

## **Renewable energy: a renewed approach to sustainable development – a natural source of empowerment for the Pacific Islands**

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### **Introduction**

*Although scientists cannot account for the origin of energy and matter or why the total energy is conserved, the Bible offers an explanation. God alone can truly create. Man can only re-fashion pre-existing materials. Since God has ceased from his creative works, energy can no longer be created. The reason energy cannot be destroyed is because God is “upholding all things by the word of his power”. He preserves and keeps in store his creation (Huse, S.M. 1996. 'The collapse of evolution', 2E. p.76 Michigan, USA)*

Energy is defined as the ability or capacity to do work. In the first law of thermodynamics, ‘energy can be converted from one form into another, but it can neither be created nor destroyed. For example, the heat from your cup of coffee is energy converted from electricity energy that is transformed from hydro energy produced by the hydroelectric power (HEP) plant.

The UNDP (2000) in its world energy assessment report define *renewable energy* as the 'energy obtained from the continuous or repetitive currents of energy recurring in the natural environment'. In other words, it is energy that can be used or utilized over and over again and is found naturally. Sources of renewable energy include traditional fuel like firewood, forests, coconut husks that are termed biomass or biofuel; hydro energy from the HEP plant. Solar energy is energy obtained from capturing the heat of the sun. Wind energy is energy derived from the velocity and speed of wind and similarly, wave energy is energy captured from the velocity, magnitude and amplitude of the ocean waves.

### **Primary energy consumption**

What and how much *primary energy* is consumed in developed and developing countries would help us understand why energy is important in every day living.

The graph above shows developing countries consume 22% of biomass fuel as primary energy compared to the developed countries that consume five times less. Recent studies clearly indicate that the use of biomass and coal as primary sources of energy for indoor and outdoor cooking and heating homes during winter are the main causes of primary and secondary health hazards. These hazards include cancer – lungs, liver, abdomen; asthma and asthma related, cataracts and blindness, and respiratory problems especially among women and children (Baird, 1999). These effects are worse amongst the rural poor and impoverished especially in developing countries. On the other hand, the utilisation of hydro energy in the developing countries is a step in the right direction.

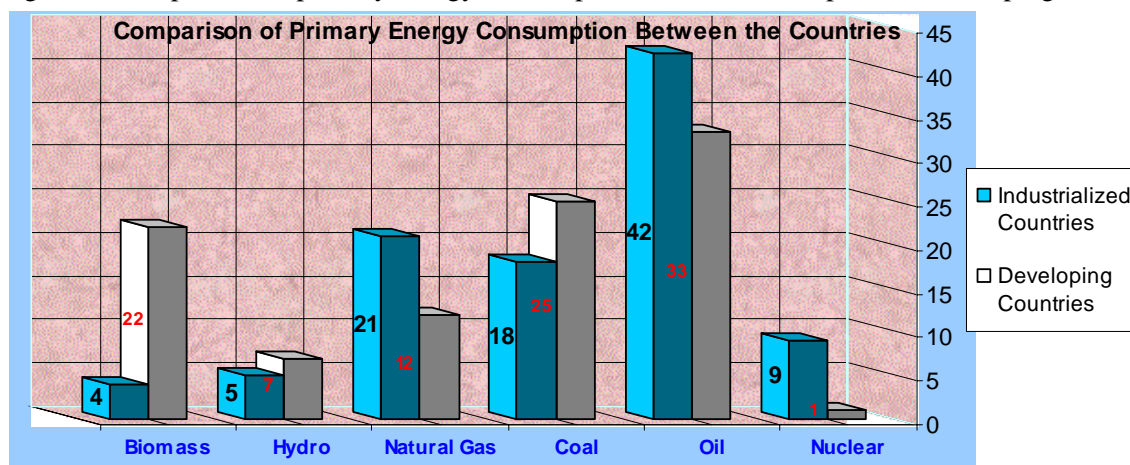
Natural gas is an example of clean and modern energy. The isolation of developing countries from the advantages of technology restricts the availability and use of natural gas and

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liquefied petroleum gas for transportation in the developing world. On the other end of the spectrum, coal, an unclean but widely available source of energy, is still in use by larger third world countries like China, India and south east Asia.

Figure 1: Comparison of primary energy consumption between developed and developing countries



Oil, the more popular non-renewable energy source shows continual growth and leading primary energy consumption. However, world leaders predict that in the next decade or so developing countries will lead in oil energy consumption.

### Why is energy important?

#### *Worldwide*

Why energy is imperative to our livelihood anywhere in the world will help us define a more definitive approach to sustainable development that applies to our region given the current climate change discourse.

Energy is important to us because it gives us the means to sustain and control our survival. Throughout the world, two billion people do not have access to electricity and an additional two billion have access to unreliable electricity (UNDP, 2000). Samoa and Fiji are examples of countries that have unreliable electricity mainly because they have little control over the climate, their isolation which makes it difficult and expensive to import the technology to sustain electricity.

There are two billion people that cook using traditional fuels like firewood, or biomass especially in the rural areas. Studies have shown that the use of traditional fuels in developing countries has led to health problems such as mutagenic and carcinogenic related sicknesses (Baird, 1999). It has also shown that women and children are more at risk and many lack the medical facilities and expertise to cure or solve these problems.

#### *The Pacific Region*

A report by the Small Island Developing States (SIDS) to the UNFCCC at the Earth Summit (UNDP, 2000), stated that the Pacific region together with other small islands around the world (Caribbean islands...etc) were the most vulnerable to the effects of climate change although their contribution to global greenhouse gas emissions are but a tiny fraction.

The effects of climate change on the region include cyclones and droughts that are now occurring frequently. Sea level rise would result in coastal land inundation. But the full

impact and implications of sea level rise would be felt more by atolls and low lying islands termed as 'sinking islands'. This can have an impact on social issues such as land conflicts and social disruption in society creating chaos and panic, not to mention the effect on the economy and political uproars.

### **Sustainable energy**

The UNDP and World Energy Council (2000) identified the importance of sustainable energy needed to 'half the number of people living in poverty by the year 2015'. The United Nations define sustainable energy as the energy that is 'produced and used in ways that simultaneously support human development over the long-term in all its social, economic, and environmental dimensions (UNDP, 2000). Sustainable energy therefore not only refers to a continuing supply of energy, but to the production and use of energy resources in ways that promote – or at least are compatible with – long-term human well-being and ecological balance.

### **Characteristics of renewable energy**

In order for any country to apply and achieve renewable energy island (REI) status, it must be able to achieve two important features. That is, renewable energy must be *modern* and *clean*. The former is important in order to overcome poverty while the latter serves to make the air cleaner and healthier thus helping to mitigate the impacts of climate change.

### **Renewable energy islands (REI)**

Faeroe Island, Denmark became a REI because the only energy source in the islands is wind energy, supplying 100% electricity. A renewable energy island is 'an island that is 100% self-sufficient from renewable energy sources, including transport' (Jensen, 2000)

#### *Why islands?*

Islands have the unique potential for renewable energy compared to big landmasses like the US, China and Russia. Many islands for instance, show the right attitude towards renewable energy on the political level, because of the threat of global warming and climate change. Samoa, Fiji, Cook Islands, New Caledonia, Northern Mariana Islands and more have shown great interest in investing into renewable energy projects. There is a strong interest in changing present unsustainable energy patterns to more sustainable patterns. The near absence of fossil fuel resources on islands has prompted governments to invest in cheaper, cleaner and modern alternatives like renewable energy.

Islands are highly visible laboratories for technology. It is open to energy factors like wind, wave, geothermal, hydro and solar. Already, islands like the Cook Islands, Tuvalu and Samoa have undergone preliminary and feasibility studies into wave and wind energy resources.

On the other hand, the fundamental problem that lies with most islands is that their resources have not been fully explored or tapped into. Many islands have no funds allocated for these new REI projects. There is limited or no technology, nor any regional or government support. Another main reason for the laggard attitude towards the renewable energy approach is the expensive and environmentally problematic fossil fuels that are the only energy sources that are heavily relied upon.

### **Finding potential REIs in the Pacific - case study: Samoa islands**

#### General Information:

- Population (1998) - 174,800
- Land area - 2935 square kilometres
- 99% land area on Upolu & Savaii Islands
- About 2/3 of the population live on Upolu
- Location -: between 13° 25' and 14° 05' S and 171° 23' and 172° 48' W

#### Main source of energy: biomass

- Total Energy Consumption:
  - Biomass: 65% (fuel wood and coconut residues)
  - Petroleum / Electricity: 35%
- Electricity Generation: > 50% HEP supplied
- Mineral Resources / hydrocarbon sites: NIL
- Solar Energy: limited use (to heating water)

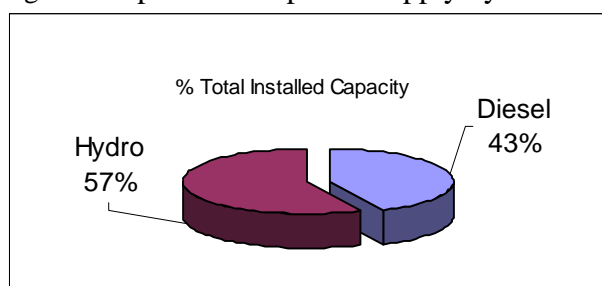
#### Upolu Island

Catered with two sources of electricity supply

- Diesel Oil - maximum capacity: 8.5 Megawatts (or million watts)
- Hydro energy - maximum capacity is 11.4 Megawatts

As shown in Figure 2 power supply for Upolu is approximately 60% hydro and 40% diesel

Figure 2: Upolu island power supply by source 1997



#### Savaii Island

Catered with one source of electricity supply

- Diesel oil - maximum capacity is 2.7 Megawatts

#### Energy sources

Table 1: Capacity vs production

	Renewable energy = hydroenergy	Non renewable energy = diesel
Capacity (how much it can take in)	60%	40%
Production (how much it can give out)	40%	60%

Data in Table 1 shows that although the renewable energy source can take in approximately 60% of the energy to supply, it can only manage to produce 40% of total electricity

throughout the island. The expensive and environmentally polluting diesel with a total percentage capacity of 40% cater for 60% of electricity needs. 40% production by the hydro energy (renewable energy) is made up by the existing Afulilo dam that produces 4MW and five other 'run-off-river' hydro stations - with a total production of 7.4 megawatts. Altogether they produce only 40% electricity.

### **Operation 'REI Samoa'**

If Samoa were to initiate actions to become a renewable energy island (REI), actions include:

#### Potential RE project: Sili hydro hybrid project

Initial planned capacity: 4 MW hydro station - feasibility study completed (funded by the Japan Aid, [Jensen, 2000])

- -Location: Sili River, south of Savaii island
- -Target consumption: 100% electricity supply for the big island, Savaii
- -Potential capacity: >8 MW hydro station
- -Potential target consumption: 100% Savaii, Manono, Apolima and eastern part of Upolu Island supplied
- Problem: customary land ownership issues, land conflicts, limited funds, limited technology, no REI policy

#### Potential benefits - if mission 'operation REI Samoa' accomplished

If Sili hybrid-hydro project is a success: it would yield,

- 100% energy consumption from RE source
- Reliable electricity for the 4 main islands
- 70-100% hydro supplied, 0-30% diesel supplied
- Diesel costs drop, less pollution
- Become self-reliant and self-sufficient
- A sense of self-empowerment
- Well-established renewable energy policy - Pacific friendly policy for sharing
- Lead the region in renewable energy accomplishment and economic self-reliance and energy self-sufficiency

The fundamental problem that Samoa faces like most Pacific island countries is the lack of a comprehensive policy in place although there was assistance from SOPAC to initiate the development of such a policy (Jensen, 2000). Lack of funds has contributed to the unsuccessful completion of sustainable energy projects in a number of Pacific island countries as was the case with Kiribati and Tuvalu.

Islands in the developed countries have led the way into becoming REIs because of the availability of modern technology and sound policy measures provided by the government, for example, electricity production on the island of La Desirade of France is supplied by 100% wind energy. Samsøe Island (Denmark) and Pollworm (France) utilises the same source of energy (see Figure 3).

Leading the way in hybrid hydro and diesel electric power plants in the Pacific region is Fiji Islands and together with the Cook Islands, Solomon Islands, Tuvalu, Tonga and Samoa have taken the initiative to become REIs (Jensen, 2000). However, modern technology remains a challenge for islands of the region, and will be ineffective unless the decision-makers at the

political level are convinced of the economic and environmental benefits of renewable energy.

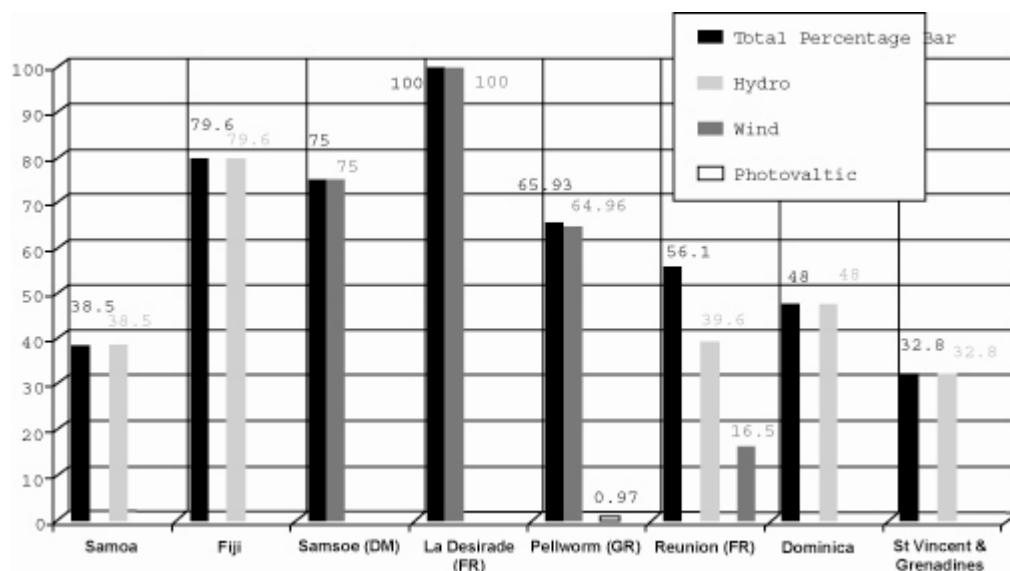
### Conclusion

Energy is important to us because it gives us the means to sustain and control our limited natural resources. Hence, sustainable development objectives and criteria should be clearly defined and practicable. All islands in the world have a unique potential to be the world-premier in renewable energy for self-reliance and self-sufficiency. However, there is a need to be vigilant, cautious and attentive to solutions both local, regional and at the international level.

Samoa which has empowered itself economically in its initiative for economic reform in the Pacific region through its policy action, can further boost this empowerment by becoming a renewable energy island, through a similar positive system. In order for small island states to take it to the regional level, there must be assistance and consensus amongst the island states on capacity building and expanding comprehensive policies to benefit the region as one. Therefore, funds received from developed countries plus assistance from the private sector in each island state should enable access to technology and establish a reality of reaching a renewable energy island status with mutual understanding and help from each other.

Once energy is re-fashioned to suit our survival and well being, sustainable development can be greatly boosted. A sense of natural empowerment is again maintained in the islands as well as the region, and most of all, lead the way to helping others help themselves.

Figure 3: Total percentage of electricity production and renewable energy sources



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