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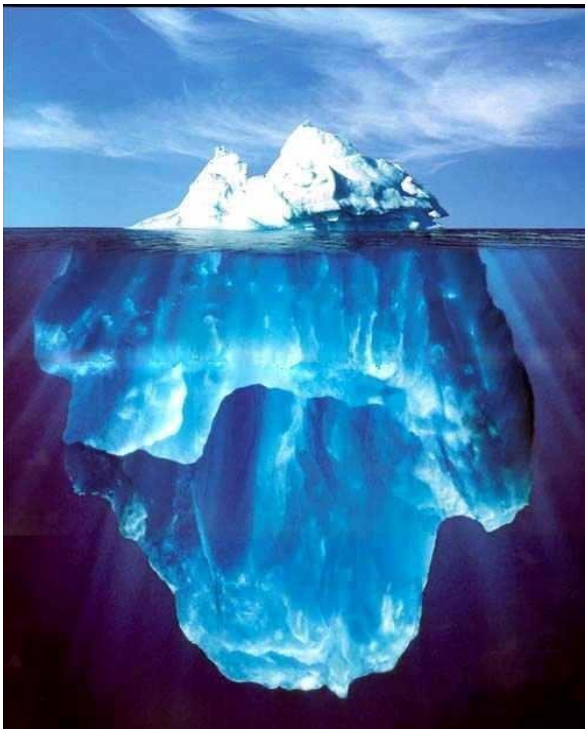
FINAL Report

Coping with Climate Change in the Pacific Island Region



ENERGY Component

Albrecht Kaupp, MED-EMIP, Cairo, Egypt, May 2010

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Final Report Energy Component of CCCPIR

1. Executive Summary

CRS code: 23010 Energy policy and administrative management
23030 Power sector and renewable energy

DAC and BMZ code

PG (Participatory development/Good governance): 2
UR (Environmental protection and resource conservation):2
GG (Gender equality): 1
TD (Trade development): 0
DES (Combating desertification): 0
BIO (Biodiversity): 1
KR (Crisis): 1
AO (Poverty orientation): MSA
PBA (Programme-based approach) relevance: 0

The energy component design of CCCPIR has benefited from various excellent and frank assessments of what has been going right as well as wrong in the energy sector in this region, what should be done in terms of future guiding principles, and the need for changing framework conditions to overcome barriers[1].

The energy component will focus on three key areas towards a sustainable, socially fair, inclusive and climate change relevant indigenous based future energy management for sustainable economic development. The first key area outputs will appraise the annual incremental and aggregated incremental costs to achieve very ambitious or even unrealistic benchmarks of national energy policy plans for the year 2010 - 2020 and beyond. Who is paying and who can afford to pay? Jointly working on the answers with as many stakeholders as possible should increase awareness that the present fragmented donor driven and project oriented piecemeal approach becomes too unsustainable and costly for the PICs and donors.

The second key area output is a continuation and value addition to the first one. Practical and cost effective financing mechanisms for an energy programme following the guiding principles of national policies will be identified. The value addition lies in shifting unsustainable risky investment subsidies for urban and rural energy service expansion or changing power mixes into cross subsidies, or subsidies for generation and efficient consumption of electricity and oil.

[1] Ref 12 and 32 deserve special mention and are of particular clarity and frankness about the subject.

The third key area is the built up of a demand driven pipeline of measures that pass proper cost effectiveness test and looking for financing. Climate change relevance, following established and agreed guiding principles and having a sincere ownership are evenly important indicators. All interventions focus on the macro and meso level. Services are delivered by international and national long term and short term consultants. PICs covered by the energy component are all those with an established long term energy policy plan and are members of PSC. The region covered extends 6,500 km from West (Palau) to the East (Samoa) and 3,500 km from the North (Marshall Islands) to the South (Tonga). The overall duration of this energy component will be 3 years (2011- 2013) with an initial funding of € 1 Million.

2. Context / Problem Analysis

The twelve PICs under consideration from West to East are: Palau, Papua New Guinea, Solomon Islands, Nauru, Fed. States of Micronesia, Marshall Islands, Vanuatu, Kiribati, Tuvalu, Fiji, Tonga and Samoa. Table -1 shows the 10 smallest islands either by land area, population, or electricity consumption. They are part of the 26 members of the Secretariat of the Pacific Community (SPC) which includes Australia and New Zealand.

Table-1: Ten smallest * PICs by land area, population and electricity consumption

Island State	Energy GWh/y	Island State	Population	Island State	Land sqkm
Tuvalu	4	Niue	1,549	Nauru	21
Kiribati	14	Tuvalu	9,729	Tuvalua	26
Nauru	31	Nauru	10,163	Wallis et Futuna	142
Vanuatu	42	Wallis et Futuna	15,472	Marshall Islands	181
Tonga	43	Cook Islands	15,537	Cook Islands	237
Solomon Islands	71	Palau	20,279	Niue	259
Marshall Islands	108	Marshall Islands	53,236	Palau	444
Samoa	109	Northern Marina	62,969	Northern Marina Island	457
Fed.State of Micro.	113	Kiribati	97,231	Tonga	650
Palau	130	Tonga	102,724	Fed.States of Micronesia	701

* Excludes the SPC small island members of Pitcairn, Tokelau, American Samoa and Guam. Data is based on 2005 – 2009 statistics from various resources

One particular failure in the PICs is climate change policies with no links to, or consistency to national energy policies even where both have Cabinet endorsement. An environment agency may plan and implement an aid-supported climate change project that provides energy but refuses to coordinate with the local utility or energy office.

The PICs energy supply for electricity generation, and without saying for transport, is mostly based on fossil fuel oil imports which had been highly vulnerable to price shocks and also occasional supply interruptions in this hurricane prone region. Electricity production accounts for roughly 40% of petroleum use in the region. In the three Melanesian countries overall electrification rates remain very low, typically about 20%. PICs power tariffs, as shown in Annex Figure – 1, are relatively high compared to the EU-27 system average rates, and considered very high compared to the MENA region countries. These high tariffs obviously ask for an introduction of renewable energy based electricity generation that is already cost effective or close to grid parity.

The United Nations Human Development Index (HDI) is closely correlated to the per capita electricity consumption. The latter indicator is an inclusive growth and pro poor indicator reflecting the participation of the poor at economic development. Annual per capita electricity consumption[2] is between 160 and 1000 kWh except for higher figures for Palau, Marshall Islands and Nauru. Obviously there is a need to increase per capita electricity consumption to improve on the HDI, albeit in a very efficient and climate proof way, for PICs that are below 1000 kWh.

PICs have developed national energy policy plans clearly identifying the present deficiencies and challenges to overcome identified barriers. Some PIC also prepared medium term action plans. None of them offer a confirmed, or realistic budget to achieve the benchmarks or targets. So far some progress has been achieved with respect to improved enabling framework conditions “to let this all happen” as envisioned or planned by the energy policies. There is an expectation by PICs that even financially attractive investments of the national energy policies are to be grant supported. This may be the very reason why good energy policies and donor intentions are often poorly implemented and become non-sustainable.

There is no problem of relating national energy policy measures to the IPCC 2007 definition of adaptation. The latter is not only slightly esoteric, but also allows too many degrees of freedom in its interpretation.

[2] These figures need to be compared to about 7000 kWh for the EU, 15,000 kWh for the USA and Kuwait. We consider per annual per capita consumption of below 600 kWh as a serious barrier for inclusive growth and economic development and a signal to support increase of electricity consumption albeit in an efficient way keeping energy modesty in mind.

> "*Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities".*

Only Morse coded Shakespeare may beat this adaptation definition in terms of obscurity. In plain language the definition implicitly accepts the fact that every single ton of CO_2 mitigation assists in better controlling climate change. Any reduction of fossil fuel consumption would release more financial resources for adaptation measures. However there is a need to improve due diligence concerning selection of low cost/high impact measures in energy related mitigation, taking into consideration finite financial resources for climate change response measures.

Therefore, the best strategy to improve on coping with climate change, having limited financial resources would be to invest in no regret mitigation and adaptation measures. The untapped potential is especially large in the energy and power sector. Financing energy projects to prove or disprove anecdotal evidence or speculative hearsay concerning climate change in the PICs should be avoided, considering the large number of untapped no regret mitigation projects with a quantifiable and measurable benefit to the PIC communities.

One major issue in this context is the lack of enabling frameworks for a sustainable, inclusive growth and climate proof future energy supply mix while acknowledging the need to adhere to the regional energy policy of the pacific islands as well as national energy policies.

Improved framework conditions encompass to pay more attention to shortcomings in the core subject areas which are already mentioned in the national and regional energy policy papers : (i) poorly targeted energy cost subsidies , (ii) no tariff regulators, (iii) power utilities reluctant to provide access to the grid for IPP, (iv) no feed-in-tariffs, (v) few efforts to shift "bad" subsidies into "good" subsidies, (vi) reluctance to comply with the guiding principles of national and regional energy policies, (vii) too few private sector investors, (viii) lack of compliance with environmental impact assessment rules as well as climate change strategies relevant for the energy sector, (ix) no institutionalized regional watchdog following up on effectiveness and compliance with many energy policies.

Increased dependency on fossil fuels for electricity generation and transport is not inevitable and may, if not solved, become a more serious problem with respect to affordability and availability for all sectors of the society in the future.

3. Past and current TA of donors addressing the issue (by donors)

An incomplete project list of present and planned donor assistance is given in ANNEX Table-2. Total cost of about 30 listed projects is in excess of US$ 275 Million. Projects are addressing sustainable energy management, particular energy supply/demand issues and softening any oil price shocks. Most TA is focused on two thematic areas: energy policy advisory in the three common subject areas *energy efficiency*[3], *demand side management*[4] and *renewable energy*[5]. In addition donors engage heavily in grant financed renewable energy based electrification outside of urban areas.

4. Proposed technical assistance

4.1 Expected energy component objective **(**outcome**)**

Indicator Overall Goal Energy

At least 5 demand driven projects consistent with national and regional energy policies including climate change policies aiming at improving sustainability, reliability and/or cost effectiveness reach financial closure.

Outcome Energy:

PICTs have economically and financially assessed national energy strategies and plans as well as projects/initiatives which aim at shifting present investment subsidies into generation subsidies, consistent with climate change and regional energy policy guiding principles.

Indicators:

1. At least 5 national economic and financial reports jointly prepared by stakeholders have been endorsed and applied as described;

2. Concept and strategy paper jointly prepared by all stakeholders are accepted to be tested in principle;

3. At least 5 financial grade papers prepared and submitted to IFI through concerned partner authorities;

[3] To introduce appliances or electricity/energy consuming machinery that is highly efficient in using electricity or energy for the intended output.
[4] To educate or to direct electricity consumers to use less electricity without affecting quality of life. Energy modesty is a better word for it since it addresses life style changes.
[5] Renewable energy is not necessarily dependable or sustainable energy as experienced with hydro power plants which seem to become more unreliable electricity providers with climate change.

4. At least 15 demand driven projects aiming at improving sustainability, reliability and/or cost effectiveness are identified and processed and at least 5 projects reach financial closure.

4.2 Target Groups

Major target groups are households in rural areas. Except for Nauru (with a 100% urbanized population) about 87% to 30% of the PIC population lives in rural areas. None or unreliable energy services are the rule and not the exception. On the other hand, national energy policies are aiming at a dramatic reduction of the dependency on fossil fuels for power generation. These benchmarks can only be achieved through grid based hydro, solar, bio-fuel and wind power capacity addition combined with isolated grid rural electrification by hybrid[6] systems. Electricity consumers in urban areas will therefore also be included.

4.3 Regional coverage

The twelve Pacific island countries under consideration from West to East are: Palau, Papua New Guinea, Solomon Islands, Nauru, and Federal States of Micronesia, Marshall Islands, Vanuatu, Kiribati, Tuvalu, Fiji, Tonga, and Samoa. This regional project area covers a distance as the crow flies of 6,500 km from West (*Palau)* to East (*Samoa)* and 3,500 km from North (*Marshall Islands*) to the South (*Tonga*). The five island states of Kiribati, Nauru, Tuvalu, Tonga and Vanuatu are with respect to proposed measures under key action area 2, due to their combined low annual electricity consumption of about 134 GWh, most suitable partners to show a real impact with limited financial contributions. However all other measures are equally benefiting all twelve island states.

4.4 Partner Institutions and other implementing agents/counterparts

The proposed regional strategy deals with a subject that is capital intensive as well as depended on improved energy framework conditions. Regionally oriented platforms are:

a) The energy working group of the CROP
b) The newly founded energy division of SPC and SOPAC
c) The Pacific Power Association (PPA) as 11th CROP member and implementation partner for power sector related projects of SPC
d) Pacific energy donor/IFI working group[7]

[6] Diesel generator set combined with wind or PV power generation, or coconut oil and diesel mix generation.
[7] The WB lead group has clearly focused ToR and seeks to coordinate donor energy related technical and financial assistance.

The above four regional organizations represent both donor and regional implementation and coordination agencies, including the financial sector. National counterparts are the national Ministries or Departments of Energy as well as environments. Other stakeholders are the vertically integrated[8] Government owned power utilities. Vanuatu is an exception since the power utility UNELCO is a private firm. There will be a need to engage Finance Ministries in the dialogues due to the significant economic impact[9] national energy policies will have on trade balances and level of subsidies.

4.5 Methodological approach and components of support

The energy component of CCCPIR adopts a multi-level approach. Interventions concentrate at the macro and meso levels. The micro level, the key action area-3 of demand driven measures, will create enough awareness and discussion for more cost effective, climate proof and sustainable investments in the energy sector. The results of these activities are brought into policy discussion and financial circles of the regional energy groups and partner organisations mentioned in section 4.4. Applying and updating national and regional energy strategies and their implementation is the intervention at the macro level.

The support components of the programme consist of consultancy measures to be carried out by international as well as national long-term and short-term experts which should work in tandem. Furthermore local training for professional development and limited provision of public relations and workshop materials are included.

4.6 Key action areas with expected key outputs

Three key action areas had been identified supporting sustainable and economic development towards an affordable, cost effective, socially fair, reliable, mostly indigenous energy supply within 30 years.

Key action area 1: Support to beneficiary PICs concerning economic and financial assessment of what it will cost the country and the donors for the next 20 years to achieve the benchmarks of the national energy policy plans.

This key area of action is addressing the issue of poor energy investment allocation efficiency and insufficient assessment of the economic and financial impact of national energy policy plans. It supports guiding principle # 6 of the regional energy policy draft

[8] A power utility in charge of generation, transmission and distribution of electricity..
[9] All PICs have large negative trade balances

and national energy policies: *"All assessments of proposed investments whether grant, loan or internally financed will include analysis of expected economic and financial viability"*

Outputs: (i) National economic and financial reports to implement the published national energy **policies jointly prepared** with stakeholders and implications discussed with energy donor group and the CROP agencies for energy and environment.

Indicator- 1.1: At least 7 national reports jointly prepared with stakeholders

(ii) CCCPIR advice **is adapted** by PIC decision makers and **becomes part** of the negotiation process with donor agencies

Indicator- 1.2: At least 5 national reports adapted and applied as described

Key action area 2: Support to PICs, in particular the seven smaller ones, and the energy donor/IFI group, in how to finance this fuel mix transition by shifting poorly targeted subsidies into well targeted and minimized subsidies for the public and private sector.

This key area of action is addressing the issue of non-sustainable costly financing of energy supply infrastructures. It supports guiding principle # 5 of the regional energy policy draft: *"Serious efforts will be made to develop practical and effective financial mechanism on a basis that expands self-financing from within the region over time".*

Outputs: (i) Strategies and delivery mechanism to shift the present unsustainable and costly investment subsidies for energy services into acceptable levels of subsidies, or cross subsidies for services and consumption **jointly decided** by stakeholders, CROP agencies and pacific donor energy group;

Indicator- 2.1: CCPIR concept and strategy paper prepared, discussed in all three groups and accepted to be tested in principle.

(ii) Negotiations to test strategy and delivery mechanism for the 7 smallest PIC electricity consuming PICs (200 GWh/y) **resulted in** a financial grade paper and a business plan over a period of 10 years;

Indicator -2.2: At least 5 financial grade papers prepared and submitted to IFI through concerned partner authorities

(iii) One of the two smallest electricity consuming PIC (Tuvalu or Kiribati) is **agreeing to implement** the strategy with the financial support by members of the pacific energy donor group (This is an option if at least € 10 Million are made available to cover incremental costs until grid parity is reached).

Indicator – 2.3: Formal negotiations with donor group have yielded a request by either Tuvalu or Kiribati

Key action area 3*:* Capacity development to assist demand driven request complying with the regional energy guiding principles # 7 and five cost effectiveness tests common for energy projects. It supports guiding principle # 7 of the regional energy policy: *"Consistency of energy projects with climate change policies"* as well as guiding principle # 6: "*It is inappropriate to use pacific communities for experimental or prototype energy technologies that are unproven elsewhere."*

Outputs: (i) A pipeline of indigenous energy services project proposals, satisfying the criteria of being affordable, technically viable, cost effective, socially fair, and climate proof **jointly prepared and discussed** with the CROP and the Pacific energy donor group.

Indicator 3-1: At least 15 demand driven projects aiming at improving sustainability, reliability and/or cost effectiveness are identified and processed
(ii) Financing of project proposals **jointly negotiated** with CROP groups and pacific energy donor group.

Indicator 3-2: At least 5 projects reach financial closure
(iii) Standards to assess the climate change relevance and climate proof of the energy service measures **discussed and agreed by** CROP energy and environment groups as well as Pacific energy donor group.

Indicator 3-3: One standard prepared and formally accepted by at least one working group

4.7 Technical assistance instruments (TA)

No cash relevant financial contributions are foreseen for the energy component. Indirect or in kind contributions need to be negotiated with several stakeholders such as the Pacific energy group members, the official regional counterpart the SPC, and beneficiary PICs.

Capacity building and training will be mostly within the PIC countries and within the CROP energy and environment groups. One LTE (110 x 3 = 330 w/days, 50% over three years) will coordinate and represent the energy component of CCCPIR. He/she should be experienced in subject areas such as energy policy, mitigation policies, energy conversion technologies, renewable energy and the power sector. Know how of financial and economic assessment of energy projects are an advantage. The LTE will be supported by two national or international STE (2 x 150 = 300 w/days over three years) specializing in subjects such as climate proofing of energy investment projects. One will be advising on preparation of financial grade papers satisfying IFI due diligence and project appraisal procedures. Short term home based backstopping of highly specialized STE consultants will be necessary for the demand driven parts of the energy component to be processed within the first 18 months of the project. A total of 60 w/days over two years are allocated for such services.

4.8 Coordination with other TA

The Pacific energy donor/IFI working group is the coordination entity of all energy related projects, irrelevant under what implementation cover[10] the project runs. This group may be the major partner of CCCPIR at the donor level. The minimum level of cooperation is to participate in regular meetings and exchange information about project progress as well as unforeseen challenges. A more involved level of cooperation may be to jointly implement and design TA and FA projects. One key action area, the reduction of non-targeted and unnecessary subsidies for RE power generation, would in any case require very close cooperation with the major financiers the WB, ADB, GEF, EIB and Governments of Australia and New Zealand.

4.9 Expected Impacts

4.9.1 Expected effects on executing agencies and intermediaries

The intermediaries are the four groups described in section 4.4. Executing agencies are Ministries and departments in charge of energy and environment matters, such as policy

[10] Energy related TA and FA projects in the region are traditional energy measures. Some are enhanced by or labeled mitigation and adaptation subjects under climate change.

formulation and enforcement, as well as capacity expansion and rehabilitation of energy infrastructure and services. The latter is often delegated to government controlled vertically integrated power utilities. The expected effect on executing agencies and intermediaries is value addition to existing mandates and standard operating procedures as well introduction of new elements of appraisal. No follow-up costs are incurred at the end of the programme outside the budgeted programme of the participating parties.

4.9.2 Development-policy effectiveness at the level of the TC measure

The energy component contribution is assed with respect to relevance, effectiveness, efficiency, impact and sustainability.

The **relevance** of the energy module is assured because the newest 2010 regional energy policy for the pacific islands clearly points out the existing short comings in the energy sector and agreed on guiding principles. The CCCPRI energy component activities and outputs react specifically to selected guiding principles of this policy and assist in linking this policy with intermediaries and executing agencies policies that in the extreme are mutually exclusive and may require adjustment. The energy component is built on stakeholder structures that are capable of influencing as well implementing energy policies in a more budget allocation efficient way improving **effectiveness** of public and private spending. The high competence of the GTZ to provide energy policy advice at all intervention levels and the integrated approach to search for the most economic alternative improves **the efficiency.** All three key areas of activities, although addressing the energy policies and action plans from different directions, are a contribution towards shifting subsidies into sustainability.

On the **impact** of the energy component it is assumed that eventually guiding principles and analysis to improve value addition of TA will find takers among intermediaries and executing agencies.

4.9.3 Result chains, DAC and BMZ coding

4.9.3.1 Results chain of the three key areas

In **key area 1** (policy advice) the key participants at the national level are advised on the financial and economic implications of their national energy policy. A comprehensive report is prepared jointly (**output)**.They are supported in stakeholder forums to conduct an informed policy dialogue with donor agencies and decision makers on the subject of budget allocation efficient financing of national energy policies to cope with climate

change while following their national sustainable development path **(use of output**). The (**direct benefit)** is based on the fact that available national and international financial and human resources may be more efficiently used and cost/benefit ratios of mitigation/adaptation projects may improve.

In **key area 2** (financial advice) the key participants at the national level of two smaller PIC are advised, based on key area -1 outputs, on reducing national and international subsidies to provide adequate levels of energy electricity supply to support the change in energy mix as announced in the energy policy report. A comprehensive report is prepared jointly for all 7 smaller PICs (**output)**. The recommendations of the report should be used for negotiations with national decision makers, IFI and also donor agencies for consideration of feed-in-tariffs or similar financial/fiscal instruments to reduce unsustainable investment subsidies (**use of output**). The **direct benefit** is a revamp of how measures in the energy sector are financed, increasing the availability of more financial resources for adaptation/mitigation measures that really need investment subsidies due to their end-of-pipe nature .

In **key area 3** (demand driven) a pipe line of mitigation/adaptation measures is built up. The pipeline of proposals is undergoing proper standard cost effectiveness tests to appraise their financial and economic effectiveness and relevance under a national adaptation/mitigation scheme with respect to climate proofing standards **(output**). Reports and analysis are taken as a basis for project financing negotiations with IFI and donors (**use of outputs**). The **direct benefit** is the institutionalization and mainstreaming of proper assessment of adaptation/mitigation measures in the energy sector and a higher cost/benefit ratio.

4.9.3.2 DAC and BMZ coding

- Socioeconomic results (poverty index)

The development measure concentrates on the macro and sector levels. The results chain from TA output to target group is long. Renewable energy and energy efficiency measures lead to cost savings and improved healthy indoor conditions and an improved national HDI, from which poor sections of the population also benefit (direct savings in the household, increased revenues and improved competitiveness for businesses and the securing or creation of jobs as well as higher HDI): **MSA** (comprehensive poverty reduction at the macro and sector level).

- **Participatory development and good governance**

Participatory development/good governance is an important secondary objective of the energy module. It supports an explicitly participatory approach to implementation of existing energy policies and energy strategies, drawing together all relevant actors from government, business and civil society. It helps to ensure that government agencies dealing with energy operate in a way that is verifiable, effective and efficient: **PG-1**

- Gender equality

The energy component has deducible positive effects on gender equality; this is however not a primary objective of the energy component. Within the programme framework women are brought in to the various decision processes in the demand driven projects. **GG-1**

- **Conflict reduction**

The development measure is taking place in a conflict situation with increased perceived but no yet well documented and verified risks through climate change for the PICs; the planning and implementation are therefore implicitly sensitive to this emerging and unavoidable long term conflict that may also as a worst **or** best case result in eventual migration and abandoning of low laying islands or areas of islands. This crisis prevention is an explicit objective of the CCCPIR.: **K-1**

- Environmental protection and resource conservation

The measure is oriented to ecological sustainability, environmental protection, climate change mitigation and natural resource conservation: **UR-2**, no action required.

4.10 Risk analysis

The number of donors and projects supporting energy policy and action plans under various thematic subjects such as clean energy, renewable energy, efficient energy and climate relevant adaptation and mitigation schemes is large and fragmented. Similar strategies and delivery mechanisms are applied in the USA and the European Union. Those programs and projects, at a much larger scale, face identical problems such as conflicting national interests. Efforts to regionalize and harmonize the approach, even with neighboring regions, are helped in these regions of the world by a strict regulatory and impact oriented monitoring system.

This difference pointedly shows the major risk of TA and FA energy projects in the PICs compared to those in the USA or EU: *"The absence of proper appraisals, no cost effectiveness tests, circumventing set standards and absence of an institutionalized*

watchdog in charge of continuously monitoring, reporting and publicizing positive and negative impacts to decision makers and the public at large ". The absence of such regulatory measures and impact monitoring activities, combined with insufficient efforts of creating a true sense of ownership with beneficiaries, has been and still is the largest

risk. It is also a fertile ground for the observed phenomena: *"If a project fails there are few misgivings, since beneficiaries are at least not worse off as they were before the intervention" .*

The risk of failing to mitigate these short comings is at a medium level since this project component may provide the means and toolkit for positive intervention if accepted by all stakeholders.

5 Cost estimates for proposed energy component of CCCPIR

Cost category		EUR
1	Personnel	700,000
2	Equipment and materials	50,000
3	Financing/local subsidies	0
4	Other direct costs	150,000
5	Total direct costs	900,000
6	Overheads/profit/VAT	12,000
7	Estimated price of the offer	1,000,000

Inter island transportation costs: The PICs Samoa, Tonga, Vanuatu, Kiribati, Tuvalu, Solomon Islands and the French Territory New Caledonia (the seat of SPC) are accessible by direct flights from Nadi or Suva. Average return ticket costs are about € 450. The PICs Marshall Islands, Palau, Papua New Guinea, Federated Sates of Micronesia and Nauru are not directly reachable from Fiji and return tickets are about approx. € 800.

Total of 4 x 7 x 3 = 84 flights of PIC reachable directly from Fiji € 37,800 (for LTE)
Total of 4 x 4 x 3 = 48 flights of other PIC € 38,400 (for LTE)
Total of 2 x 4 x 3 = 24 Flights for STE € 19,200 (for STE)

Total € 100,000

LTE and STE w/days:

LTE 330 w/days over three years
STE 300 w/days over three years
STE (backstopping) 60 w/days over two years

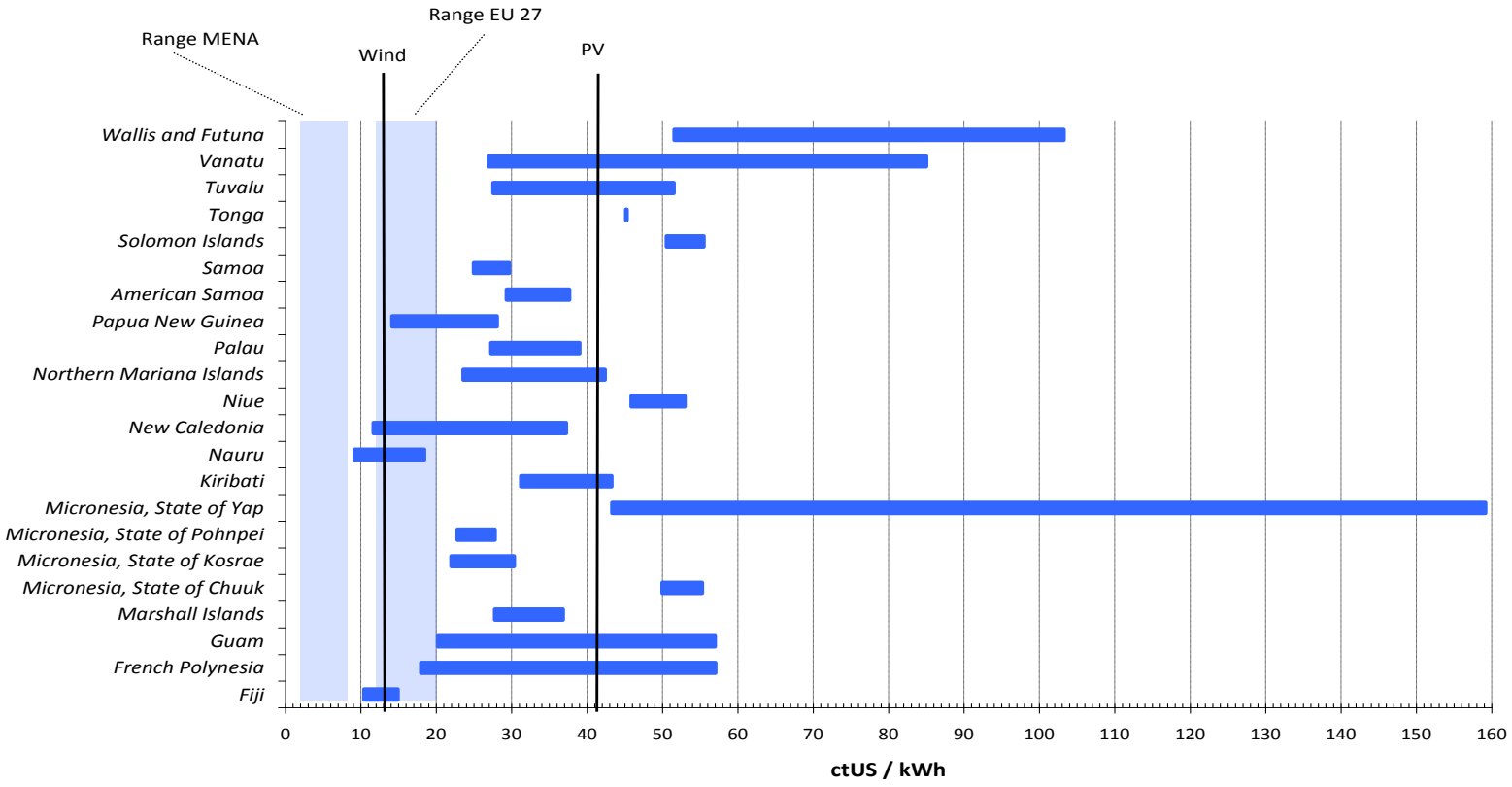
Total of LTE and STE 690 w/days = € 700,000 includes average per diem of € 200/day for mission days and transportation from home base to and from Fiji but excludes inter-island flying costs for LTE and STE mission to consult PIC or attend meetings of the various working groups.

Plan of outgoing funds for the project phase from 2011 to 2014			
Budget year	**Expenditure (incl. administrative overheads, and VAT)**	**Unused contract amount *)**	**New funds made available**
Year 1 (2011)	**300,000**	**0**	**300,000**
Year 2 (2012)	**450,000**	**0**	**450,000**
Year 3 (2013)	**250,000**	**0**	**250,000**
Total	**1,000,000**	**0**	**1,000,000**

ANNEXES

Annex: Tables and Figures

Figure-1 : Power tariff range of the PICs and comparison with EU- 27, MENA region tariffs and PV and Wind EU feed-in-tariff example[11]



[11] Compiled from own data and PPA, 2007 – 2010. PICs indicative tariff range due to mixed tariffs of demand charge and energy charges for industrial and commercial users. No system average tariffs as asked by tariff regulators have been collected and published for the PICs.

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Table-2: Present and future TA energy related projects of donor community

GEF- Project / Programme	PICs included	Execution	US $m
Promoting Energy Efficiency in the Pacific	Cook Islands, Samoa, Tonga, Vanuatu	ADB	6.0
Action for Development of Marshall Islands Renewable Energy (ADMIRE)s	Marshall Islands	UNDP	1.1
Sustainable Economic Development through Renewable Energy Applications (SEDREA)	Palau	UNDP	1.1
Energizing the Pacific Regional Project	PNG, Solomon Islands and Vanuatu	World Bank	4.0
Fiji Renewable Energy Power Project (FREPP)	Fiji	UNDP	1.1
Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP)	Eleven PICs (excludes Palau & RMI)	UNDP/ SPREP	5.2
Accelerating the Use of Renewable Energy Technologies	Nauru, Niue and Tuvalu	UNEP/ IUCN	1.5
Sustainable Energy Financing Project (SEFP)	Marshall Islands, Vanuatu	IFC	9.5
	Fiji, PNG, Solomon Islands	World Bank	
Total GEF		**US$**	**≈ 30**

Japan - Project / Programme	PICs included	Execution	US $m
The Projects to be funded under the contribution by the Government of Japan to the PIF Secretariat for the Implementation of the Pacific Environment Community Commitments	Palau, RMI, FSM, Tuvalu, Vanuatu, Kiribati, Fiji, Nauru, Samoa, Tonga, PNG, Solomon, Niue, Cook Islands	Forum Sec./ Govt of Japan	≈75
The Project for Introduction of Clean Energy by Solar Electricity Generation System	Palau, RMI, FSM	JICA	17.3
Follow-up assistance for the Project for Upgrade of the Electrical Power System	Palau	JICA	0.56
Advisor for the Improvement of Electric Power Supply	Palau	JICA	-
Hydro Power Energy Study	PNG	JICA	-
The Project for Introduction of Clean Energy by Solar Home System	Tonga	JICA	6.6
Advisor for Renewable Energy Development	Tonga	JICA	-
The Project for Improvement of Sarakata River Hydroelectric Power Station	Vanuatu	JICA	14.4
Advisers for the Power Sector Expansion Project(Generation, Machine, Electric System Planning, SCADA)	Samoa	JICA	-
Senior Volunteer (Civil engineer)	Samoa	JICA	-
The Study for the Maximum and Effective Use of Renewable Energies in Electric Power Supply	Fiji	JICA	-
Total Japan		**US$**	**≈ 115**

ADB – Project/Programme	PICs included	Execution	US $m
Promoting Energy Efficiency in the Pacific	Cook Islands, PNG, Samoa, Tonga, Vanuatu	ADB	1.7
Promoting Renewable Energy in the Pacific	PNG, Solomon Isl, Vanuatu	ADB	3.0
Strengthening Capacity of Pacific Developing Member Countries to Respond to Climate Change	Pacific Developing Member Countries	ADB	1.5
ADB energy grant pipeline for Pacific Member Developing Countries in 2010	Marshall Islands	ADB	3.0
	Papua New Guinea		3.0
RMI support from Japanese Fund for Poverty Reduction	Samoa		1.0
	Tonga		3.0
Other ADB energy sector grants linked to loan finance	Samoa	ADB	27.4
	Samoa		1.9
	Samoa		1.2
	PNG		0.5
	PNG		1.2
Total ADB			**≈ 50**

PPA - Project / Programme	PICs included	Execution	US $m
Energy Efficiency Assessment Programme for the Northern Pacific Utilities	FSM, Marshall Islands, Palau, Guam, Northern Marianas	PPA	≈ 0.4
Capacity Support for Sustainable Management of Energy Resources in the Pacific Region	ACP Pacific Island states	PPA	≈ 1.6
Northern Utilities Support	Northern Pacific PIC utilities	PPA	0.4
Capacity Support for Solar PV Stand Alone & Grid Connected Systems and Demand-side Management;	PICs	PPA	0.6
Energy Efficiency Assessment Programme for the Southern Utilities (not finalised)	Cook Islands, Tonga, Kiribati, Niue, Solomon Islands, PNG, Samoa, Fiji, Tuvalu	PPA	≈ 0.3
Total PPA			**≈ 3.3**

Other –Energy Project / Programme	PICs include	Execution	US$m
Feasibility study for Tina River Hydropower	Solomon Islands	EIB	≈ 0.7
Italy/Austria Pacific Energy Programme	Palau, RMI, Samoa, Tonga Tuvalu & Vanuatu	IUCN Oceania	10.0
	Cook Islands, Kiribati FSM, Fiji, Nauru, PNG	The PIC governments	
North Pacific/ACP Renewable Energy and Energy Efficiency Programme (North REP)	FSM, Palau & Marshall Islands (RMI)	SPC	≈ 20
Other European Commission EDF-10 national energy assistance.	Nauru	Nauru govt	≈ 3.2
	Niue	Niue govt	≈ 3.5
	Kiribati	Kiribati govt	≈ 5.6
	Tonga	Tonga govt	≈ 6.9

Clean and Affordable Energy for the Pacific Islands	All Forum Island Countries	AusAID (mainly thru PRIF)	≈ 22
Renewable Energy & Energy Efficiency Partnership (REEEP) Pacific Programme	Regional	AusAID/ REEEP	≈ 1.3
Miscellaneous AusAID	All Pacific Island Countries	Support to dev partners	See comments
Total others			**> 75**

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 programme (ADB, JICA, AusAID):
- Contribution to WB SEFP in Solomon Islands – approximately $1m over 3years (2007/08- 2009/10).
- Vanuatu Power Access Programme – 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 programme (though PRIF): Not yet commenced – support for preparation currently being provided through the PRIF.

Table-3: Country Statistics

Country	GDP [kUSD]	GDP per Capita [USD]	Gov. Exp per Capita [USD]	Inflation [%]	Exports [kUSD]	Imports [kUSD]	Balance [kUSD]
Fed. St. Of Micronesia	235,900	2,136	1,396	4.10	3,421	137,993	-134,572
Fiji	2,695,666	3,212	962	3.27	762,182	1,820,745	-1,058,563
Kiribati	61,433	632	640	-1.00	6,280	63,167	-56,887
Marshall Islands	149,219	2,803	1,792	4.35	-	75,235	-
Nauru	27,661	2,722	1,719	-	3,769	25,599	-21,830
Palau	170,144	8,390	4,369	5.07	-	-	-
Papua New Guinea	6,044,220	934	209	2.27	4,978,800	2,692,908	2,285,892
Samoa	532,000	2,961	658	3.90	96,456	263,812	-167,356
Solomon Islands	373,800	722	260	7.30	129,546	231,020	-101,474
Tonga	234,484	2,283	799	6.90	9,319	115,489	-106,170
Tuvalu	17,514	1,800	1,794	3.07	99	12,797	-12,698
Vanuatu	459,010	1,970	432	2.03	30,380	205,780	-175,400

Country	Population	Growth Rate [%]	Urban Population [%]	Overseas Visitors	Net Available El [GWh]	Net Available El/Capita [kWh]
Fed. St. of Micronesia	110,443	0.40	22	20,150	113	1,023
Fiji	839,324	0.60	51	539,255	928	1,106
Kiribati	97,231	1.80	44	-	14	144
Marshall Islands	53,236	1.00	68	-	108	2,029
Nauru	10,163	2.30	100	-	31	3,050
Palau	20,279	0.60	64	93,031	130	6,411
Papua New Guinea	6,473,910	2.20	13	104,122	2885	446
Samoa	179,645	0.10	21	218,241	109	607
Solomon Islands	517,455	2.70	16	13,748	71	137
Tonga	102,724	0.40	23	-	43	419
Tuvalu	9,729	0.30	47	1,108	4	411
Vanuatu	233,026	2.60	21	167,082	42	180

Source: http://data.un.org and http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm , other data taken from http://www.spc.int/prism/ (2008 Pocket Statistical Summary).

ANNEX: Brief excursion about renewable energy technologies

Geothermal: No commercial experience exists in the PICs except PNG. This is a typical large scale technology for power generation of more than 5 MW by PICs standard. Exploration drilling is going on in Vanuatu by private sector firm from Australia. Large investments beyond € 10 Million required. In general this is a clean, firm, sustainable and reliable energy resource in form of steam tapped directly from the earth's heat. Specific generation costs in € / MWh of electricity are very site and capacity specific but usually below 100 US$ / MWh. Projects are private sector driven. The 52 MW geothermal plant in PNG earns about 3 Million US$ / year from CERs.

Photovoltaic (PV) based solar electricity: Most popular with donor agencies but also most controversial for various reasons and so far not too successful despite 25 years of efforts to introduce the technology in the PICs. The technology is very scalable in terms of capacity. It is on the market as a 1 Wp PV panel solar electricity charger for cellular phones on remote islands but also as a large scale 1 MW centralized solar power station..

Very significant decreases in the costs[12] of the PV panels for the last 20 years and even more recently make this source of electricity more and more affordable as a non-firm power source. However there are also some shortcomings of the technology related to past and still practice poor implementation strategies. Changes need to be initiated to make measures more successful. The regional annual yield of PV electricity in kWh per kWp installed varies widely between 500 kWh (shaded and rainy conditions) to 1600 kWh (unobstructed sunshine for at least 240 days a year and 6 hours a day).

Wind power plants technology has been introduced on an experimental basis for hybrid power systems and is also commercialized in Vanuatu, New Caledonia, and Fiji. Single wind tower capacities do not go beyond 275 kW in Vanuatu and Fiji as compared to tower capacities of 1.5 – 3 MW in the EU-27. Barriers are lack of heavy cranes to put up the tower platform and a higher hurricane incident.

Wind power technology is a mature one. Some designs are reasonable climate change proof with respect to increased frequency and ferocity of hurricanes. Wind power is not firm[13] but my be considered an important fossil fuel saver for fuel oil driven power plant systems of some PICs. The expected average yield of 1800 kWh / kW in the PICs region is at the lower end of commercial plants yielding from 1700 kWh to 3600 kWh per kW elsewhere. Nevertheless cost wise the technology is presently the most competitive compared to PV, small scale hydro and even coconut oil. It can for sure compete as non-firm power against ADO based power systems at ADO supply cost above US$ 1.3[14].

[12] Cost dropped about 23% for every doubling of sales over the last 20 years. Presently at 1.8 to 2.4 € / Wp wholesale and a factor 1.7 to 2.4 higher turn key installed.
[13] Firm power refers to an electricity supply based on an energy resource that is available 24 hours per day and whenever there is an explicit demand for it.
[14] As an orientation, excluding the worst and best cases, small diesel generator sets (5 kW – 50 kW) burn about 1 Liter of oil to generate 2 kWh - 3 kWh of electricity.

Operation of wind power plants systems and synchronization with the grid requires the assistance and cooperation / ownership of an experienced power utility. Financial institutions require wind density monitoring for at least 1 year to lower risks with respect to predicted plant load factors (PLF). Expansion of wind site monitoring is therefore recommended to reduce commercial risks[15]. Measuring stations may be used to collect additional metrological data necessary to assess the impact of climate change. A second acceptable strategy is to put up one wind power plant and observe its performance over 1 year before a decision to expand is made.

Hydro power technology has been commercialized and is very site specific in the PICs. Citing specific generations cost would be speculative and citing average costs does also not make sense. The climate change related issues are clearly the changing hydraulic ratio of the rivers and creeks as well as the sustainability of the flow input to larger reservoirs as a function of changing rainfall patterns and deforestation. Both indicators together are affecting the design as well as the plant load factor (PLF) of any run-of-the river or reservoir fed hydro power plant.

Three years of monitoring the hydraulic ratio and flow patterns of the water source are required to mitigate unpleasant surprises and to avoid rejection or high risk premiums by lenders. Furthermore developing a hydro power strategy requires long term planning, dedicated data collection over years and foresight to mitigate financial risks.

Vegetable oil based power generation by diesel generator sets: The concept of coconut oil based power generation is nothing new to Vanuatu[16] and has been practiced on and off for the last 30 years by the local power utility as buffer against oil price shocks. Much smaller experimental units are also in place in Fiji and elsewhere. Enough empirical evidence is available in the PICs to judge the technology. However there is uncertainty of which installations are still in operation. Other alternatives such as the two major non-edible fuel oils Pongamia and Jatropha[17] are discussed but seem to be unrealistic options.

Operational challenges to run conventional diesel generators on coconut oil are decreasing with increased size of the generators and improved control over the quality of copra processing and milling.

None of the ADO based electric power generators[18] in the PICs is completely isolated from the local or international trade in copra. Consequently a successful strategy to expand coconut oil based power generation will need control over the supply and processing of the copra while paying a higher price for the copra than competing users of coconut oil. The

[15] These commercial risks are higher bank interest rates due to low quality measurement data and higher offers if bidding takes place.
[16] It has been done on and off for the last 30 years by the local power utility UNELCO
[17] This oil plant that is toxic to humans and animals and therefore non-edible. Oil yields are seasonal and only between 300 and 1500 liter/ hectare/ year depending on availability of water and fertilizer.
[18] Government owned and controlled vertically integrated power utilities as well as owners of captive power plants

danger of jeopardizing in general food security by using coconut oil as an energy resource may be overrated. It ignores the fact that the control over copra supply is mostly with the communities. The opposite scenario of an unreliability copra supply for power operators, due to higher demand from the food sector, is a more realistic scenario that has happened on and off in the PICs in the past.

Energy efficiency as a source of energy: Among all energy resources, energy efficiency measures[19] are the cleanest and often the least expensive source of energy. Energy efficiency is not yet recognized as a **source** of energy in the PICs. The concepts and algorithms to calculate the costs of one kWh of electricity **saved** and to treat it as a resource that can be traded and bought by a utility are well known since 1972.[20] Applying this concept as part of a mandatory integrated resource planning (IRP) exercise is desirable and should be introduced by regulators to partially protect consumers against higher future tariffs. The latest draft of the REEPI recommends following an IRP assessment. It remains to be seen to what extent donors[21], FI's, PIC energy planning units and MoF's will agree to institutionalize[22] the IRP tests and algorithms.

Any switch to locally available renewable energy resources combined with energy efficiency is in addition a buffer against oil price shocks, oil transport costs, interruption of regional or international oil supply lines for whatever reason. In this context the system average rate (SAR) of the electricity tariff is a strong indicator to what extent adaptation and mitigation measure based on energy efficiency and renewable energy are already cost effective or close of being cost effective within a few years by reaching grid parity[23].

[19] The problem with some EE measures is the rebound effect, i.e. diminishing effectiveness over time.
[20] Referred to as the five California cost effectiveness tests of 1972 and updated version of 2001.
[21] Some donor agency and IFI projects in the power sector would not pass an IRP test.
[22] …i.e to be included in financial grade papers as an mandatory part of the appraisal process
[23] Grid parity means the supply costs of RE based electricity equals roughly the supply costs of the fossil fuel based electricity mix for a specific consumer group.

Annex: Energy sector and its place with respect to adaptation and mitigation

Ensuring the energy supply for transport and power generation is next to food security one of the most critical and most costly items in the PICs development since it directly affects the PICs ability to further develop their fragile economies. PICs requests for support in the energy sector are focused on sustainable economic development.

Improved energy independence, energy efficiency, demand side management[24], and utilization of indigenous energy resources are strategies which always hade been and will be improving the resilience of a society facing energy supply interruptions and high energy costs. These strategies may or may not be related to climate change and are in any case no regret adaptation and mitigation measures.

The cause and effect relations are given for the group of measures falling under energy efficiency and demand side management:

- **Promote efficient use** of electricity, gas and oil to

---> Slow down and partly remove the increased dependency on fossil fuels
---> Increase energy security in times of interruption of fossil fuel delivery
---> Reduce investment for costly and vulnerable oil and gas storage infrastructure
---> Reduce need to invest in renewable energy based power plant technology
---> Increase household cash available for same level of energy consumption
---> Mitigate financial impact of necessary increase in the per capita electricity consumption
---> Reduce CO_2 emissions in a most cost effective way[25]
---> Mitigate the effect of costly adaptation measures such as increased air conditioning

The cause and effect relations with regard to adaptation and mitigation are given for the group of measures falling under utilization of renewable energy resources.

- **Promote electricity generation from renewable** energy resources to

---> Reduce CO_2 emissions
---> Increase energy security in times of interruption of fossil fuel delivery
---> Buffer against unpredictable and most likely higher future fossil fuel costs
---> Guard against fossil fuel supply interruptions
---> Diversify the energy fuel mix as additional resilience against climate change effects affecting supply as well as costs of fossil fuels to the PICs.

In summation any energy measure addressing improved access to modern[26] renewable energy resources as well as promoting a more cost effective[27], more energy efficient[28],

[24] Demand side management (DSM) refers to all measures reducing the energy consumption of end users without lowering well being or level of productive use
[25] To reduce CO2 emissions to assist in worldwide mitigation strategies does not make sense for the PICs unless it is a project that generates CER or VER for urgently needed revenues.

affordable[29] and inclusive[30] growth of energy consumption may be considered a "no regret"[31] measure independent of the severity of climate change affecting the PICs. All what we need to do is to scale up faster and more budget efficient of what we already know best and have been doing for many years.

A refined classification into "no regret" **and** "cost effective" adaptation and mitigation measures may further improve the budget allocation efficiency and social acceptance of EE and RE measures.

[26] The term „modern" renewable energy **excludes** traditional use of wood and agricultural residues as an energy resource at the household level.
[27] The term "cost effective" refers to the algorithms of the five cost effectiveness tests for energy related investments of the residential, commercial, industry and public sectors.
[28] The term „energy efficient" refers to getting the most **usable** energy out of energy resource available to consumers
[29] The term „affordable" refers to domestic energy costs which are within a range of 4 %-10% of available household income. Beyond that we talk of energy poverty;
[30] The term „inclusive growth" or "pro poor" refers to measures which directly or indirectly benefit the poorer or marginalized sections of a society;
[31] The term „no regret" refers to mitigation or adaptation measures which qualify as *"modern, cost effective, energy efficient, affordable and inclusive"* and therefore should have been done anyway no matter whether climate change effects are predicted to be positive or negative for the target group in question.

Abbreviations

$Cents	US Dollar Cents
ACCPIR	Adaptation to climate change in the pacific island region.
ADO	Automotive diesel oil used in power generation.
CDM	Clean development mechanism, a special instrument under the Kyoto Protocol
CROP	Council of regional organisations in the Pacific
DSM	Demand side management
EE	Synonym for energy efficiency measures
EWG	Energy working group of CROP
G+T+D	Generation, transmission and distribution infrastructure of a power industry
HDI	Human development index of the UN
IPP	Independent power producers
IFI	International finance institutions
kWh	Standard commercial unit to sell electricity
kWp	Kilowatt “peak” the standard commercial unit to state PV capacity installation.
LC	Local currency
MoF	Ministry of Finance
MWh	Megawatt hour of electricity equal to 1000 kWh of electricity
PIEP	Pacific Islands Energy Policy developed in 2002 by the CROP energy working group
PIESAP	Pacific islands energy strategic action plans 2005 -2007
PLF	The plant load factor of a power plant expressed as ratio of total annual kWh generation over total kW installed x 8760 hours
PICs	Pacific island countries
PPA	Pacific power association
PV	Photovoltaic process of generation of electricity by direct conversion of the sun’s radiation into electricity.
PREPA	Pacific islands regional energy policy for action
Wp	Watt peak the unit in which wholesale and retail prices are stated for PV panels. One kWp = 1000 Wp
RE	Synonym for renewable energy source
REPPI	Regional energy policy for the pacific islands
R&R	Rules and regulations of a notified Act, directive or policy
SAR	System average rate in local currency / kWh, defined as ratio of all power utility income from sales of electricity divided by the amount of kWh delivered to the transmission grid.

SPC	Secretariat of the pacific communities
SPREP	South pacific regional environment programme

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