

APFEDII – Fifth NetRes Meeting
16-19 November 2009
USP, Suva, Fiji



Renewable energy in Fiji and the Pacific
– challenges and the way forward

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Outline of talk

- Types of renewable energy (RE)
- Importance of RE – a global perspective
- Requirements for RE production
- Developing RE in the region – energy policy
- Energy production and consumption in Fiji and the region
- Potential for RE utilisation – resources, capacity, policy and legal framework
- The way forward



Why is renewable energy important to climate change?

- Renewable energy (RE) provides one way of reducing global warming through reducing the production of the greenhouse gas carbon dioxide produced by use of fossil fuels
- Provides the basic rationale for the Pacific Islands Greenhouse Gas Abatement through Renewable Energy (PIGGAREP)



1. Types of renewable energy

- All renewable energy comes from the sun(except geothermal)
- **Solar energy**
 - Evaporates water – rain, rivers – **hydropower**
 - Creates wind – **wind energy**
 - Plant life – **biomass**
 - **Ocean energy** – energy in tides, waves, and temperature difference between surface and deep down
- **Geothermal energy** – energy from interior of earth (inner core $\sim 4000^{\circ}\text{C}$, mantle $\sim 1000^{\circ}\text{C}$)



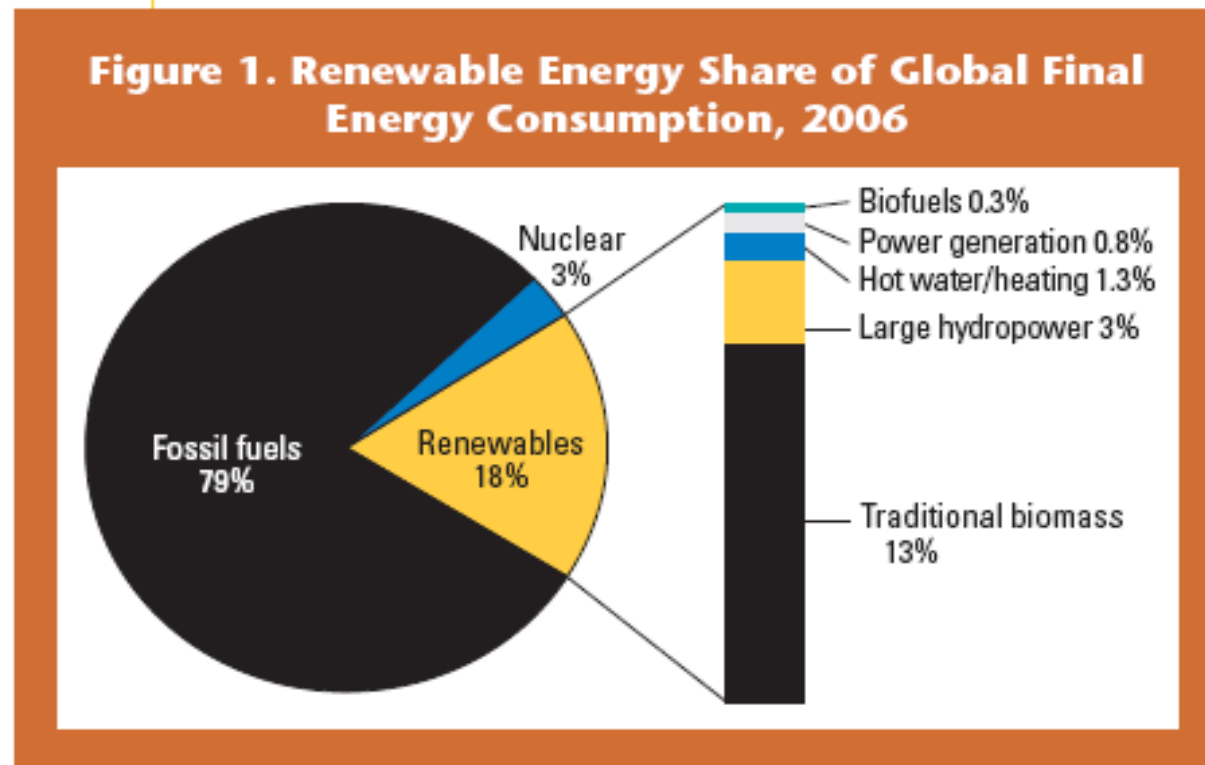
Availability of RE in the PICs

Not all Pacific Island Countries (PICs) have all these forms of energy available to them.

The availability depends on geology, geography, and climate

2. Renewable Energy – A global perspective

How much of all energy used globally is renewable?



(Source: Renewables 2007 – Global Status Report (REN21))

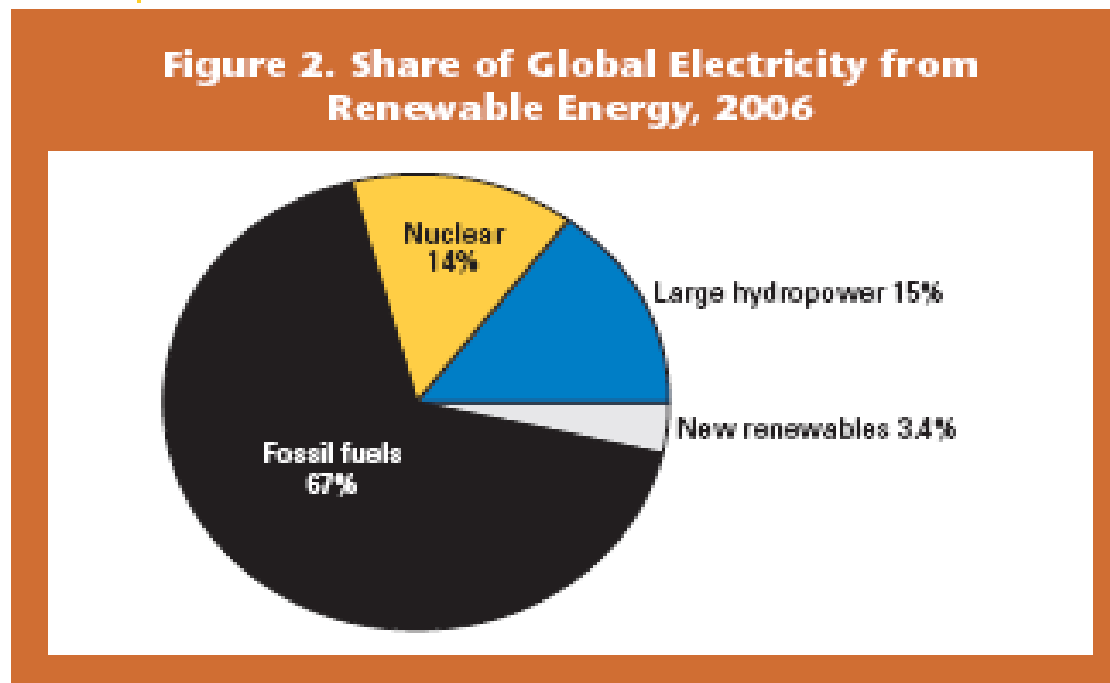


Global perspective – total energy use (cont)

- Only 18% of global energy consumption is RE. Of this, 13% is traditional biomass (firewood etc in poor countries).
- So the consumption of non-traditional RE (new renewables) for mainstream economic purposes is only 5%

Global perspective – electrical power generation

What fraction of all electrical power produced comes from renewables?



(Source: Renewables 2007 – Global Status Report (REN21))



Global perspective – electrical power generation (cont)

- Only 18% of the global power generation comes from renewables. Of this, about 15% is due to large hydro schemes that existed before the world found out about global warming and energy crises.
- So only 3.4% of the current global power needs are generated using the new renewables of small hydro, wind, solar, biomass, geothermal energy



Global perspective (cont.)

Can the world go completely renewable?

NO IT CANNOT

It must find alternative strategies to assist in the fight against global warming and future energy crises.

They will have to be socio-economic in nature.



3. Requirements for renewable energy production

- To develop and utilize renewable energy in a country, you must have
 - energy resources
 - land and site requirements
 - policy, legal and institutional framework
 - institutional capacity
 - human resources.

What does Fiji and the other PICs have? What do they lack? What can we do?



4. Developing RE in the region - Energy policy

PICs face unique energy challenges (PIFS report):

- They are small and isolated – access, market
- About 70% popln are still without electricity
- No indigeneous forms of fossil fuels (PNG)
- Limited storage facilities – energy security issues
- lack of appropriate technology and human resources, poor institutional mechanisms



Energy policy (cont.)

- The Pac Is Forum Secretariat through SOPAC has developed energy policies for regional countries starting in 2001 through its ***Pacific Islands Energy Policy and Strategic Action Plan (PIEPSAP) project.***
- Includes National Energy Policies, Rural Electrification Policies and Renewable Energy Policies.
- Countries considered: Fiji, FSM, Samoa, Tonga, Tuvalu and PNG.



Fiji's National Energy Policy

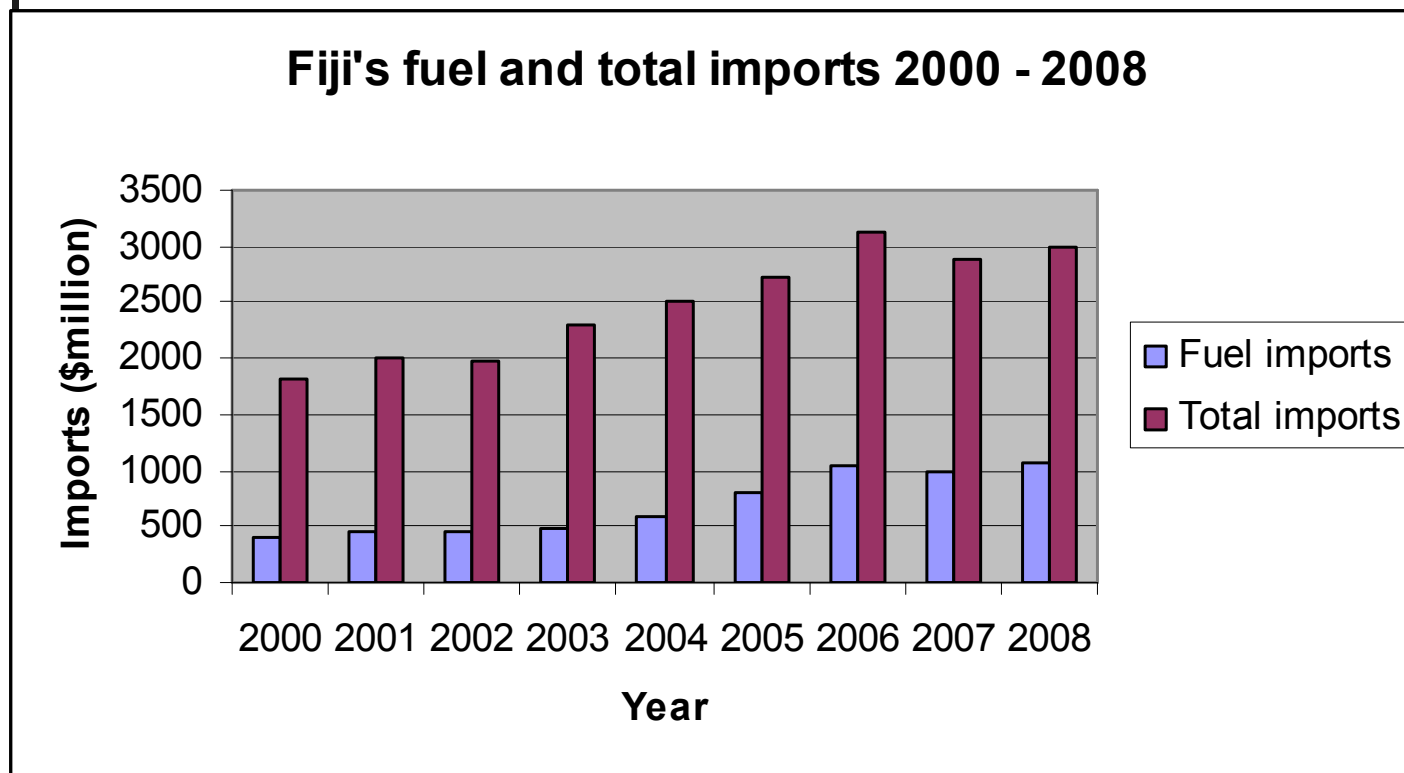
- The NEP – approved 21 Nov 2006
- A common framework for all (both public and private) for “the optimum utilization of energy resources for the overall growth and development of the economy over the next five years”
- Four strategic areas:
 - National energy planning (provide policy, regulatory and implementation frameworks)
 - energy security (through eg greater collaboration within the industry)
 - power sector (increase access to affordable electricity)
 - renewable energy (research, promotion and utilisation)



5. Energy production and consumption – the case of Fiji

- Like all other PICs, Fiji is heavily dependent on imported fossil fuels for its energy needs.
- This places a serious strain on its import bill.

Fiji's fuel import



Source: Fiji Islands Bureau of Statistics, 2008, P66



Fuel consumption by type -2007

Fuel type	Quantity (000 litres)	Percent of total (%)	Value F\$(000)
Motor spirit	78,753	9.55	95,429
Automotive distillate	62,231	7.55	62,208
Aviation turbine fuel	291,327	35.33	321,743
Kerosene	667	0.08	1,062
Industrial distillate	375,656	45.55	416,912
Residual fuel	16,017	1.94	12,950
Total	808,650	100	910,304

Source: Fiji Islands Bureau of Statistics, 2008



Electricity demand - 2007

Sector	Quantity (kWh)	% of total (%)	Value (\$F)
Industry	195,133,086	25.4	34,144,625
Commerce	332,656,989	43.4	68,477,240
Domestic	239,029,843	31.2	44,229,121
Other	N/A	N/A	867,757
Total	766,819,918	100	147,718,742



Going renewable

- **Fiji's only viable option to its energy supply problem is to go renewable.**
- It has a sustainable national energy blueprint
- Fiji needs to build human resource capacity and institutional mechanisms.
- What is Fiji doing to meet these challenges?



How FEA is meeting the challenge

- FEA's generation capacity on Viti Levu at the end of 2008 consisted of
- Older diesel power stations and
- Monasavu hydro scheme, 4x20 MW generators at the Wailoa power station commissioned in 1983
- The 6 MW Wainikasau hydro-station, commissioned in 2004



FEA (cont.)

- New caterpillar generators at Kinoya, total capacity of 7.45 MW capable of running on a variety of fuels including vege oil and heavy fuel oil
- The 2.8 MW Nadago hydro-electric scheme
- Butoni wind farm, consisting of 37 x 0.275 MW Vergnet wind turbines launched in October 2007



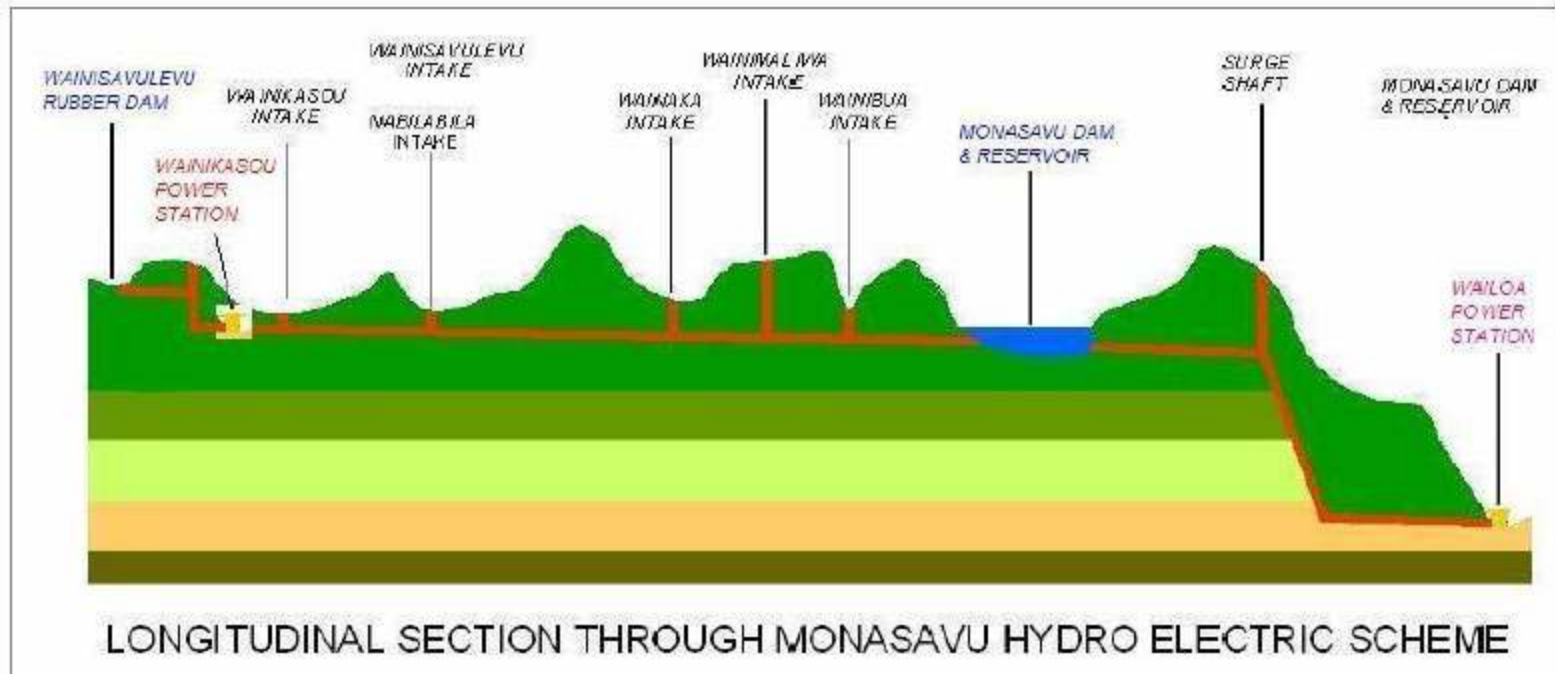
FEA(cont.)

FEA Diesel to Hydro mix – 2006-2007

Year	Diesel gen (GWh)	Hydro gen (GWh)	Total gen (GWh)	Wailoa hydro gen (GWh)
2006	394(53%)	341(47%)	735	315
2007	256(33%)	508(67%)	764	481 (record)

Schematic section of the Monasavu/Wainikasau system

Monasavu Cross-Section



Source: Hasmukh Patel, REMM2009 Nuku'alofa, Tonga

The Wainisavulevu weir/dam

Wainisavulevu Weir with Rubber Dam



Source: Hasmukh Patel, REMM2009 Nuku'alofa, Tonga

Butoni wind farm



Butoni wind farm (cont.)

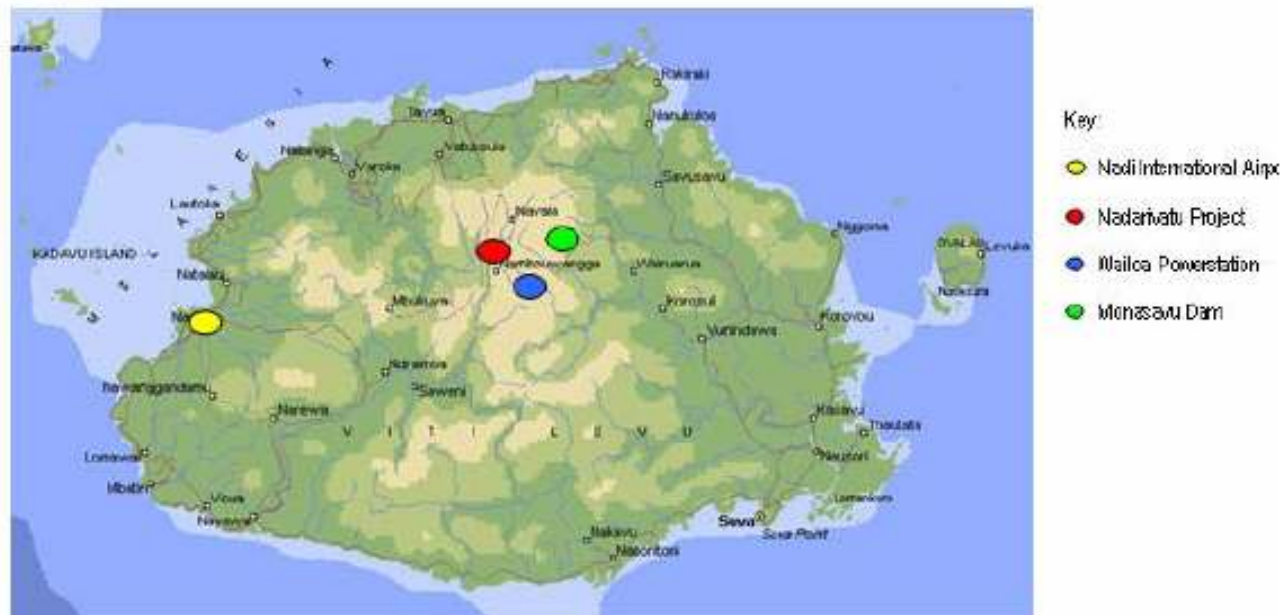




FEA's Plans for the future

- The 40 MW run-of-the-river Nadarivatu hydropower scheme initiated in March 2009 – project under way, but costs rising (initial \$US150m, estimates now almost double this, expected completion date mid-2011)
- A 3.0MW Biomass plant Deuba and a 2.8 MW biomass plant planned for Savusavu are on hold

FEA hydro locations – Viti Levu



Source: FEA Nadarivatu Renewable Energy EPC Project Report Description 29 Jun 2007, MWH



Independent Power Producers (IPPs)

- FSC: In 2006 it had two bagasse-fired thermal power plants at the Lautoka mill, capable of producing ~17MW at capacity, and 10MW generation capacity at the Labasa mill.
- In 2008, there were plans to build 20-25MW stations at the Lautoka and Rarawai mills.



IPPs (cont.)

- Tropik Wood: an older 3.3 MW hog fuel-fired plant at Drasa still exists
- New 9.3 MW plant in place.
- Plans to build a 20MW power plant at Qeleloa, Nadi.

Tropic Woods - old power plant



Tropic woods – new 9.3 MW power plant





Rural energy needs – (FDoE)

- **Sustainable Energy Financing Project (SEFP)**
- An FDoE/ANZ/World Bank project launched 18 Dec 08
- to finance solar PV, pico-hydro, biofuels (coconut oil) for individual households, micro-small businesses, and energy sector suppliers
- part of World Bank Sustainable Energy Financing Project, funded by the Global Environmental Facility (GEF)

Eg of pico-hydro – Savu village, Naitasiri



Pico-hydro: the turbine-generator system



Pico-hydro: showing Pelton Wheel turbine and jet



Pico-hydro: storage batteries





6. Energy production and consumption – other PICs

- Large variation in the energy consumption, generation capacity and renewable sources
- Comparison of energy production and consumption in selected PICs
 - source: JICA survey June 2009 (A1P JR 09-009)

Total annual energy production and consumption in selected PICs

Country	Popln/ GDP	Total power (MW)	Energy use per cap(kWh)	Cost of power (\$A/kWh)	Energy efficiency (Wh/GDP)
Nauru	10,000/ \$A37m	5MW (2008)	2100 kWh	0.30	569
Kiribati	94200/ \$A120m	5.45 MW(2008)	210 kWh	0.37	164
PNG	6m/ \$US4600m	551MW	130 kWh	-	170
S.I.	500,000/ \$US360m	25MW	60 kWh	-	83
Samoa	180,000/ \$US450m	35MW	630 kWh	0.26	251
Fiji	850,000/ \$US2223m	190MW	916 kWh	0.12	345



7. Potential for RE utilization in the PICs

- Need
 - energy resources
 - institutional and human capacity, policy-making capacity
- Consider RE resources of selected PICs

Renewable energy resources of selected

PICs

Country	Geog	Solar (kWh/ m ² /day)	Wind	Hydro	Biomass /fuel	Geothermal	Ocean
Nauru	21 km ²	Yes (5.8)	? PIGGAREP (May09)	No	No	No	No waves - OTEC
Kiribati	32 atolls	Yes (5.7)	No – atolls	No	CNO (5500Mton)	No	No
PNG	mount aneous	Yes (6)	Yes – 19 sites	Yes (1400MW)	Timber, palm oil	Yes (1 station)	No
S.I.	6 volc.Is	Yes	No data	Yes (JICA 330MW)	CNO	Maybe	No
Samoa	2 volc is	Yes (6)	~ 3m/s	Yes (issues)	5%CNO blend	No	No
Fiji	2 volc	Yes	Yes - Butoni	yes	Timber, CNO	?	?



Renewable energy resources of selected PICs (cont.)

- Solar energy depends on the latitude – PICs close to equator so all have solar
- Wind – low, unknown
- Hydro – needs mountains and rain – PNG, SI, Samoa, Fiji (all volcanic)
- Note difficulty of hydro in SI
- Biomass – geography and climate – atolls can have CNO (Kiribati)
- Geothermal – PNG 52 MW (Lihir gold)
- Ocean energy – no!!



Human capacity – what we need and what we have

- The many tiers of human capacity requirement
 - Operators and technicians – RETs deployed all over the region
 - Engineers and middle managers
 - Policy and decision-makers
 - Trainers for all of above



Building human capacity- what we have and what we need

- Need Bachelors degree/ Diplomas/short courses for upskilling decision-makers for the whole region
- USP – BSc with RE emphasis (needs more staff and lab space)
- FIT's new Diploma in Renewable Energy Technologies (RETs).
 - Units offered are *Introduction to RETs, Biomass and Hydropower Systems, Photovoltaic Power Systems, Hybrid Power Systems, Wind Turbine Systems.*



Our consultancy dependency

- Large RE projects invariably given to overseas consultants – lack of regional personnel of sufficient calibre
- Need to breed the required cohort of regional consultant-level personnel
- Requires both training and experience



8. The Way Forward

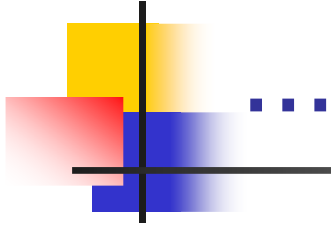
- What is lacking is not only human capacity but knowledge capacity and policy development capacity
- Regional organisations such as SOPAC have been partly fulfilling this role so far
- Need the capacity to combine information, understandings to produce sound policies



The way forward (cont.)

- *We need a policy incubator, that inputs information and understandings, and outputs sound and considered policies for the leaders of the region to adopt.*

***We need an Institute of
Energy***



Thank you
for your attention!