Regional Energy Strategies and Energy Planning in the Pacific Island Countries

Analysis of current status and identification of potential EUEI PDF interventions in the Pacific

EUEI PDF
Partnership Dialogue Facility

Executive Summary

The pacific island countries (PIC) are native to a most delicate eco-system encompassing one third of the globe and host to most of the global climate formation.

Energy development has affected them in multiple ways: Warmer seawater reduces coral and then fish, the rising water table submerges the atolls, and the heavy dependence on petroleum strains economies and eventually hinders further human development.

Renewable energy for power generation, nowadays strongly promoted in industrialized countries, is being used in the PIC with some success for remote electrification. A consequent and necessary transition of the power sector to use utility scale RE generation has commenced, but with the vast distances and limited capacity and experience, this process will take time.

Rational use of energy and a systematic approach to energy efficiency is universally acknowledged as the necessary first, most effective and fastest way to reduce energy dependency. The incremental cost is lower than building new power plants and even less than building renewable generation capacity.
Political actors and the international development community are aware of this benefit, so new initiatives and interventions are on line, yet momentum picks p slowly.

The EUEI PDF avails of the tools to support and strengthen those efforts. In participatory cooperation with national administration and the energy business, this can be a valuable contribution to create additional momentum in action.
The potential work field for EUEI in the Pacific could be to provide competent background knowledge and capacity enhancement to the following options:

- Draft regional and national **energy strategy**: How to set certain goals and plan to achieve them, assess the role of **IPPs** and create the **regulation** to supervise them
- Draft **RE law**: Formulating above policy in a law, integrating off-grid and grid policy, encouraging planning security. Often, RE regulations are non-binding or so weak that implementation, particularly from private sector, finds no incentive.
- Improve **Energy planning**: Describe options of policy, power sector, user and private sector. Develop catalogue of EE interventions, their cost and impact. Show facts and examples. Analyse, prioritize applicable potential of RE sources in PIC (wind, hydro, agri-fuel) How can national and international resources assure sustainability. How will a PIC benefit from RE, who will be winners and losers.
- Develop **Energy supply modelling**: Optimize the combination of various energy sources, hybrid modelling, priorization, sensitivity analyses. While monovalent supply was already difficult to manage, multivalent models which need to be forming the future energy mix are almost unknown and lead to inefficient planning.
- Recommend **operational structure**: Efficient and sustainable operation of RE projects, stakeholder participation. Most RE projects failed due to operational shortcomings.
- **Energy efficiency** potential and capacity: investment, regulation and impact of EE interventions. Utilities often fear to lose business, look at EE only on the supply side, and reduce it to RE projects. Role and participation of the **private sector**.

The analysis of the PIC projects in Annex 3 shows that **work fields** of most activities relate to improved energy efficiency, followed by renewable energy application (mostly PV), financing tools and energy policy.
Most **activities** go to PNG, followed by Samoa, Solomon, Vanuatu, Marshall, Cook and Kiribati.
The most important **partners** for energy related cooperation would be the
- Energy Development Partners Working Group (EDPWG) in which the EU is a member and where the WB is the lead, and the
- Secretariat of the Pacific Community (SPC) representing the various national associations and energy administrations

The most substantial energy related **assistance** comes from Japan (75m$), the EU (51m$), the ADB (41m$) and Australia (24m$)

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Regional Background

"Petroleum products will remain the major source of energy for the region for a long time to come." This statement from the Pacific Energy Ministers Meeting might be found rather optimistic, as in view of the approaching oil peak and consequent supply shortages with unpredictable cost the regions economic lifeline will not hold.

The Pacific Ministers of Energy representing some 10 Million people, in 2009 acknowledged that Pacific economies are the most vulnerable in the world to rising oil prices, and stressed the urgent need to reduce this vulnerability through mainstreaming energy security into national planning and budgetary processes; improving energy efficiency and conservation; adopting financially viable renewable energy sources; and, where appropriate, taking regional and subregional approaches to petroleum procurement and coordination of regional services.

While the PICs continue to rely heavily on fossil fuels and only 30% of the population on average has access to electricity, they at the same time have some of the highest renewable energy (RE) potential per capita.

RE can reduce the PICs' dependence on fossil fuel and thereby provide cleaner, more reliable and cost-effective energy services that are needed for the sustainable development. However, Pacific island countries and territories face a unique and challenging situation. Due to the large distances and small land-mass productivity is low and contribution to the world economy little. Copra export is decreasing steadily and tourism is highly competitive and depending on the worlds' economic health. For this reason, PICs have a weak economic perspective and often are dependent on outside support. Particularly the outer islands which have been sustaining on subsistence level feel the decrease of opportunities, leading to migration to the main islands, where they add to the economic pressure.

- Pacific island countries (PICs) comprise a wide range of ecosystems, predominantly influenced by marine systems, that make infrastructure development difficult and environmental impacts significant;
- Energy supply security is vulnerable given the limited storage for bulk petroleum fuels, which are sourced over a long supply chain at relatively high prices;
- Demographics vary widely between countries, but often feature small, isolated population centres;
- Markets are very thin, difficult to serve, and without significant economies of scale;
- 70% of the regional population is without access to electricity, but access varies widely, from 10% to 100% at the national level;
- Environmental vulnerability through climate change and sea level rise is very high, particularly for small islands and low-lying atolls;
- Environmental damage, habitat loss and pollution resulting from development and use of conventional energy sources have significant effects on fragile island ecosystems;
- There is limited scope for market reforms considering the variation in size and density of markets, therefore appropriate alternatives very between countries;
- The region has limited human and institutional capacity to respond to these challenges;

(source: Pacific Islands Energy Policy PIEP, 2004)

The next decades will change the face of the PICs and their eco-systems. For the energy sector, where investments made today will have effects for many decades, PICs must consider carefully where to locate large petroleum storage terminals, how to dispose safely of wastes and plan for spills where coastlines may erode. They must decide whether to make large investments in hydropower or biomass energy if rainfall patterns may change or in wind energy if wind patterns might change significantly over time. They must decide how to protect expensive investments in renewable energy technologies (RETs) and best develop energy services in a changing environment.

EUEI-PDF Interventions

The European Union Energy Initiative for Poverty Eradication and Sustainable Development (EUEI) has created a Partnership Dialogue Facility. The PDF supports ACP partner countries in improving access to energy services and energy security, mainly through the development of instruments and legal, fiscal and regulatory structures to achieve national objectives for energy services.

The contribution is unconditional, fast and practical and has already provided interventions ranging from energy access studies to policy formulation and donor harmonization.
This PDF is available in ACP countries and thus could be of particular value to the pacific countries which currently undergo a serious restructuring of the energy sector.

Energy Actors

In a situation where much of the resources and management was being provided by the supporting nations, the PICs after independence felt little need for developing a political and financial planning capacity. This applies to the overall economy as much as to the energy supply situation.
This is changing: With a strained global economy and dwindling resources leading to sharp fuel price increase, the confidence in a constant provider is fading. The islands are not only looking for other supporters but take a keener interest in their own independent policy development.
The Energy Ministers from the Pacific Island Forum June 2010 in Brisbane endorsed the "Framework for Action on Energy Security in the Pacific" (FAESP).
The Framework is coordinated by the Secretariat of the Pacific Community (SPC) and states that "energy security exists when all people at all times have access to sufficient sustainable sources of clean and affordable energy and services to enhance their social and economic well-being". It outlines a new approach to improving energy security in the Pacific region but acknowledges that national energy policies and plans must be the principal means for achieving energy security.

The framework acknowledges the primacy of national energy policies and plans as the principal means for achieving energy security in the Pacific.

For the entire community, a separate regional Implementation Plan for Energy Security in the Pacific will be developed, focusing on regional interventions that provide practical support for the implementation of national policies and plans. The Plan will be prepared for endorsement at the 2011 Pacific Energy Ministers Meeting.

PIC Energy Administration

When left into independence, a notion was that PIC would have no individual energy administration and rather bundle their energy matters, for volume was small to very small and supply by petroleum the uniform choice. It did not happen this way but still today practically none of the PICS have Energy Ministries responsible for national energy policies and planning, an Energy law or a legal basis for renewable energies. Even the largest PICs (PNG and Fiji) only have relatively small government departments (see table 3). Most energy offices were established as a result of a cabinet decision in the early 1980s. None have been established under legislation that gives them a clear statutory or other legal mandate with responsibilities and powers agreed by parliament. Apparently only three energy offices (Fiji, PNG and Vanuatu) have a strategic, corporate or business plan, defining roles and medium-term goals within the public service.

In many PICs, the "energy unit" or "energy office" consists of only one or two staff, who deal mainly with the administration of donor-funded renewable energy projects, and have very little influence on broader national energy policies. In mid 2004, only three PICs (the Cook Islands, the Marshall Islands and Tokelau) had current national energy policies with some form of official endorsement by their cabinets.
First approach at a joint energy path was the 2002 Pacific Islands Energy Policy and Plan (PIEPP), by the Energy Working Group (EWG) with a review in 2004. To some extent, all policies under development or recently completed have been influenced by the content and format of PIEPP. All PICs have at least an implicit electrification policy. In most PICs independent power production (IPP) and rural electrification lacks clear policy and regulation. In Solomon, a draft Rural Electrification Policy was prepared (1996) with German assistance. Currently, Vanuatu is establishing a "regulator´s office" with AusAid assistance. Tonga has drafted a Rural Energy law.

Development assistance

As described above, assistance in the Pacific came from the colonial powers and was based on territorial or economic interest. This has changed, the PIC receive net subsidy and although their situation is not visibly improving, support programs grow steadily (see Annex 3). This sometimes leads to conflicts: PICs want more help and donors want more cooperation. So PICs are looking for other support and have not too much problem finding it, as donors are competing to offer direly needed help. This includes not only traditional partners like US, France and Japan, but recently also Taiwan, China and the EU. Even more assistance would be available, just that PIC partners find it difficult to deliver (from the EU 200 Mio ACP-funds under EDF-10 Africa got 94% the Caribbean 5% and the pacific less than 1%). So the situation is challenging in that way that more support is available than can reasonably be consumed by the countries. In absence of a national strategy this leads to patchwork projects where interventions follow less the long-term national interest than the short-term, often hurried project objectives.
In order to coordinate and harmonize donor assistance, the **Energy Development Partners Working Group** (EDPWG=ADB, AusAID, EIB, EU, JICA, NZAID, REEEP, UNDP, WB) was formed with the WB as lead and is now meeting regularly, which by all is appreciated as good progress. The EU is one of the EDPWG partners.
Within the EDPWG the support has shifted, NZ is largely concentrating on their associated partners Cook and Niue, AU is keeping up a strong support (24m$)through various channels, including PRIF and REEP (a gross overview or regional strategy is not available though).
At present, the substantial and most consistent contribution is from the **European Union** (51m$) through the EDF-9 and EDF-10 programs which are mostly hardware based, but include also CD components. Noteworthy, during the last five years, Italy was financing RE support through the IUCN (10m$)

Focus of EU assistance: Strategy papers for EDF10 (-2013)

Country	Focus	Particular Energy	Total Allocation €
Cook	water Energy		3,3
Kiribati	water, energy	PV electrification	13,8
Marshall	water, energy	basic energy, OI	5,8
FSM	energy	renewable, OI	9,0
Nauru	water, energy	renewable	2,9
Niue	renewable energy, en. efficiency	power generation	3,3
Palau	water, energy	renewable NSA	2,9
Tonga	water, energy	renewable OI	6,8
Tuvalu	water, sanitation	renewable	5,4

The **Asian Development Bank** ADB support for TA and energy sector restructuring, also "Promoting Energy Efficiency in the Pacific" is about 41m$)
For all Asia, the Asia Solar Energy Initiative (ASEI) from 2010 establishes a knowledge management platform and targets the deployment of 3 GW of PV. For PIC, this includes 1 MW in Tonga and about 5oo kW for RE-electrification in Yap. For Cook Islands, Samoa, Tonga, Vanuatu and Papua New Guinea an energy efficiency project is in the second phase of execution.
The **World Bank**, including "Energizing the Pacific Project" accounts for 14m$ and, more importantly, takes the lead in regional donor coordination.
Asian partners, foremost Japan, China, Taiwan and Korea engage in individual projects and their contribution is mostly hardware based. They do not involve in energy policy and show no interest to participate in the relevant associations; there is also no regional strategy visible. Japan accounts for the largest overall contribution (75m$) and they are also member of the EDPWG.

Energy Associations

Both national and international energy stakeholders looked at the installation of regional non- or trans-government organizations as useful mediator and facilitator. There is a history of many formations, transitions and successions, in view of a sustainable energy policy however, they have not achieved much. This may have been due to their fragmented organization or insufficient capacity or clout. An improvement came by congregating in the Council of Regional Organizations of the Pacific (CROP) which also included SOPAC the SPREP and the Pacific Power Association (PPA) which represents most utlities (table 3). 2010 it was decided to declare the Secretariat of the Pacific Community (SPC, Noumea) the common "Lead-Agency", which has assumed a considerable work load in creating „policy, strategy and implementation" for a better energy future.

Potential EUEI work field : Cooperate with EDPWG, SPC on RE policy and planning at national and regional level.

Generation

In the past, PICT energy supplies have been based on the use of petroleum fuels and indigenous sources such as hydro and biomass.
For the reason of low load density, energy supply was mostly restricted to the main islands. Outer islands have isolated gen-sets which are operated at odd schedules. Primary energy source is petroleum based which at lower availability and hiking prices leads to a dead-end.
So while the demand for energy consuming appliances rises and population wishes more opportunities, the supply situation worsens.
More energy security can only be achieved by less dependency on imports. Local resources are available and could contribute substantially. Many attempts were made with various success. The pertinent options and experiences are described below.

Wind power conversion

Current action: Wind mapping in Tonga, Vanuatu, generator design in Yap
The Pacific wind energy resource varies from virtually non-existent in most of the equatorial regions to moderately good in the higher latitude islands such as the northern islands of the Marshall Islands and those at higher latitudes of the south Pacific such as Niue, Cook Islands, Tonga and Fiji. Geographical conditions on islands however can lead to venturi effects where spots can reach higher, more attractive speed. Minor wind farms exist in Caledonia, Fiji, Nauru. Many islands are within the Taifun-belt, so the size is moderate and

equipment must allow for protection against heavy gusts. Energy planning usually starts with wind mapping. A number of mapping activities have been done and more will be done and yet generators have been build more with view to grid-access and service. Wind in the region is not considered a veritable generation component rather a nice-to-have fuel saver.
In favourable off-grid locations small wind generators have their merit. Due to the irregularity of the wind generation practically all wind generator schemes are hybrid installations with support from diesel or PV generators. A frequent experience is that little maintenance often renders these hybrids without the wind component.

Hydro power generation

Current action: Rehabilitation plans in Vanuatu, Yap, Fiji
Hydro can contribute significantly to fuel independence in the bigger islands. PNG's power utility (PNG Power) commissioned 162 MW of hydro at 11 locations. The Fiji Electricity Authority FEA commissioned an 80 MW hydro system at Monasavu, Samoa installed 12.2 MW capacity. There is extensive experience in the high islands of the region with hydroelectric systems, ranging from household level pico scale, through village micro/mini-hydro to large-scale utility-run systems.
The lower and atoll islands do not have sufficient watershed. Flow duration curves often are not encouraging, and efficiency low, so hydro often is merited as a good activity for village mobilization.

Biomass Conversion

Current action: Coconut oil in Vanuatu, landfill gas in Tonga
While biomass accounts for the major contribution in household energy, the potential for fuel saving is limited to combustion of agri-waste, use of landfill gas and coconut oil. Biogas production could be attractive in farms; electricity generation from biogas however has never left experimental stage in the PIC.
Biomass combustion has been used for power generation in Fiji, PNG and Samoa. In Fiji the Fiji Sugar Corporation has a long history of generating electricity from bagasse. In Tonga, the issue of using energy-rich grass (mycanthus) was strongly discussed, and postponed because of the land use and the expensive effort of harvesting and transporting the material. Similarly, burning agri waste could only be an option where labour cost is low enough to guarantee a steady flow of material.
This is also true for coconut oil. In Vanuatu, labour cost is low enough to justify collection of nuts, so UNELCO can mix a good portion of CNO to their generation fuel. For Tonga, labour cost may turn out too expensive to expect a similar proportion. In view of the dwindling export rates for copra and consequently large areas of coconut plantations all over the islands lying fallow, CNO could become a very good source of indigenous fuel, once fossil oil prices rise enough.

Solar Thermal Generation

Current action: none in power generation, SWH frequent
Concentrating Solar Power (CSP) plants are emerging in mostly dry, cloudless regions of the world, and have the potential to produce substantial base load at competitive cost. The PIC however are not dry and cloudless so concentration would seriously lack efficiency. At this time, the concept is not followed.

Dedicated PV

Current action: Grid connected PV in Niue, Yap, Tonga
PV grid feeding generators enjoy a very high solar radiation in the PIC, are not restricted in location like wind and hydro, and can be placed anywhere along the line. Consequently, the PIC utilities develop a keen interest in utility size PV generation which is very likely to become the most important alternative to fuel generation.

Due to strong support programs on grid connected PV in industrialized countries, the technical level of grid feeding PV has increased dramatically in recent years, while cost has come down to utility generation level (grid parity). With the existing grid as carrier, no storage is needed and maintenance and operation efforts are much within the capacity of the utility. Modern equipment allows for the ratio of PV to conventional generating capacity rising, but because of the intermittent solar profile existing generators will not become less or smaller, unless a useful size of storage is introduced. At this time, there is not much knowledge and experience on how to model an optimum ratio of PV/storage to gen-set which would guarantee maximum service reliability at best cost. As an example, the scenarios presented under the TERM ended up with prohibitively high cost for PV and storage.

Distributed PV

Current action: Grid connected PV in Palau, Cook

The benefit of distributed privately owned PV grid connections compared with utility-scale central generators is obvious: The utility would save investment, users would actively "buy in" in energy matters, land use is minimized, remote grids could be "healed" and the effect of clouds are lessened. All this would require utilities to be open for IPPs and a suitable legislation and management, which is only emerging by this time. Distributed grid feeding is allowed in Cook, it was strongly recommended under the TERM, and in Palau a pilot project with 100 roof-based PV AC-generators is in implementation phase.

Single Home Supply (SHS)

Current action: From 2011, Marshall Islands is installing 1500 SHS (300kWp) through the SPC, Tonga is upgrading 400 SHS with JICA, Palau installs some 100 DC systems of 500-1000 Wp, Kiribati doubles the existing SHS to 500 kW under the EDF-10.

For many years, solar home systems are the single most frequent means of providing electricity access to remote sites and outer islands and have been well supported by donors as it offers to reach out to many remote users at moderate cost. Tonga, Tuvalu and Kiribati each had their own style of PV based rural electrification incorporating over 1000 SHS altogether. PNG has several thousand SHS, mostly through private suppliers, and there may be several hundred in the Solomon Islands.

The rationale is not primarily on fuel saving but on improving living conditions by basic electricity for lighting, some entertainment and production. Eventually this improvement might also have a positive effect to reduce migration to the urban centres. A fuel saving effect can be seen in as much as SHS may reduce the use of kerosene for lighting and avoid the infringement of small fuel based generators. Critical issue has always been to provide sufficient service over large distances, and as a consequence the typical system size grew from 50 Wp to 150 Wp as was learned that larger systems are less prone to failure and hence offer more favourable life-cycle cost. In order to reduce operation and replacement cost, donors were willing to pay these enhancements which has led to the particular situation that in PIC projects donors usually shoulder all capital cost so service fees would be used entirely for the upkeep of operation.

There is a strong trend to further enlarge system size for the more enterprising users so as to accommodate more productive applications. Advances in efficiency of e.g. lights, refrigerators and PCs make it possible to include more attractive appliances in the energy bracket of the SHS. This will also lead to more AC systems and offers the potential that in more prosperous areas the SHS concept will become pre-electrification, eventually growing into a local grid-supply.

MiniGrid

Current action: Experimental

Lately, the concept of small decentralized mini-grid PV-supply is explored. Instead of an array of individual AC SHS, a clustered community might benefit from a "real" grid supply, when their load demand is varied and the consumption times complement each other. The need for battery replacement, grid management, load measuring and plant service on the other side render the concept more expensive. Positive examples of mini-grid application exist with tourist resorts. Existing small grids operated with gen-sets have a good potential to benefit from the addition of a PV array, as often because of fuel shortage these gen-sets could be operated only few hours.

Hybrid

Current action: Commercial in telecoms, Experimental Wind/PV/Diesel in Fiji, PNG
Hybrid generators, comprising of two or more primary sources, offer to complement the generation profiles so all components could be minimized (e.g. a small run-off-the-river hydro unit can be complemented by PV, so rainy and sunny weather provides a contribution) Proper design of such a concept however proved difficult and an optimized control complex, so most installations soon were down to one component which provides reduced output.
The very well proven PV/Diesel hybrids used in telecom repeater stations aim at reliability, but can be adopted for maximized fuel-saving. PV here assumes all load, the gen-set only cuts in as back-up during exceptionally bad weather. For standard electrification, the dual generator will be too expensive. It can however, improve and expand an existing small grid run by an inefficient gen-set.

Lantern

Current action: Vanuatu Access Power
A low profile, low cost basic electricity supply has been developed with the availability of low-consumption LEDs for portable, rechargeable lanterns. It is sometimes lauded for eradicating kerosene consumption but the virtue much rather is in introducing a convenient, mobile and cool electric light at very low cost. An additional benefit is the ability to charge mobile phones, which have made their way by now to the most remote locations. Whether this service is satisfactory to island families will be found out. Service, repair, disposal of the lanterns (which have very limited lifetime) will need a structure and will cost.
The AusAID financed Vanuatu Access Power program has commissioned two NGOs to develop suitable dissipation and service structures for the outer islands.

Potential EUEI work field: Develop energy planning model considering RET cogeneration (hybrid), Potential analysis of RE sources in PIC (wind, hydro, agri-fuel)

Efficiency

Developing new sources of energy and generation takes time, in planning, financing, solving access and land disputes etc. Development cost, even if shouldered by donors, can become significantly higher than power investment itself. Reducing the consumption however, was always found the more efficient and least time consuming approach. Modern energy saving appliances, better controls and most of all the pressure of expensive fuel are continuously creating opportunities for energy saving, where expensive energy is replaced by smart action.
In every PIC there have been efforts to improve energy efficiency through energy audits and subsequent investments. These suggested typical overall demand savings of 17% with a range of 8-28% One of the barriers to implementation was that although net benefits overall were significant, the value to the utilities was negative, so utilities have to look at new generation and conservation as sides of one medal.

Where energy use is inefficient, it does not make economic sense to invest in expensive new sources of energy. So new generation plans inevitably have to include efficiency of energy use.

Proposed measures on energy efficiency potential before were more on GHG abatement, which not always enjoyed full enthusiasm. Lately, in view of substantial price increase and shortage of supply for petroleum, efficiency measures become a necessity. Some are investive and short-track, which is clearly preferred by all receipients and donors, some require behaverioal changes and longer term attention.
Efficiency measures distinguish the supply side and the demand side.

Supply side efficiency

Saving on fuel starts with the fuel supply chain. Most PIC have supply contracts with the major oil-companies that give them relative short-term conditions. This subjects them to oil-price volatility, which hit particularly painfully late 2008 and caused all local energy companies to re-think their strategy. As part of the the World Bank's contribution to the Tonga Energy Road Map process, the Bank suggested financial hedging in order to negotiate better long-term prices. Another option is physical hedging, i.e. managing fuel storage. Those countries (Nauru) who opted to buy storage from the original suppliers and manage their own supplies have suffered evidently less from price-hikes.
Not only solar generators, also diesel generators have improved and sometimes the replacement with a smaller, more efficient gen-set will substantially save fuel. Replacing of the power engines is one of the elements of the Tonga TERM scenario.
In many PIC, distribution lines consume significant maintenance effort (in forest or sea) and high technical losses, due to their exposure also non-technical losses (e.g. theft) More efficient power distribution can save affair amount of fuel.

Demand side efficiency

ADB is doing a 5 country (Cook Islands, Samoa, Tonga, Vanuatu and Papua New Guinea) energy efficiency project which is by 2011 entering the second implementation phase with substantial capital input. Potential in the domestic, governmental and commercial demand have been assessed and an efficient deployment and monitoring structure will have to be implemented.
Before, audits have recommended clear action which was rarely taken. Energy saving appliances were made available and received well, but did not result in market change. It is obvious that replacing electric boilers with solar hot water systems saves electricity. For this reason the EU funded new SHW systems in Niue and elsewhere. The same is true for refrigerators, which in A++ class consume less than a third energy. Another win-win are energy saving lamps, so all these replacements can receive a well justified donor funding and will reduce fuel consumption.
The result may not be as much as is assumed by multiplying all power labels, but the more critical part is that one-off measures may not sustain when the next refrigerator is to be bought and only a cheap and wasteful model is around.
Energy saving involves the will for a market change and continuous capacity to manage this. Knowledge is also required when planning energy saving streetlights or the new aircondioned government building. Energy efficiency has several levels and mostly requires a longer term involvement.

Transport

When studying fuel saving potentials, it is very special for the PIC that in view of the vast distances and scattered settlement most fuel is consumed for transport.
Data in the early 1990s indicated that transport typically accounted for half of petroleum fuel use in PICs. For seven of the twelve countries covered, transport accounted for over

70% of petroleum fuel, and thus was an appropriate target for energy conservation efforts. Typically, fuel for road travel was 64% of total transport fuel use, sea 28% and air 7%. Within ground transport, fuel efficiency for cars, buses, and trucks depends upon a number of factors including road conditions, vehicle condition and others. Banning bad cars may be one remedy, introducing bio fuels another.

Barriers to Energy Efficiency in the Pacific

- Relevant cost-benefit information for energy efficiency measures is often unavailable to decision makers. Benefits are often under- or over-represented.
- There is very limited information about quantities and patterns of current energy use within government and commercial buildings within the PICs so planners often don't realize how much is being spent on energy services.
- Policies and programmes that only provide awareness may have some positive effect but do not address or overcome behavioural barriers and inertia.
- Organisations do not have easy access to the expertise or tools to identify or take advantage of available energy efficiency opportunities.
- Studies in several countries suggest that organisations often appear to require a higher return for energy efficiency investments than other investments.
- Governments tend to begin programmes (such as. DSM support) but are seldom consistent in terms of policies and resources over the long-term.
- There is little evidence of achievements within the region from energy efficient applications and government measures because of poor measuring, monitoring and reporting of past efforts.
- There are very few local companies or individuals with the skills to carry out good energy audits and recommend cost-effective investments to reduce energy use.

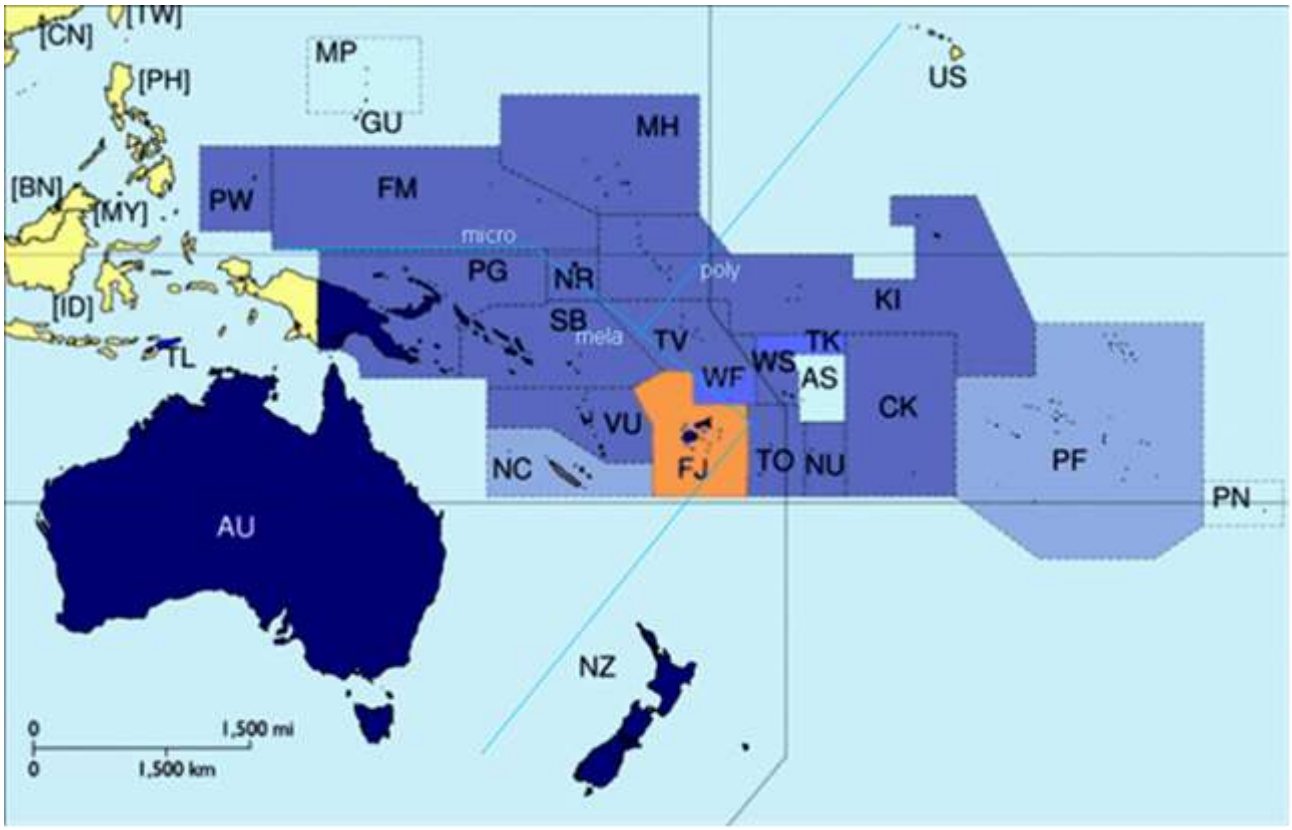
Potential EUEI work field: Develop catalog of EE interventions, their cost and impact. Show facts and examples. Describe options of policy, power sector, user and private sector.

ANNEX 1: Pacific Island Countries, Energy action

Location	Land kkm²	Population	Density	GDP US$/c	PPA member	staff	RE-Law	Rural-Policy	SPC	**Programs**
American Samoa	199	65,896	331	9,041	American Samoa Power Authority	/	/	/		
Cook Islands /NZ	237	15,708	66	10,875	Te Aponga Uira O Tumu-Te-Varovaro	3	/	/	x	**ADB**
Federated States of Micronesia	701	111,364	159	2,183	Pohnpei Utility Corporation, Yap State Public Service Corporation, Chuuk Public Utility Corporation, Kosrae Utility Authority,	/	/	/		**Yap m-grid, EDF**
Fiji Islands	18.273	847,793	46	3,499	Fiji Electricity Authority	25	X	X	x	
Kiribati	811	100,835	124	1,490	Public Utilities Board	6	/	X	x	**EDF**
Marshall Islands	181	54,439	301	2,851	Marshall's Energy Company, Kwajalein Atoll Joint Utility Resource	1	/	X		**EDF**
Nauru	21	9,976	475	2,071	Nauru Utilities Authority	/	/	/	x	**EDF**
Niue /NZ	259	1,479	6	9,618	Niue Power Corporation	/	/	/	x	**EDF**
Northern Mariana Islands (CNMI)	457	63,072	138	12,638	Commonwealth Utilities Corporation		/	X		
Nouvelle-Calédonie /F	18.576	254,525	14	37,993	Électricité et Eau de Caledonie , Enercal		X	X		
Palau	444	20,518	46	8,423	Palau Public Utilities Corporation	2	/	/		**Grid PV, EDF**
Papua New Guinea	462.840	6.744,955	15	897	PNG Power Limited		/	X	x	**WB,**
Polynésie française /F	3.521	268,767	76	21,071	Électricité de Tahiti		/	/		
Samoa	2.785	183,123	66	2,672	Electric Power Corporation	1	/	/	x	**ADB**
Solomon Islands	30.407	549,574	18	1,014	Solomon Islands Electricity Authority	3	/	X	x	**WB,**
Tokelau	12	1,165	97	1,035	Dpt. of Energy	2	/	X	x	**NZ**
Tonga	650	103,365	159	2,629	Tonga Power Limited	5	X	X	x	**EDF, ADB :TERM**
Tuvalu	26	11,149	429	1,831	Tuvalu Electricity Corporation	2	/	/	x	**UNEP**
Vanuatu	12.281	245,036	20	2,218	EnUnit, UNELCO Vanuatu Limited	4	/	/	x	**AccessPower/AU, WB, ADB**
Wallis et Futuna	142	13,256			Électricité et Eau deWallis et Futuna					
Region	**553.369**	**9.853,135**	**18**		**SPC**					

Micronesia: Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Republic of Kiribati, Republic of the Marshall Islands, Republic of Nauru, Republic of Palau, Territory of Guam and Territory of Wake Island
Melanesia: Solomon, Kingdom of Tonga, Wallis et Futuna Tuvalu, Nouvelle-Calédonie, Fiji, Vanuatu, Papua New Guinea
Polynesia: Cook, Niue, Samoa, French Polynesia, Tokelau

ANNEX 2: **Country Briefs: The Pacific Island Countries**



Cook Islands

15 islands totalling 240 km² of land. The political "free association" with New Zealand leads to a very high GDP (over 10ooo$US/pp) and a non-resident population (about half of the population living abroad, most NZ, see Niue) Climate is maritime tropical with modest seasonal changes.

Baselines

The Cook Islands are overwhelmingly dependent on imported refined petroleum fuels, which account for some 90% of gross energy supply, biomass providing the remaining 10%, mainly for cooking. Petroleum imports are expected to grow at 4.1% annually. Nearly 99% of all households have electricity, with an estimated 8% growth in peak demand.

Solar water heaters are well established and are found in nearly all the new housing and commercial buildings. Various solar photovoltaic installations for lighting, radio, water pumping, fish freezing and refrigeration on the outer islands but most have suffered from post-installation support. Likewise, various wind power units were installed and have suffered from both inappropriate technical designs and the lack of expertise for post installation support. The opportunity to use copra oil for fuel is much higher in the Northern Group than in Rarotonga.

Cook Islands has adopted an Energy Policy in which the goal is to increase the utilisation of renewable energy technologies in the supply.

FSM

The Federated States of Micronesia (FSM) is one of the youngest nations in the world, released into independence in 1986 after a tumultuous history under various colonial powers. The sovereign island nation is made up of four states from west to east: Yap, Chuuk, Pohnpei and Kosrae. FSM covers a land area of just 702 km² but an enormous Exclusive Economic Zone (EEZ) of some 2.9 million km², containing some of the world's most productive tuna fishing grounds.

Of its 607 mostly low-lying islands only 76 are inhabited by a total population of around 120,000. The remote location makes the cost of imported fossil fuels extremely high. ADB concluded in 2003 that FSM "shows little progress towards meeting the MDGs by 2015.

FSM has one of the best solar resources in the world, with an average 5.5 peak sunshine hours per day, and is therefore ideal for solar energy generation. In 2009, a decentralized mini-grid with a 100 kWp PV generator was installed under the EDF-9. In 2011, ADB commissioned commissioned a supply strategy for Yap which will include grid integrated wind generators and PV plants.

Baseline
The FSM is dependent on imported petroleum fuels for commercial energy. Approximately 86% of gross energy supply is from petroleum and 14% from biomass for cooking. The Nanpil hydro system previously provided several percent of electricity but is not now operating. Solar energy provides considerably less than 1% of the total. The 2000 national census reports that over 50% of all households use wood as their main fuel, ranging from 8% in Kosrae to 71% in Chuuk.
There are electric power systems on the principal islands of all four FSM states, and much smaller systems on some outer islands of Chuuk and Yap states. Pohnpei effective (derated) capacity is 15 MW, the power distribution system reaches nearly all inhabited areas of the main island. Yap State Public Service Corporation serves Yap Proper and has four operational generators effectively rated at 7.6 MW. The network reaches 98% of Yap Island's population and, in 2000, 57% of the state's households. The Chuuk Public Utilities Corporation serves the main island of Weno with 5 MW of effective capacity. In 2000 only 19% of the state's households were electrified through the utility. The Kosrae Utilities Authority has an effective capacity of 5.4 MW. 98% of Kosrae's households were
electrified through the grid in 2000.
Nationally, generation is roughly 90 GWh, nearly half in Pohnpei. In 2000, about 54% of all households in the FSM had electrification from some source ranging from 33% in Chuuk, to 59% in Yap, 68% in Pohnpei and 100% in Kosrae. Overall, 46% of FSM's households were electrified through a state utility, varying from a low of 19% in Chuuk to a high of 98% in Kosrae.

Fiji
The Republic of the Fiji Islands comprises of 320 islands on 18,333 km² of which about a third are inhabited. 90% cover the main islands Viti Levu (10.429 km²) and Vanua Levu (5.556 km²) like most of the islands volcanic.
Fiji's economy was highly dependent on sugar and other agricultural, primary products (timber, fish) and is now more in tourism as well as hosting many international organizations. GDP (low at 1.840$US/pp) is now 53% on service, 29% production and 18% agriculture. The 847 thousand population is 57% Melanesian and 37% of Indian origin. An independent republic since 1970, Fiji had a coup in 2006 and since 4/2009 is under martial law.
Baselines
Fiji has a larger fuel market than most neighbouring countries and prices are generally lower. Retained petroleum imports to Fiji including LPG apparently are about 350 million litres.
Hydro provides 53% of FEA's generation of 699 GWh and has been steadily declining as a percentage of the total over the past decade. Growth in generation has been uneven but averaged 6.4% from 1997 through 2003.

Kiribati
Kiribati is spread over an ocean area 4,200 km East to West and 2,000 km North to South totalling to 5,2 Mio. km², almost the size of Australia. The total land area of 811 km² includes one raised coral island (Banaba) and 32 atolls in three island groups (Gilbert, Line and Phoenix). Due to rising sea level Kiribati is expected to be submerged by 2060. While the rural population is declining, the urban area of Tarawa is growing at 5.2%, representing 43% of the total population of Kiribati and is at 2.558 pp/km² on of the world's densest.
Kiribati economy is poor, coming largely from overseas workers. Phosphate, once the leading source of income, is mostly mined out. Outer islands remain in traditional subsistence and barter economy.
Baselines
Kiribati is highly dependent on petroleum imports for electricity generation for urban areas, land transport, sea transport and air transport. In 2003 about 4.9 ML of petrol, 2 ML of kerosene and 9 ML of ADO was delivered to Kiribati customers. Biomass used for cooking and crop drying provides around 25% of the gross national energy production. Though solar power is a significant energy source for the outer islands, overall it produces less than 1% of the total energy.
With 2003 generation on Tarawa 15.9 GWh, around 4.4 ML of ADO is for electricity production (55% government, 30% domestic and 15% commercial)
Kiribati Solar Energy Company (KSEC)
The KSEC is about to receive 4,1 million euros of new funding from the European Union EDF10 for the expansion of the installed capacity from 250,000 Wp to around 500,000 Wp. As a result, the average installed capacity per island is going to be 28,000 Wp, half of which will be 100 Wp Solar Home Systems (or around 140 units per island) and the other half are expected to be slightly larger PV systems to be installed in schools, churches, community houses and businesses. As a result, the percentage of houses in the outer islands with access to electricity services will increase from 34% to 52%.

Nauru

Consisting of a single, isolated raised coral island, Nauru has a land area is 21 km² which makes it the world's third smallest state. From the rich phosphate accumulations, the population of 10,065 was one of the world's richest in late last century. Meanwhile it is almost mined out, GDP has sharply declined and Nauru is being used as a detention centre by Australia. The climate is equatorial marine in nature. There are no cyclones but droughts are a serious problem.

Baselines

Power generation and transportation are 100% dependent on fossil fuels with the phosphate mining as the major consumer. Fossil fuel consumption has declined with the decline in the mining industry. In 2003, fuel imports were estimated at 14 million litres.

By 2001, domestic use of electricity amounted to 18.4 GWh. With 1677 households enumerated in 2002, electricity use per household is one of the highest in the Pacific with an average use of 915 kWh/month.

Niue

Niue is a single raised coral island of 259 km2 located about the centre of a triangle consisting of Tonga, Samoa and the Cook Islands. The state, like Cook Islands, is in "free association" which means strong economic dependence with New Zealand. The current population of ethnic Niueans in New Zealand is about 20,000 while the population on Niue is around 1,700. There has been some effort to encourage repatriation though there continues to be a slow loss of families to New Zealand.

GDP in 2000 was about $14.2 million with 3 million from agriculture, $311,000 from tourism and $204,000 from manufacturing. The remainder came from donor funding with about $6 million from New Zealand. Remittances from family members overseas are also an important input to the economy.

Baselines

Electricity is generated and delivered by the Niue Power Corporation, a government corporation reporting to the Secretary for Government. Capacity is 2.4 MW using three 800 kW Caterpillar engines, is derated to 1.6 MW. A total of 55 kWp grid connected PV was provided by the EU in 2009 and more is planned.

PNG

Papua New Guinea (PNG) is by far the largest of the Pacific Island Countries (PICs), with over 600 islands, immense physical variety, and 7 million people of all PICs, PNG is the most affected by natural disasters, has the lowest GDP, and has the lowest life expectancy. It is also one of the most rural, with only 18% of its people living in urban centres. About 97% of land is under traditional clan ownership, a tenure called "customary land title" providing an opportunity for people to manage land for their long-term benefit. PNG has two distinct economies: i) a modern, cash economy dominated by mining, timber, gas and oil, and agricultural exports (coffee, cocoa, tea, oil palm and copra); and ii) the traditional subsistence economy and semi-subsistence farming, with most villages producing little or no surplus for trading.

Baselines

Since 1992, PNG has exported about 340 million barrels of light crude oil from recoverable reserves of roughly 550 million barrels. In 2003 exports were 15 million barrels earning about US$ 520 million. Production will steadily decline over the next decade as the resource is depleted. The natural gas resource is equivalent to about 2,700 million barrels of oil (perhaps far more), over ten times PNG's remaining recoverable oil reserves.

The WB estimates that in 2001, about 600 MW of installed electricity capacity (PNG Power and private) generated about 2,600 GWh. PNG Power supplies electricity to only 5.5% of households nationally, accounting for 82% of customers but 11% of sales. It is likely that under 10% of the population are electrified by any means: grid, self-generation, nearby industry, small hydro or solar.

The technical potential for renewable energy (RE) in PNG is enormous but much of the resource is in remote locations with limited demand and not readily exploitable.

Samoa

Samoa, northeast of Fiji, has 2,934 km² of land area, mostly in the islands of Savai'i (58% of land) and Upolu (38%). The climate is warm, humid and tropical with distinct wet and dry seasons. In 2001 22% of the 176,848 population resided in the Apia urban area, 30% in northwest Upolu, 24% elsewhere in Upolu, and most of the remaining 24% in Savai'i.

In 2003, an International Monetary Fund study concluded that the Samoan economy has been transformed into 'one of the best-managed in the Pacific islands' … with 'perhaps the most successful example of reform in the region.

Baselines

In 2001, 93% of Samoa's households were electrified and most of those unelectrified live relatively close to distribution lines. About half of Upolu's electricity is from hydro, other commercial energy needs met primarily from petroleum fuels. From 1989-1998, petroleum imports grew 7.3% annually. Cooking with biomass

probably accounts for half of gross energy demand but there are no reliable or recent data to confirm this. There has been limited use of solar photovoltaics (PV) on a very small scale.
EPC has eight small hydroelectric plants (950–2000 kW, mostly run-of-river) at five locations on Upolu totalling 11.5 MW of effective capacity and about 18 MW of diesel. Dry season hydro capacity is 4.2 MW. Overall, the derated dry season capacity of all systems is about 22 MW of which 81% is diesel and 19% hydro. The peak Upolu load in 2002 was 15.8 MW. The Savai'i peak was 2.85 MW with 4.5 MW of (derated) capacity. A 2003 Japan International Cooperation Agency (JICA) study estimates that generation will grow in the next few years at 6.5% per year.

Solomon Is

The Solomon Islands consist of nearly 1,000 islands – 350 populated – spread over 0.8 million km² of sea with 28.450 thousand km² of land and six main islands: Guadalcanal, Malaita, Makira, Santa Isabel, Choiseul and New Georgia.
The country is relatively rich in mineral, hydro and forest resources. 1998 conflicts destroyed the infrastructure, trust in the economy. Today Solomon is one of the poorest PIC (704 US$/c)
The economy consists of a mixed subsistence sector on which the majority of the population is dependent, and a small monetised sector dominated by large-scale commercial enterprises. Between 1996 and 2002, gross domestic product declined in real terms by 24%, over 35% per capita. Performance was considerably worse for the monetised sector.
Baselines
In Solomon, biomass still accounts for about 61% of gross national energy production, petroleum products for 38%, and hydropower and solar about 1%. Dependency on imported petroleum for its commercial energy needs is strong and constitutes a fairly high percentage of total imports by value, higher than the early 1980s when high oil prices were of concern to the government.
Estimated data on sectoral energy demand have transport accounting for 56%, electricity 28%, commerce and industry 15% and direct household use (mostly cooking and lighting) 1%. About 89% of all households rely mainly on biomass for cooking. The 1999 census indicated that 16% of all households, but only 9% of those outside Honiara, had access to electricity. 69% received power from SIEA, 28% generated their own power, and 23% had other sources.

Tonga

The Kingdom of Tonga comprises of 176 islands (36 inhabited) with a total area of 748 km² and an Exclusive Economic Zone (EEZ) of about 700,000 km². The capital, Nuku'alofa, is located on the largest Island, Tongatapu representing with 72,045 inhabitants 71% of the total Tongan population. There is continuous migration from the outer islands; approximately 108,000 Tongans live overseas (around 40% in New Zealand, 40% USA, 20% Australia). These overseas Tongans send back "remittances" which equate to 31% of Tongan's annual GDP. Tonga has a small open economy with squash, coconuts and vanilla the main export crops that make up 2/3 of total exports.
The climate is tropical with warm-humid weather during December to May and cooler weather for the remaining months. Winds are seasonal with tropical cyclones most likely between November and March.
Baselines
Overall energy requirement is highly dependent on imported fuels, accounting for 75% of Tonga's energy supply, 25% coming from biomass (i.e. fuel wood and wood waste, coconut and palm oil residues) and less than 1% from off-grid solar PV. There have been no other renewable energy resource developments. All grid-supplied electricity (98% of electricity used in Tonga) is generated from diesel.
Tonga's total fuel imports account for about 25% of all imports and about 10% of GDP, increasing prices are expected to increase that percentage in the future.
Cognizant of this threatening development, the Government of Tonga embarked on the ambitious goal to reduce petrol consumption by 50% until 2012 and called the donor community for assistance.
In a so far unique process, dubbed the Tonga Energy Road Map (TERM) the donor community coordinated by the WB studied all options and set out a three-tiered action plan. This process in terms of country participation and commitment, donor participation and harmonization, and international recognition was uniquely constructive. The WB will therefore offer to replicate such instrument to interested countries in an "energizing the pacific" instrument.

Tokelau

Tokelau is a territory of New Zealand that consists of three tropical coral atolls (Atafu, Fakaofo and Nukunonu) with a combined land area of 10,8 km² They lie about 500 km north of Samoa, where the administrative presence is maintained and the Office for the Council of the Ongoing Government resides. Ships generally make the trip from Apia to the three atolls once a fortnight There are no airstrips, ports or harbours. Tokelau lies in the Pacific typhoon belt.

Tokelau has the smallest economy of any country in the world. The government is almost entirely dependent on subsidies from New Zealand. Currency is the NZ$,Tokelauans carry NZ passport. The population of 1,433 (as of July 2008). declined by 20% compared with the 2001 census.
A Department of Energy (DoE) exists within the Ministry of PublicWorks. Electricity supply is managed by individual taupulega with technical support and standards provided by the department. Petroleum imports are managed by the taupulega through the island stores on each island.
To date, all renewable energy has been developed by TeleTok (the telecommunications company) on each atoll and the University of the South Pacific (USP) at its Atafu facility. Future development of renewable energy will be coordinated by the DoE.There is a draft National Energy policy and associated strategy document (NEPSAP) that includes strong energy efficiency measures and the long term goal of 100% renewable energy for the island group. As a New Zealand dependency, Tokelau has limited access to non-New Zealand capital funding for renewables.
Late 2010, NZaid launched the Tokelau Renewable Energy Project (TREP) which aims to supply each atoll with a 120 kWp PV generation system.

Tuvalu

The parliamentarian Monarchy of Tuvalu is the world's fourth smallest state with a total land area of 26 km² spread over eight islands. The largest, Vaitupu, has an area of about 5.6 km² while the smallest, Niulakita, has only 0.42 km² of land. The EEZ is 900,000 km² in area. Growth has been slow and 1/3 of the 12ooo population already lives in NZ. Because of the rising sea level, also the atolls of Tuvalu are expected to be submerged in the not too distant future and resettlement plans are discussed.
Tuvalu ranks third among the Pacific developing member countries of the ADB in the Human Poverty Index. The primary problem for Tuvalu's economic development is its small size and its isolation. The Tuvalu Trust Fund provides over 10% of the Government budget.
Baselines
The Electricity supply includes 2.4 MW of capacity on Funafuti, 260 kW of capacity on Vaitupu and from 160-180 kW on the other islands (excluding Niulakita where solar power is used). Technical losses are estimated to be 9%-10% which is somewhat high but non-technical losses are low at 4% to 5%.
Only solar photovoltaics and solar water heaters have proven successful in Tuvalu. Biomass is limited since most of the land is covered by coconut trees that have more economic value as coconut producers than as fuel. Biomass for energy is hampered by the poor soils

Vanuatu

The republic of Vanuatu, once a joint Anglo-French 'condominium', became independent in 1980. It is mostly mountainous, of volcanic origin with narrow coastal plains. About 41% of all land is cultivable with 14% utilised. Total land area is 12,200 km² with 66 islands populated of 83 total. Between the 1989 and 2009 censuses, population grew at 2.6% per year reaching 243.304 of whom about 27% live in the urban centres of Port Vila and Luganville, and 80% on seven islands.
Vanuatu has a classic dual economy: a small, high-cost modern sector and a subsistence/small-scale agriculture and fishing with most ni-Vanuatu largely outside the cash economy. Nearly 80% of the population engage in subsistence agriculture contributing only 10% to GDP. Recently, Vanuatu became known for providing an attractive tax haven for international investors.
Baselines
Vanuatu is overwhelmingly dependent on imported petroleum for commercial energy. Biomass probably provides over 50% of gross national energy production, and solar and hydro together less than 1%. By 2002, petroleum imports were equivalent to between 56-86% of domestic exports.
Overall, 61% of urban households are electrified, 36% use kerosene for lighting and 53% cook mainly with LPG. Only about 7% of rural households are electrified, 86% light with kerosene, and over 95% cook with wood. About 106 kilo tonnes of fuel wood are consumed per annum for cooking.
In 2010, Vanuatu with AU assistance embarked on a national power access program which should attempt to provide RE power on all islands. Since salaries are low, the only provider UNELCO can have coconuts collected for oil production and fuels 30% of the generation with this by-mix. A regulator's office is now created to invite competitive bidders for the electricity franchises.

ANNEX 3: **Matrix of Energy Sector Grant Support to PICs** (Indicative Only)
(Revised: 18 February 2010)

These tables are based on consultations with donors and development partners and reports available on-line. It incorporates information from the 19 January 2010 matrix prepared for the Energy Development Partners Working Group and subsequent information provided by ADB, AusAID, the EC, EIB, NZAid, PPA and UNDP. This excludes the French Pacific, for which information was unavailable. Smaller programmes (such as NZ's Pacific Energy Data Initiative under US $0.2m are not included. A number of PICs and Pacific regional organisations have submitted concept proposals for funding from phase 2 of the ACP/EU Energy Facility but it will be several months before there is a call for full proposals for those to be short listed.

Table 1: Global Environment Facility Energy Support to Pacific Island Countries

Project / Programme	PICs included	Execution	US$m *	Comments
Promoting Energy Efficiency in the Pacific	Cook Islands, Samoa, Tonga, Vanuatu	ADB	6.0	Excludes $1m ADB grant. Being developed during 2010. (See *Promoting Energy Efficiency in the Pacific* in Table 2)
Action for Development of Marshall Islands Renewable Energy (ADMIRE)s	Marshall Islands	UNDP	1.1	March 2009 – March 2014. Status review planned for March 2010. No substantive activities begun.
Sustainable Economic Development through Renewable Energy Applications (SEDREA)	Palau	UNDP	1.1	Preparatory work for renewable energy fund at national development bank; reports include RE technologies appropriate for Palau & electricity tariff review.
Energizing the Pacific Regional Project	PNG, Solomon Islands and Vanuatu	World Bank	4.0	From April 2011 – April 2018; possibly to include Kiribati
Fiji Renewable Energy Power Project (FREPP)	Fiji	UNDP	1.1	Medium sized project to be developed during 2010; Co-financing estimated as $1.5m
Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP)	Eleven PICs (excludes Palau & RMI)	UNDP/ SPREP	5.2	Effectively 2008-2011. Over $3.5m remains for 2010-2011.
Accelerating the Use of Renewable Energy Technologies	Nauru, Niue and Tuvalu	UNEP/ IUCN	1.5	Being implemented by IUCN Oceania, with project development underway in February 2010
Sustainable Energy Financing Project (SEFP)	Marshall Islands, Vanuatu	IFC	9.5	Missions in 2009 but no (?) activities
	Fiji, PNG, Solomon Islands	World Bank		WB components underway
Total GEF-			29.5	

* Budget indicated is for GEF input only

Table 2: Other Energy Sector Grant Assistance in Energy to Pacific Island Territories and Countries

Project / Programme	PICs included	Execution	US$m *	Comments
Grid-connected Photovoltaics in Pacific Island Countries (JICA)	All 14 Forum Island Countries	Forum Sec./ Govt of Japan	≈75	From 2011? About 6.8 billion yen for grid-connected and stand alone PV for power and potable water (osmosis) systems
Promoting Energy Efficiency in the Pacific	Cook Islands, PNG, Samoa, Tonga, Vanuatu	ADB	1.7	Support for energy efficiency pilot projects (audits, CFLs, appliance labelling, retrofits, etc.)
Promoting Renewable Energy in the Pacific	PNG, Solomon Isl, Vanuatu	ADB	3.0	Hydro (PNG), biofuel (SI) & PV (Vanuatu)
Strengthening Capacity of Pacific Developing Member Countries to Respond to Climate Change	Pacific Developing Member Countries	ADB	1.5	$1m for up scaling RE; $0.5m for promoting Clean Development Mechanism. Awaits approval from Japanese Asia Clean Energy Fund
ADB energy grant pipeline for Pacific Member Developing Countries in 2010 (RMI support from Japanese Fund for Poverty Reduction)	Marshall Islands	ADB	3.0	Improved Energy Supply to Poor Households
	Papua New Guinea		3.0	Improved Power Supply to Poor Communities
	Samoa		1.0	Support for Power Sector Regulator
	Tonga		3.0	Support to Energy Sector Roadmap ($1m in 2010 + $2m for 2011)
Other ADB energy sector grants (linked to loan finance)	Samoa	ADB	27.4	Power sector expansion. $15.4 m ADF, $12m AusAID
	Samoa		1.9	Implementing National Energy Policy
	Samoa		1.2	Afulilo hydro environmental impact
	PNG		0.5	National power sector development plan
	PNG		1.2	Off-grid provincial centre hydropower
Italy/Austria Pacific Energy Programme	Palau, RMI, Samoa, Tonga Tuvalu & Vanuatu	IUCN Oceania	10.0	Of total, €4m (over US$5m) is managed by IUCN for 2008-2011. From 2010 IUCN initiatives include increased ecosystem focus.
	Cook Islands, Kiribati FSM, Fiji, Nauru, PNG	The PIC governments		

* Values converted to US$ at early Feb 2010 exchange rates from ExchangeRate.com (US$1.00 = A$ 1.14 = €0.73 = yen 89)

Table 2: Other Energy Sector Grant Assistance in Energy to Pacific Island Territories and Countries (continued)

Project / Programme	PICs included	Execution	US$m *	Comments
Energy Efficiency Assessment Program for the Northern Pacific Utilities	FSM, Marshall Islands, Palau, Guam, Northern Marianas	PPA	≈0.4	2010 – 201. Power sector supply-side energy efficiency assessment funded by US Department of the Interior, Office of Insular Affairs (USDOI OIA)
Energy Efficiency Assessment Program for the Southern Utilities (not finalised)	Cook Islands, Tonga, Kiribati, Niue, Solomon Islands, PNG, Samoa, Fiji, Tuvalu	PPA	≈0.3	2010 – 2011 Power sector supply-side energy efficiency assessment funded by EC & NZAid
Capacity Support for Sustainable Management of Energy Resources in the Pacific Region	ACP Pacific Island states	PPA	≈1.6	Mid 2008-2011; effectively 2010-2011. EC EDF9 grant of €1.2m for assistance in integration of RE to grid, identification of supply side losses and training
Northern Utilities Support	Northern Pacific PIC utilities	PPA	0.4	2009-201 supported by USDOI OIA. Engineering services for northern utilities
Capacity Support for Solar PV Stand Alone & Grid Connected Systems and Demand-side Management;	PICs	PPA	0.6	2009-2010. Workshops on PV systems and energy efficiency (demand-side) for PIC utilities supported by the e8 utility network.
Feasibility study for Tina River Hydropower	Solomon Islands	EIB	≈0.7	€0.5m; 2010
International Partnership for Energy Development in Island Nations (EDIN)	PICs & island countries globally?	USA, NZ & Iceland ?	**?**	Established late 2008 for pilot projects. Inactive ?
Strengthening of the Energy Sector in Pacific ACP countries (EC EDF-10)	All Pacific ACP states	SPC	≈12	2010-2014. €9 m from EC regional programme. Identification fiche accepted; detailed proposal to be submitted by mid 2010.
North Pacific/ACP Renewable Energy and Energy Efficiency Programme (North REP)	FSM, Palau & Marshall Islands (RMI)	SPC	≈20	€14.4 m 2010-2014 from EDF10 national allocation as follows: FSM €7.47m, RMI € 4.5m & Palau €.2.47m.
Other European Commission EDF-10 national energy assistance.	Nauru	Nauru govt	≈3.2	€2.3m for supply-side EE and also RE
	Niue	Niue govt	≈3.5	€2.55m for supply-side EE and also RE
	Kiribati	Kiribati govt	≈5.6	€4.1m for outer island solar photovoltaic energy
	Tonga	Tonga govt	≈6.9	€5.0 m for Tonga Energy Programme

Table 2: Other Energy Sector Grant Assistance in Energy to Pacific Island Territories and Countries (continued)

Project / Programme	PICs included	Execution	US$m	Comments
Clean and Affordable Energy for the Pacific Islands	All Forum Island Countries	AusAID (mainly thru PRIF)	≈22	A$25 m from AusAID. FY 2009/10 - 2012/13 mainly through PIAC/PRIF to expand access to reliable and affordable energy services, while reducing reliance on imported fuel
Renewable Energy & Energy Efficiency Partnership (REEEP) Pacific programme	Regional	AusAID/ REEEP	≈1.3	A$1.5m from AusAID. Activities include green tourism study (Fiji)), energy audits & training through SOPAC (RMI, Palau), microfinance (Fiji, Samoa), support for 'Roadmap' (Tonga), kerosene replacement (SI, Vanuatu, PNG)
Miscellaneous AusAID	All Pacific Island Countries	Support to dev partners	See comments	Over US$15m (over A$17m) but not included in table to avoid double-counting. See note below this table.
American Recovery & Reinvestment Act (ARRA) funds for energy improvements. **	Guam	Guam	≈20	2010-2013? Improved efficiency, reduced reliance on imported energy, improved reliability of electricity & fuel supply, reduced environmental impacts energy
	American Samoa	A Samoa	18.5	
	Northern Marianas	N Marianas	10 +	

Note on AusAID. AusAID provides support for other energy activities, including supporting energy projects led by other development partners. These include in Australian dollars):

- Samoa Power Sector Expansion program (ADB-led): AusAID has provided grant funding of $8 million with future support envisaged. (This is in addition to ADB grant financing and loans, and grant financing from Finland and Japan. ADB will know the total project values.)
- Contribution to WB SEFP in Solomon Islands – approximately $1m over 3years (2007/08- 2009/10).
- Vanuatu Power Access Program – through PRIF, approx $7 million for an initial 3 year period from 2009/10.
- Nauru Infrastructure reform (in partnership with ADB): Support for utility management (power and water) over an initial 7 year period (from 2004/05). Funding totals unavailable at the present time but can provide additional information if necessary.
- Energizing the Pacific: $1.05 million provided in 2008/09 to support its development.
- Through Energizing the Pacific/World Bank, providing support for the Tonga Energy Road Map (actual figures not yet available).
- Solomon Islands Hydropower: World Bank's Tina River Hydro program (though PRIF): Not yet commenced – support for preparation currently being provided through the PRIF.

** The ARRA data are approximate as reporting sites are confusing. There are many other US programmes from which they (and FSM, RMI & Palau) can receive energy funding

ANNEX 4: **Literature**

For this report, the following documentation was studied and compiled

PIC Baseline Information

02 10 Pacific Islands Energy Policy and Plan (PIEPP).pdf
06 4 ADB-REEEP.pdf (Pacific Subregional Renewable Energy and Energy Efficiency Programme
06 US-IAEA update.doc (Insular Areas Energy Assessment Report)
08 EU aid policy.doc (EU aid policy towards the Pacific ACPs)
09 4 NEPSAP Tokelau.pdf (National Energy Policy and Strategic Action Plan)
09 10 ADB Energy-Outlook.pdf (Energy Outlook for Asia and the Pacifc 2009)
09 ADB-Pacific-Approach-2010-2014.pdf

PIREP National Reports 2004

The Pacific Islands Renewable Energy Program in 2004 facilitated a Pacific Regional Energy Assessment with country profiles, useful and mostly still valid:

Rep.1: Regional Overview Report
Rep.2: Cooks Islands
Rep.3: Federated States of Micronesia
Rep.4: FIJI
Rep.5: Kiribati
Rep.6: Marshall Islands
Rep.7: Nauru
Rep.8: Niue
Rep.9: Palau
Rep.10: Papua New Guinea
Rep.11: Samoa
Rep.12: Solomon Islands
Rep.13: Tokelau
Rep.14: Tonga
Rep.15: Tuvalu
Rep.16: Vanuatu
0610 PIREP Evaluation Report
04 Financing Mechanisms for RE Development
05 DemoProjects to showcase the business angle
PIREP Workbook1-Cook to Palau (7countries)

2010 Documents on RES-PIC

106 SEC10-SecurePacific.pdf (SPC: Framework for Action on Energy Security in the Pacific)
108 FAESP Draft.pdf (SPC: Framework for Action on Energy Security in the Pacific)
107 AP-Dialogue-CEGR.pdf (Asia&Pacific Dialogue on Clean Energy Governance and Regulation
106 ADB background-paper.pdf (on Asia-Pacific Dialogue)
107 ADB-PEM.pdf (Pacific Economic Monitor)
106 WB-Energizing the Pacific.docx (promote strategic development of the electricity sectors in PICs)
106 Whole-of-Sector Approach.pptx (to Energy Development in the Pacific Islands: WB)
107 Presentation Johnston Reserve Bank.ppt (Practical Steps to Reduce Fiji's Petroleum Fuel Imports ?
108 SPREP Strategic Plan 2011-2015 - DRAFT.pdf (Environment And Development Context)

Tonga Energy Road Map (TERM) documentation 2010

9 Tonga Renewable Energy-Act 2009.pdf
910 TONGA Road Map EE Appendix.doc (DSMOpportunities for Improved Efficiency)
10 1 MRX final report.pdf (Tonga MR Tanker Port Feasibility Study)
10 1 Martin Swales Report on Tonga Electric Supply System.docx
10 3 GHD Final Technical Report.doc (On-Grid Report: Renewable Energy Supply to the Four Island Grids in Tonga)
10 4 MAFFF Coconut_Biogas.doc (Coconut, a potential Biofuel. Biogas from piggery livestock)
10 4 Tonga Off-Grid Initiative- Final.pdf
10 4 Tonga Off-Grid Electrification Initiative.ppt
10 4 TERM-Minutes-7-9-April-2010.pdf
10 4 Draft TERM for circulation.doc
10 4 Mission Report Tonga.pdf (HW Böhnke report on final TERM session)
10 6 TERM-Final-Report.pdf