all of its energy needs. Bulk of these fuel imports is diesel fuel oil (DFO), which is mainly used for power generation. Petroleum products are also used in transport (e.g., gasoline, high-speed diesel), including aviation (jet fuel), industries, and households (e.g., kerosene, LPG). Although the country is expected to continue to rely on imported fuels for most of its energy needs, renewable energy (RE) forms such as solar, wind, biomass and ocean energy are recognized as potential energy alternatives.

The Government of Palau (GOP) has taken various steps in the past and present to address the long-term effects of high dependence in petroleum fuels and environmental problems in the country. Among others legal and regulatory frameworks and policies have so far been issued by the GOP including a National Energy Policy in 2010.

### 1.2. Project Summary

The Medium Sized Project (MSP) on Sustainable Economic Development through Renewable Energy Applications (SEDREA) in Palau is a Global Environment Facility (GEF) funded project through the United Nations Development Program (UNDP). The three year project is implemented by the Palau Energy Office (PEO). The project begun operation in June 2009 and is plane to end in May 2012.

This project is intended to remove the barriers to Palau's efforts to reduce greenhouse gas emissions through the widespread use of feasible renewable energy technologies (RETs).

### 1.3. Project Expected Outcomes

The main expected outcome of the project is the effective utilization, and realization of benefits from the use, of the country's feasible Renewable Energy (RE) resources. The expected outcomes per project component are as follows:

- *Outcome 1:* Renewable Energy (RE) policy and institutional capacity building
- *Outcome 2:* RE technology delivery and financing mechanism
- *Outcome 3:* RE technology development and industry support
- *Outcome 4:* RE information, training and advocacy
- *Outcome 5*: Programme Management Unit (PMU)

## 2. Project Status

The key component of SEDREA is to establish a Renewable Energy Fund Window (REFW) at the National Development Bank of Palau (NDBP). Thus so far the focus has been on the preparation and launching of the REFW. In the period from September 2009 to February 2011 a very comprehensive preparatory phase were undertaken that among others included: market assessment; assessment and selection of appropriate renewable energy technologies; preparation of loan guidelines and operating procedures; capacity assessment; various capacity building activities including the ability of the NDBP staff to evaluate loan applications and evaluate the performance of contractors and financed installations and contractors' capacity to install and maintain renewable energy systems in Palau; marketing of REFW; various on demand technical advice and support to NDBP; and monitoring of the initial performance and effectiveness of the REFW. As of February, 2011, the REFW is in operation with commitments made for the finance of both grid-connected solar and off-grid solar PV installations.

In addition a tariff review of the Palau Utility Corporation (PPUC) has been undertaken. The primary objective was to identify long-term revenue requirements of PPUC and recommend a base tariff that allows a commercially sustainable operation of the utility. The review recommend a tariff model that considers both PPUC's main operation on the Islands of Koror and Babeldaob and the delivery of electricity services to Palau's three outer islands. Among others the tariff review enabled an increased understanding of pricing issues associated with renewable energy based power generation to make it competitive with petroleum based generation, which provided input to the preparatory work for the REFW.

**Objectives of the Mid-Term Review**
The following are the overall objectives for monitoring and evaluation of GEF projects:

a. To promote accountability for the achievement of GEF objectives through the assessment of results, effectiveness, processes and performance of the partners involved in GEF activities. GEF results will be monitored and evaluated for their contribution to global environmental benefits; and,
b. To promote learning, feedback and knowledge sharing on results and lessons learned among the GEF and its partners, as basis for decision-making on policies, strategies, program management, and projects and to improve knowledge and performance.

As defined in the GEF Monitoring and Evaluation (M&E) Policy, an evaluation is a systematic and impartial assessment of an activity, project, program, strategy, policy, sector, focal area or other topics. It aims at determining the relevance, impact, effectiveness, efficiency and sustainability of the interventions and contributions of the involved partners. An evaluation should provide evidence-based information that is credible, reliable and useful, enabling the timely incorporation of findings, recommendations and lessons into the decision-making processes.

The specific objective is to undertake an independent and objective mid-term review (MTR) of the SEDREA as per UNDP/GEF requirements and procedures.

## 3. Scope of the Mid-term Review

The scope of the mid-term review (MTR) covers the entire UNDP/GEF-funded project and its components as well as the co-financed components of the project.

The MTR will assess the Project implementation taking into account the status of the project activities and outputs and the resource disbursements made up to date.

The evaluation will involve analysis at two levels: component level and project level. On the component level, the following shall be assessed:

- Whether there is effective relationship and communication between/among components so that data, information, lessons learned, best practices and outputs are shared efficiently, including cross-cutting issues.
- Whether the performance measurement indicators and targets used in the project monitoring system are specific, measurable, achievable, reasonable and time-bounded to achieve desired project outcomes.
- Whether the use of consultants has been successful in achieving component outputs.

The evaluation will include such aspects as appropriateness and relevance of work plan, compliance with the work and financial plan with budget allocation, timeliness of disbursements, procurement, coordination among project team members and committees, and the UNDP country office support. Any issue or factor that has impeded or accelerated the implementation of the project or any of its components, including actions taken and resolutions made should be highlighted.

| Components/Activities | | Budget | | |
|---|---|---|---|---|
| **Planned Activities** | **Actual Accomplishment** | **As per ProDoc** | **Actual Expenditures** | **% of Actual vs. Project Budget** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

On the project level, it will assess the project performance in terms of: (a.) Progress towards achievement of results, (b.) Factors affecting successful implementation and achievement of results, (c.) Project Management framework, and (d.) Strategic partnerships.

4.1 *Progress towards achievement of results* (internal and within project's control)

- Is the Project making satisfactory progress in achieving project outputs vis-à-vis the targets and related delivery of inputs and activities?
- Are the direct partners and project consultants able to provide necessary inputs or achieve results?
- Given the level of achievement of outputs and related inputs and activities to date, is the Project likely to achieve its Immediate Purpose and Development Objectives?
- Are there critical issues relating to achievement of project results that have been pending and need immediate attention in the next period of implementation?

4.2 *Factors affecting successful implementation and achievement of results* (beyond the Project's immediate control or project-design factors that influence outcomes and results)

- Is the project implementation and achievement of results proceeding well and according to plan, or are there any outstanding issues, obstacles, bottlenecks, etc that are affecting the successful implementation and achievement of project results?
- To what extent does the broader policy environment remain conducive to achieving expected project results, including existing and planned legislations, rules, regulations, policy guidelines and government priorities?
- Is the project logical framework and design still relevant in the light of the project experience to date?
- To what extent do critical assumptions/risks in project design make true under present circumstances and on which the project success still hold? Validate these assumptions as presently viewed by the project management and determine whether there are new assumptions/risks that should be raised

- Is the project well-placed and integrated within the national government development strategies, such as community development, poverty reduction, etc., and related global development programs to which the project implementation should align?
- Do the Project's purpose and objectives remain valid and relevant, or are there items or components in the project design that need to be reviewed and updated?
- Are the Project's institutional and implementation arrangements still relevant and helpful in the achievement of the Project's objectives, or are there any institutional concerns that hinder the Project's implementation and progress?

4.3 *Project management* (adaptive management framework)

- Are the project management arrangements adequate and appropriate?
- How effectively is the project managed at all levels? Is it results-based and innovative?
- Do the project management systems, including progress reporting, administrative and financial systems and monitoring and evaluation system, operate as effective management tools, aid in effective implementation and provide sufficient basis for evaluating performance and decision making?
- Is technical assistance and support from project partners and stakeholders appropriate, adequate and timely?
- Validate whether the risks originally identified in the project document and, currently in the APR/PIRs, are the most critical and the assessments and risk ratings placed are reasonable.
- Describe additional risks identified during the review, if any, and suggest risk ratings and possible risk management strategies to be adopted.
- Assess the use of the project logical framework and work plans as management tools and in meeting with UNDP-GEF requirements in planning and reporting.
- Assess the use of electronic information and communication technologies in the implementation and management of the project.
- On the financial management side, assess the cost effectiveness of the interventions and note any irregularities.
- How have the APR/PIR process helped in monitoring and evaluating the project implementation and achievement of results?

4.4 *Strategic partnerships* (project positioning and leveraging)

- Are the project partners and their other similar engagements in the SEDREA project, strategically and optimally positioned and effectively leveraged to achieve maximum effect of the RE program objectives for the country?
- Asses how project partners, stakeholders and co-financing institutions are involved in the Project's adaptive management framework.
- Identify opportunities for stronger collaboration and substantive partnerships to enhance the project's achievement of results and outcomes.

- Are the project information and progress of activities disseminated to project partners and stakeholders? Are there areas to improve in the collaboration and partnership mechanisms?

## 4. Evaluation Methodology

The successful MTR Contractor is expected to become well versed as to the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. Information will be gathered through document review, group and individual interviews and site visits

At the beginning of the mission in Palau the successful MTR contractor will conduct an inception meeting with key stakeholders including the PEO, NDBP, PPUC, and the Palau Country Development Manager (UNDP/UNICEF/UNFPA) be followed by a de-briefing meeting to discuss the preliminary findings and recommendations (prior to the submission of the draft Final Report).

Prior to the mission to Palau, the successful MTR Contractor shall review relevant documents including:

- UNDP SEDREA Project Document and GEF MSP Brief
- Summary Record of the SEDREA Project Inception Workshop Annual Work and Financial Plans
- Annual Project Report/Project Implementation Review (API/PIR) for 2009-2010
- Quarterly progress reports
- Internal monitoring results
- Terms of Reference for past consultants' assignments and key deliverables

The successful MTR contractor should at least interview the following people and organisations:

- PEO, Director
- PEO, Energy Officer
- NDBP, President
- NDBP, Program Manager for the Energy Loan Program (ELP)
- NDBP, Energy Loan Consultant
- Selected suppliers and contractors involved in the REFW
- PPUC, General Manager
- Consultants including ReEx Capital Asia and Dr. Herbert A. Wade
- Palau Country Development Manager (CDM), UNDP/UNICEF/UNFPA
- UNDP Fiji Multi-country Office (MCO) in Suva
- UNDP/GEF UNDP Regional Technical Advisor for Climate Change Mitigation in the Pacific (based in Suva)

With the aim of having an objective and independent evaluation, the MTR Evaluation Team is expected to conduct the project review according to international criteria and professional norms and standards as adopted by the UN Evaluation Group (http://www.unevaluation.org/documentdownload?doc_id=21&file_id=562).

## 5. Qualifications and Experience

The successful Contractor is expected to have all or most of the following qualifications and experience:

a) Professional and academic qualifications in the areas of energy and environment or other relevant fields;

b) Proven track record of very extensive experience in project and program monitoring and evaluation (M&E) preferably in the context of GEF, in general, and UNDP/GEF, in particular;

c) Knowledge of renewable energy and climate change projects and national context of renewable energy project and program implementation in Pacific Island Countries (PICs) including Palau (or alternatively familiarity in similar country or regional situations relevant to that of Palau);

d) Experience in Palau or other PIC is considered an asset; and,

e) Excellent working knowledge of English both spoken and written.

## 6. Evaluation Schedule and Deliverables

The MTR mission to Palau is tentatively planned to commence sometime in May 2011. An evaluation report will be produced, highlighting important observations, analysis of information and key conclusions including its recommendations. The Evaluation Report will include, among others:

- Findings on the project implementation achievements, challenges, and difficulties to date;
- Assessments of the progress made towards the attainment of outcomes;
- Recommendations for modifications and the future course of action; and,
- Lessons learned from the project structure, coordination between different agencies, experience of the implementation, and output/outcome.

The draft report will be initially shared with the SEDREA PMO to solicit comments or clarifications and will be presented to the UNDP Country Office (CO) in Suva, Fiji for further deliberations. Consequently, the final MTR Report (in three copies) will be made and submitted to the UNDP CO with a copy furnished to the SEDREA PMO.

There will be two main deliverables:

- A de-brief power-point presentation with preliminary findings and recommendations of the MTE; and,
- Mid-Term Review evaluation report, including an executive summary, fulfilling the evaluation requirements set out in this Terms of Reference (TOR). The final

report is to be cleared and accepted by UNDP MCO in Suva, Fiji before final payment. The final report (including executive summary, but excluding annexes) should not exceed 50 pages.

**Proposed Methodology and Timelines**

The successful contractor shall be engaged to undertake the evaluation working according to a planned schedule to be completed by May 28th. The successful contractor will have the overall responsibility of organizing and completing the review, submitting the final report.

The successful contractor is expected to propose a work layout, plan, budget and timelines to achieve the expected outputs with the appropriate methodology.

**Fee Proposal/Price Schedule**

The consultant is requested to provide a proposal or quotation of the fees/cost for the services which will be rendered using the following format.

| | |
|---|---|
| Daily consultancy rates | A maximum range of US$250 – US$500/day for the daily consultancy rate can be proposed. |
| Air Ticket | To and from home country |
| Air Ticket | (including at least one travel to Fiji for preliminary briefings) |
| Living allowances | Based on the number of days spent at the respective duty station |
| Other miscellaneous expenses | (please state) |

**Payment Schedule**

a) Thirty per cent (30%) of the maximum payable Consultancy Fee [Professional Service] will be paid immediately following the signing of this Agreement and acceptance of a work plan by UNDP and executing agency.

b) Thirty per cent (30%) will be paid within seven (7) working days of receipt and acceptance by the United Nation Development Program of a draft evaluation report and draft cabinet paper highlighting major findings of the evaluation.

c) The remaining forty (40%) will be paid within seven (7) working days of the acceptance by the United Nations Development Program of the final Evaluation Report and final cabinet paper highlighting major findings of the evaluation;

**Evaluation Method**

The proposals will be evaluated using the UNDP cumulative analysis method whereby the total score is obtained upon the combination of weighted technical and financial attributes.

The highest combined weighted score which provides the best value for money will be awarded the contract.

**Applications**: Proposals should include:

- a Results-Oriented Curriculum Vitae with full contact details of three referees
- a cover letter summarizing your experience and qualifications for this consultation (should not exceed 2 pages)
- fee proposal and work plan with timelines to undertake this assignment
- a completed P11 form available from UNDP website

Applications to be submitted by April 4th, 2011 either electronically to **registry.fj@undp.org** or addressed under confidential cover to:

***Expression of Interest***
Mid Term Evaluation of Palau Sustainable Economic Development through Renewable Energy Application (SEDREA)
C/-- The Resident Representative
United Nations Development Programme Multi Country Office
Private Mail Bag or Level 8, Kadavu House (414 Victoria Parade)
Suva
Fiji.

Incomplete applications will not be considered and only candidates for whom there is further interest will be contacted.

Additional information including the Post Profile, Results-Oriented Curriculum vitae format is available from the UNDP website: www.undp.org.fj or the UNDP Office.

***Women candidates are encouraged to apply.***
**The Fiji Office covers Fiji, Kiribati, Marshall Islands, Micronesia, Nauru, Palau, Solomon Islands, Tonga, Tuvalu and Vanuatu*

**Further Information**

For further information concerning this Terms of Reference, Ms. Emma Mario, Acting Environment Team Leader, UNDP-MCO, Suva, on email emma.mario@undp.org / telephone (679) 3312500 or Mr. Nicholas Kloulubak of the Palau Energy Office (PEO), Palau, on email nyk@palaunet.com or telephone (680) 4881281