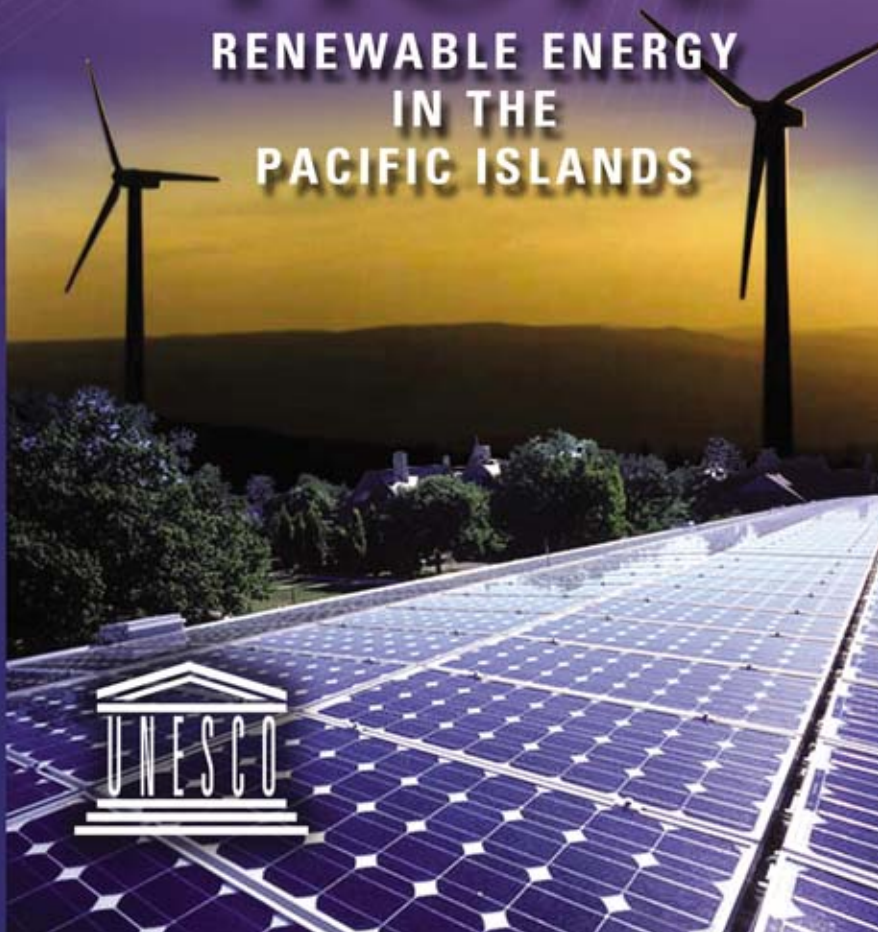




RAYS OF HOPE

RENEWABLE ENERGY
IN THE
PACIFIC ISLANDS



RAYS OF HOPE

Renewable Energy in the Pacific Islands

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Text by Dale Hermanson

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PREFACE

It is now generally accepted that the use of hydrocarbon fossil fuels has led to global warming, climate change and sea level rise. Sea level rise is nowhere more threatening than in small islands, and Pacific island countries have been at the forefront of efforts to address global warming and climate change both at the international level and in the use of renewable energy to reduce dependence on and the expensive importation of hydrocarbon fuels.

Major international agreements on climate change and reduction of greenhouse gas emissions crucial to the Pacific islands include the 1992 UN Framework Convention on Climate Change, 1997 Kyoto Protocol on Climate Change and the Global Environment Facility. There was also the call by the UN Secretary General in the Millennium Report for a Clean Development Mechanism to reduce global warming and promote the use of solar and renewable energy. While there was no agreement on timetables and targets for increasing the use of renewable energy at the World Summit on Sustainable Development in Johannesburg, 2002, it was agreed that there is a need for regional and national targets for renewable energy – which will hopefully benefit the Pacific islands and other small island developing states.



Walter Erdelen
Assistant Director-
General for Natural
Sciences, UNESCO

The production of 'Rays of Hope: Renewable Energy in the Pacific Islands' is therefore a timely contribution to information and advocacy in the promotion and innovation of renewable energy in small island states. 'Rays of Hope' tells the story of renewable energy in a region which served as a laboratory for the trial of RE technology, where countries stand a real chance of becoming the first 'renewable energy economies' in the world – which is the aim of several countries of the region. Even if the Pacific islands achieve 50% energy self-sufficiency, this will compare favourably with the proposal, not agreed at the WSSD, for an increase of renewable energy use to 10% of total primary energy supply by 2010.

Pacific islanders have been using renewable energy ever since they sailed into and around the region on wind power, cooked with biomass, dried crops under the sun and now, with international cooperation, are applying RE technologies in hydropower, for solar electricity generation, water heating and pumping, improved cooking stoves and use of coconut oil as diesel fuel – which Tony Marjoram tells me gives a sweet smell to travel. These examples again show us that the Pacific islands should serve as an example and stimulus to us all.

FOREWORD

Climate change, global warming and sea level rise have a real and immediate importance in small island states – indeed, sea-level rise in Pacific island countries has become an indicator of global warming and climate change. International agreements on climate change and greenhouse gas emissions are crucial to the survival of low-lying Pacific islands, their peoples and cultures.

Pacific island countries and communities are highly dependent on imported

hydrocarbon fuels – diesel, petrol and kerosene for generators, engines and cooking – often the largest single import in financial terms. Limited energy resources and applications pose serious constraints and barriers to sustainable social and economic development, particularly in rural areas and outer islands. There is an important need to address the energy challenge, which in turn presents particular opportunities for renewable energy applications. Renewable energy has also been promoted for poverty reduction around the world – while this potential exists, there is a particular need for financial systems to support the introduction of expensive household systems if renewable energy is to benefit poor people.

A focus on advocacy, information and communication, applied research and development, education and training as well as micro-credit and finance is required for the continued promotion and innovation of solar and renewable energy. The gender dimension of energy supply and use is also required as is the promotion of solar and renewable energy – the ‘fuel of the future’ – to young people. At the wider level human-resource and institutional capacity-building in governments and governmental agencies, financial institutions, non-governmental organizations, local entrepreneurs and



Tony Marjoram
Basic and
Engineering Sciences
Division of UNESCO

the private sector is required for the continued innovation and commercialization of solar and renewable energy, especially in rural and remote areas.

In the last decade, annual meetings of the Pacific Islands Forum, island leaders have consistently advocated measures to address the challenges of greenhouse gas emissions, global warming, sea level rise and promotion of sustainable development, and emphasised the importance of renewable energy technologies as an

effective means of addressing these problems, both domestically and internationally. At the July 2002 Regional Energy Meeting in Rarotonga, Pacific island states again welcomed the progress made on the innovation of renewable energy, and called upon the international community to set effective targets and timetables within the implementation plan of the (then forthcoming) WSSD in Johannesburg to achieve a significant increase in the use of renewable sources of energy.

Few doubt the important role that renewables will play in energy supply 100 years, 50 years or even less from now. While there was no formal agreement on timetables and targets for increasing the use of renewable energy at the WSSD, the challenge is to mobilize political commitment and move from now into the future with the application of renewable energy for the benefit of Pacific islanders and the world at large. The Pacific islands are leading the way – the rest of the world should be humbled by this and follow their role.

UNESCO would like to thank all those in the Pacific and elsewhere who have contributed to the production of ‘Rays of Hope’, and acknowledge the commitment of all those around the world who are reaching for a renewable and sustainable future.

INTRODUCTION

From the beginning, energy came from nature. In the Pacific – as elsewhere in the world – the use of nature's energy enabled people to survive and to flourish.

Today, Pacific islanders are learning that energy from nature may also be their hope for a better future.

History of Renewable Energy in the Pacific

In traditional times, firewood provided the main energy source for cooking in the Pacific. We now call this energy source 'biomass.' Biomass was easily available and – for the people in those days – the supply seemed endless.

For transportation, energy was provided by the wind. Pacific islanders sailed their great vessels across hundreds of thousands of kilometres of ocean for exploration, trade and even war.

Light was provided in some islands by traditional oil lamps or fires.

New Energy Sources

After the coming of Europeans, the Pacific islands began to change dramatically. One new development was the introduction of different sources of energy. The biggest change was the introduction of petroleum-based products to fuel the growing numbers of cars, trucks and boats for transportation.

Electricity too was powered by *fossil fuels*. Huge generators were brought in that provided much-needed electricity

but they in turn created pollution and caused waste disposal problems.

Environmental Concerns

Beginning in the 1960s, concerns worldwide began to grow about the pollution caused by petroleum-based products. The long-term effects of oil spilled into the ocean during transportation or seeping into the soil after its use, became a great worry to those concerned with the environment and health. Especially in the Pacific islands, where resources are so limited and the coastal environment so fragile, the potential for disaster was frightening.



Coral Pasisi – SPREP

'Even though it's a very minute possibility, there's always the possibility of an oil spill. We in the Pacific really don't have the ability to recover from something like that.'

In the 1970s scientists began to notice that the ozone layer in the earth's atmosphere was gradually being eaten away by the so-called 'greenhouse gases'. And this was causing the Earth's atmosphere to heat up.



Taito Nakalevu – SPREP

'The burning of fossil fuels releases gases like carbon dioxide and nitrous oxide into the atmosphere and they contribute to what are called 'green house gases.' These are gases that actually trap the heat in the atmosphere and contribute to what is termed global warming.'

The situation is called *the greenhouse effect* because of the way gases are trapped within the Earth's atmosphere is similar to the way the Sun's rays are trapped in a greenhouse to keep plants warm.

This greenhouse effect is brought on by large amounts of carbon dioxide and nitrous oxide being released into the atmosphere during years and years of burning fossil fuels – mainly by the larger metropolitan countries. And, just like a greenhouse, temperatures around the world are rising as a result of these trapped gases.

Global warming has been blamed for many environmental problems in recent years – droughts, floods, increased tropical cyclones, and a steady rise in the sea level. For example, atoll countries like Tuvalu have great concerns with sea level rise. With even a small rise in sea level, they may not have a country at all. This is a tremendous loss, not only of biodiversity in that country, but of the whole culture and the sovereignty of a people.

But the island countries' reliance on fossil fuels is not just an environmental concern. It is an economic concern too, because countries rely on a steady supply of fossil fuels to assist in the development of their growing economies. Fossil fuels provide electricity and electricity helps fuel development, particularly for the mainly rural Pacific island people.

If people don't have access to electricity, small-scale income generation projects become more difficult. Especially in the rural areas, income generation projects are usually successful only when people can work in the evenings, because during the day most villagers are busy earning a living. They're either gardening, fishing, building boats or engaged in other activities.

Because of the cost and difficulty of transporting fossil fuel to some of the isolated islands of the Pacific, many rural communities *still* have no access to electricity.



Robert Guild – FORUM Secretariat

'The current situation in the Pacific islands is that, on average, 70% of the people have no access to electricity at all. And that 70% even is a bit misleading, because outside of the urban areas, it's close to 100%.'

Discussion Points – Part 1

- 1) Before Europeans and others came to the Pacific, what were some of the traditional energy sources for Pacific islanders?
- 2) Were the new energy sources brought from overseas better or worse? Why?
- 3) How does using energy lead to the greenhouse effect?
- 4) Can you notice any effects in your country from global warming?

Energy Dependence

Reliance on fuel for electricity has created a dependency in Pacific Island countries – a dependency that carries risk for their economies. Small island countries have little or no say over the price of oil on the market. When oil prices rise, island economies have to somehow adapt. And when there is a disruption in the supply of oil, island countries are often left with nowhere to turn.

That lack of control became painfully obvious in 1973 with the Oil Embargo. Many oil producing countries slowed their production of oil, claiming that their supply was running out. Suddenly the supply of oil on the world market was uncertain. Prices skyrocketed. Most national economies are based on industries that rely directly or indirectly on electricity and transportation.

The economic development of Pacific island countries has been helplessly hand-cuffed to the regular supply of affordable oil and the reliance on oil for the supply of electricity. With a disruption in the supply of oil, countries in the Pacific – and throughout the world – had to look at other sources of energy – *renewable* sources of energy.

Renewable Sources of Energy



Mahendra Kumar – USP
'Renewable energy is actually natural. It's part of the current as it were in the environment and what one does is basically tap into this current. For example, solar energy is coming through all the time. When a solar device is actually used to harness energy, we are not depleting energy. We are just merely tapping into the current already in the environment.'



Anare Mataikiviti – SOPAC
'Many of these countries have actually realised that renewable energy is something that will take them right out of the noose of depending on petroleum products.'

Renewable energy is a source of energy that nature replenishes. For that reason, the long-term benefits are obvious. The source of the energy is provided free by nature. It is only the technology to harness this energy that will cost money. Renewable energy sources include wind, sunlight, waves, bio-gas, thermal energy and bio-mass or firewood – as long as its supply can be sustainable.



Tony Marjoram – UNESCO
'If you go to the future and look back in a 100 years around the world, renewable sources have to be more used because conventional sources of energy will be running out. So, in situations where conventional fuels are expensive, renewable energy alternatives are very viable.'

But whether it is supplied by expensive fossil fuels or alternative sources of energy, the primary need for energy in the Pacific islands is the supply of electricity.



**Solomon Fifita –
Pacific Community**

'I don't see people in the remote areas developing without a source of electricity, and renewable energy systems offer the most cost effective source of electricity for them.'



**Herb Wade –
Energy Consultant**

'The Pacific is a place where renewable energy makes good sense. It has a high solar resource, a remote population and very low requirements for electricity. It was obvious from the beginning that even though solar was relatively costly, it was more costly to use other forms of energy.'

Renewable Energy in the Pacific

In the late 1970s and early 1980s, the eyes of the world turned to the Pacific as a 'testing ground' for trying models of renewable energy.

The potential of renewable energy was recognized early on. If countries move towards becoming 100% renewable, then they will no longer need to import diesel as a fuel for generators. The countries can then spend more money on other development needs such as education and health.

Types of Renewable Energy

Many different forms of renewable energies were introduced in the Pacific. The islands became a kind of 'laboratory' for the developed world to see if renewable energy sources would work. The most widespread source of renewable energy is still 'bio-mass' which is the use of wood for cooking and heating.

Another form of renewable energy used in the Pacific is *bio-gas*, which uses the excrement from pigs or other animals in a sealed chamber to produce methane gas. This methane gas can then power a generator to produce electricity or for cooking.

Most of the main renewable energy sources available today are in use in the

Pacific or are planned for use here. These include:

- solar energy from photovoltaic electricity generation
- solar water pumps for pumping water
- solar water heating
- wind turbines to generate electricity
- coconut and other plant oils for use in diesel engines. (This can be used for transportation or running diesel generators)
- wave energy is another source that is still experimental in the Pacific. It is more likely to be used in the future rather than now
- ocean thermal energy conversion or OTEC is another new energy source
- hydro power plants that can run from an average stream
- hydro power projects on a much larger scale

Renewable energy made sense to everyone, especially in the Pacific islands. But implementing projects that would be successful in the difficult conditions in the islands was not always easy. Early experiments in solar energy, for example, met with mixed success.



Herb Wade

'The initial experience was not very good, because the technology was not well understood and many of the components had a relatively short life. The very early systems didn't even last long enough to require any maintenance.'

Gradually, the technology improved. And yet, other problems began to surface as new renewable energy projects were introduced. These problems were generally due to a lack of understanding by people on how the technology worked and how to maintain things such as batteries. These early experiments led to a realization that there was a lot more to making these systems work than just improving the technology.



Tony Marjoram

'There has to be a social and economic aspect when you're introducing new technology like this. People have to want it. People have to recognise their need for it. And also there has to be some training in terms of maintenance of the system.'

Another learning experience when introducing this new technology into the region was the need for close consultation with the local people, and that included the women. In many Pacific societies, the main end users of energy are the women.



Suliana Siwatibau – FSP

'In terms of electricity, men and the women share the benefits. But, it's usually the men who make the decision. How do we get the women's voice to be more prominent? We need to facilitate the empowerment, so that everybody begins to listen to women in decision-making.'

But as technologies continue to improve, why aren't more renewable energy projects succeeding? What lessons are being learned?



Marlene Kalmet – PREFACE Project

'In a lot of projects in the past they've looked only at the technical specifications. Well, technology driven or donor driven, it finishes right after installation. What about the institutional part? Is the capacity of people at the national and community level improving to assist in the project's sustainability?'

The methods for managing renewable energy projects and understanding socio-economic considerations are becoming better recognized. The importance of the 'human element' in renewable energy projects has now become even more important than the technology. The Pacific now appears to be entering a '*second wave*' of renewable energy development, one that points to a fairly bright future.

Discussion Points – Part 2

- 1) What is one drawback of being dependent on other countries for your energy supply?
- 2) What sources of renewable energy would work in your island country? Why?
- 3) Why do you think many of the early experiments in renewable energy failed?

SAMOA

The Pacific island country of Samoa has two main islands with just over 1,000 square miles of land. The country has a total population of just over 225,000 people. Like other island countries, Samoa's primary energy need was for electricity. And like other countries, much of its national economy was spent purchasing fossil fuels.



**Jolai Lavea –
Deputy Financial Sec.**

'Historically, Samoa has been getting its power from diesel and with the cost of imported fuel, about 12 to 15 % of our total imports are constituted by petroleum. So that's a lot of resources going out to pay for petroleum.'

With such a high fuel bill for the country, Samoa's leaders looked beyond fossil fuel sources of energy and began to examine renewable sources. Because of its mountainous geography and plentiful rainfall, the capital island of Upolu was well suited for a medium-scale hydro project. A dam was set up in Afalilo to

feed a hydro-electric power plant. This renewable energy project came online in 1993.



**Joseph Walte –
Deputy G.M. ECS**

'When Afalilo first came online, the ratio was switched from 20% hydro and 80% diesel to 80% hydro and 20% diesel. I think we would love to see 100% hydro ratio but that's a bit optimistic.'

Because of less reliance on diesel fuel as an energy source for electricity, less money travels out of the country. And this allows the government to increase the availability of electricity. Currently, nearly 95% of the population have access to electricity. But the government is planning to introduce another hydro project, this time on the island of Savaii.

But large-scale hydro projects do not come cheaply. They require a large amount of funding up front even before the first kilowatt of electricity is ever produced. Despite the large initial set-

up costs for hydro projects, the government of Samoa sees renewable energy as a long-term solution for its growing energy needs.



Jolai Lavea

'If we can generate our electricity 100% from hydro, we will reduce the burden of foreign exchange required to purchase imported petroleum and also there's the environmental considerations.'

Solar energy and wind power also have potential in Samoa. Currently, solar power is used mainly on private homes for hot water, and in more remote areas for radio repeating stations. The Samoa Electric Company also feels that wind has potential for future development as an energy source, but there are a number of steps that need to be taken before such an option can be considered viable.

But for both of these renewable sources, leaders in Samoa are keeping their eyes and ears open. For a renewable energy source to be considered, it must be commercially viable. Its purchase cost must be weighed against its operating cost to see how cost effective it would be.

Discussion Points:

- 1) Why is hydro power considered to be a renewable source of energy?
- 2) Other than providing energy, how does using renewable sources of energy benefit island countries?

KIRIBATI

The island republic of Kiribati is one of the Pacific's small atoll countries. Approximately 85,000 people are scattered across 33 islands. Rough seas or storms sometimes make transportation between the islands difficult. On the main island of Tarawa, electricity is primarily provided by diesel generation. Because of population growth and other increases in demand, the need for electricity grows approximately 5-6% every year.

The Kiribati government recognised that economic development in the outer islands was in many ways tied to the regular supply of electricity. And so, in 1984, the government established the Solar Energy Company. The early experiences of the company though involved a number of problems.

The frequent failures of their solar systems led people on the outer islands to turn back to small diesel generators for their electricity needs. The Solar Energy Company realised that, if solar energy was going to work, it had to change its approach. The company decided to hire and train local field technicians. These technicians not only assisted with the set up of the solar lighting systems, they also regularly maintained them.



**Rutete Ioteba –
Solar Energy Company**
'When it was first established, we just sold the solar equipment to the people in the outer islands. They installed their own system and they maintained it. But because they were not fully aware of the technology, we found that in most cases these systems did not last long.'

The Solar Electric Company charges a monthly payment that helps pay for the maintenance of the system as well as the replacement any defective component. The same technicians that maintain the solar systems also operate as bill collectors, collecting the monthly fee for the company.

The introduction of a reliable source of electricity in the outer islands quickly changed the lifestyle of the people.



Abamakoro Villager

'My grandchildren are in school and they use the light to study and carry out their programme in school. Some of our neighbours don't have solar and they come to our house to talk and have a meeting in this house because we have a light.'



**Terubentau Akura –
Solar Energy Company.**

'After the implementation of the rural electrification project in Kiribati, we have seen that people's lives have changed for the better. The majority of the population in Kiribati need basic lighting and probably a radio. As their income increases, we tend to see people add more appliances.'

Rural schools and students also benefit from the availability of solar powered lighting. Students are able to study longer and have other activities in the school. Rural health centres also benefit from solar power. The solar panels provide power for lighting and for the running of a small refrigerator, which is used to store perishable vaccines. In this way, solar power provides the means for the regular immunization of children in the rural areas.

Solar panels are also used to power remote radio-telephone sites in Kiribati. This makes it much easier for rural people to stay in communication. This again increases their opportunities for income generating activities. But why has Kiribati's Solar Energy Company worked, where in other island countries solar power projects have floundered?



Terubentau Akura

'We have the project planned in a way that the local people are leading the project rather than foreign consultants. This means that they know exactly what is to be done rather than being told what is to be done.'

Despite their self-reliance in operating the solar project, Kiribati still needs financial assistance in expanding their current set-up. Because of the high initial costs for establishing renewable energy projects, international donors are often sought to provide the necessary start-up funds.

In Kiribati, the European Union provided the necessary funds for their existing solar project. The EU is apparently satisfied that the initial project was a success. It is now providing funding for the installation of another 1,500 solar power systems for homes and 33 systems for village halls or 'maneabas'. The new EU project will increase the number of rural solar systems ten-fold. Despite this increase, there is still more demand than can be met.



Rutete Ioteba

'With 1,500 households to be electrified, we cover only about one-fifth of the households in the outer islands. There are many other households to be covered in this programme.'

By parliamentary decision, the Solar Energy Company is the supplier of electricity only to the outer islands. But in Kiribati's future, there may be even more solar powered electricity on the main island.



**Tokia Grieg –
CEO, Public Utilities Board**

'I think obviously if solar power can be more economical to run to be able to compete with diesel engine, I see a possibility of a merger between PUB and Solar Energy.'

Discussion Points

- 1) Do you think the solar power programme has worked in Kiribati? Why?
- 2) What benefits has solar power provided to the people?
- 3) Why is there still a need for overseas donors to assist with renewable energy projects?

PAPUA NEW GUINEA

The largest country in the Pacific – in both population and land mass – is Papua New Guinea. Most of its nearly 5 million people live in rural areas either in the mountainous interior or in the island groups to the east. Although it is one of the only Pacific island countries with its own oil reserves, the supply of energy still remains one of its basic development concerns.

Although it is a country wealthy in many natural resources, the regular and cost effective supply of electricity remains one of its primary energy goals. In the rural areas, only about 5-7% of the rural population currently have access to electricity. Part of the difficulty in delivering power to these people is the rugged isolation of rural communities.

As in the smaller Pacific island countries, renewable energy sources seemed best suited to address PNG's energy needs.



Vore Veve – Director of Energy

'There's a lot of potential for renewable energy, especially in hydro, solar, wind, ocean thermal, OTEC. But at the moment we are concentrating on technically and financially feasible renewable energy projects.'



Benson Milit – G.M. PNG Power

'It's unique here in Papua New Guinea because it's so difficult to get to some places. The actual cost of transportation – just moving equipment in and out of certain areas – is very expensive.'

One project that proved financially feasible was hydro. Beginning in the early 1960s a medium-scale hydro project was initiated first for the capital, Port Moresby, and then for other urban areas. Apart from the average consumers the hydro powered electricity supply has also helped fuel PNG's growing industries.



**Chris Bias –
Tech. Services, PNG Power**

‘Most major industries rely on the electricity supply. So if the country has a good, cheap electricity supply, then obviously it benefits both industry and the country as a whole.’

In addition to the major hydro projects, a number of smaller mini-hydro projects have been initiated to provide power for remote locations. To date, five such mini-hydro projects have been initiated, ranging from 60 to 312 kilowatt units.

Another example of how renewable energy has helped in the rural areas is in the area of education. At the Kivoli Primary School in the highlands outside Port Moresby, a *hybrid* renewable energy system was set up.

Hybrid means using more than one method of energy generation. In this case, wind turbines and solar panels provide an independent supply of power to a remote rural school.

Having electric lights increases the students’ abilities to study for national exams. It also allows the teachers to prepare for the next day’s work and to assist those students who need special

assistance after hours. And yet, once again, it is not the equipment that is affecting the success of renewable energy projects, but a lack of awareness of how the equipment works.



Luo Chow Sheung – Consultant

‘The people here, they don’t know much about renewable energy technologies. They don’t know how to maintain it, even in a simple way. For instance, some of the batteries, they lack water, but they don’t know how to fill the battery water.’

Another major issue in the further development of renewable energy in Papua New Guinea is problems with landowners.



Vore Veve

'We have an internal domestic problem with land, especially if you look at hydro. It covers wide areas of land so we need to consider land compensation programmes. It's a problem in our country. We need to address it in a sensitive way.'



Gario Gafiye – ATCDI

'ATCDI is conducting these short courses so that development workers at the provincial level can go out to the villages and educate people about the availability of renewable energies and how they can utilize them.'

Despite efforts to explain to the landowners how electricity benefits them, some choose to reject these benefits. The Energy Department is trying to address the misunderstandings and confusion of the rural population through an educational awareness campaign. The department sees awareness raising as a priority in making PNG's renewable energy projects work.

At the Appropriate Technology Development Institute, or ATCDI, in Lae, engineers are actively trying to educate and inform those who can bring the knowledge into the rural areas where it is needed most.

Even at University level, academics recognise that education in renewable energy is essential for PNG's future. At the University of Papua New Guinea in Port Moresby, renewable energy is still a relatively new topic on the curriculum.



Michael Korimas – UPNG

'We have to create some awareness among the people, and I think education can contribute to that.'

PNG is rich in resources and in potential. But it is also hampered by difficult challenges mainly brought on by a lack of awareness by rural people about the importance of renewable energy. And yet, efforts in PNG move forward, guided by those who recognise the fact that renewable energy must be introduced now before fossil fuels run out or increase even more in price.

Discussion Points

- 1) How do problems with landowners affect renewable energy projects?
- 2) How does a lack of awareness of renewable energy technologies affect their success?
- 3) How can awareness be raised about the importance of renewable energy in PNG?

COOK ISLANDS

Another of the Pacific's small island countries, the Cook Islands, comprises only 93 square miles, spread over dozens of small islands. The majority of the country's 20,000 people live on the capital island of Rarotonga. Unlike many of its less-developed neighbours, most Cook Islanders have access to electricity.

Solar energy was pioneered in the Cook Islands in the mid-1970s. Ten years later, Tom Wichman was sent to find out why nearly all of the solar systems had failed. He told one unhappy solar user that he could fix his photovoltaic system if he brought him a bush knife.

led to the failure of the renewable technologies. Learning from those experiences, the Cook Islands government continues to forge ahead with new renewable energy projects.



Tom Wichman – Consultant
'He brought the bush knife and gave it to me reluctantly. There was a banana tree growing beside his house right over his solar panel so I whacked it down. I said "Now it's working. Go and have a look.'

These early Cook Island experiences once again showed that in most cases lack of training and lack of awareness



Mata Noorea – Director of Energy
'The government is really pushing renewable energy, mainly because the cost of fuel is going up and up. Renewable energy is very important as far as the Cooks is concerned.'

A more recent solar project on the island of Pukapuka was more successful. Another project, a wind powered grid system, will be implemented shortly on the island of Mangaia. Yet another wind powered generator will be installed on Rarotonga as a trial. These projects show that the Cook Islands government is serious about its intentions to move more strongly into renewable sources of energy.

Another quite unique energy source is also being used in the Cook Islands – coconut oil. The oil can actually be used as a fuel in a normal diesel engine.



Tom Wichman

'You can run a tractor, you can run a car, an outboard motor... if it's made for diesel fuel, you can replace it with coconut oil without doing anything to it. Most people wouldn't notice the difference except there's this beautiful aroma. When I first started it, people came around to say 'what you cooking?'



Robert Guild – FORUM Secretariat

'If you produce your own fuel from coconuts that grow within your country, you're not importing drums of diesel. In addition to that you're generating local jobs, which of course people spend within the local economy and you have a multiplier effect.'

Nearly every Pacific island country has a huge supply of coconuts available. The fact that a diesel engine runs on coconut oil shows exciting possibilities for the future of renewable energy in the Pacific.

During the 2002 Regional Energy Meeting in Rarotonga, Tony Dreaver, an entrepreneur from Vanuatu, fit a small device onto a normal diesel engine to heat the coconut oil before using it to run a four-wheel drive vehicle. The vehicle drove as naturally as a regular diesel engine and was easily able to climb a steep hill.

Mr Dreaver runs buses, taxis and other vehicles in Vanuatu, all on coconut oil. If done in a large scale, the use of coconut oil as a fuel could decrease a country's dependency on fossil fuels.

Another energy use Tom found for coconut oil is in the running of generators to power his hydroponics project. Hydroponics works on providing vegetables with water and nutrients with barely any soil. The nutrients and water must continually flow through the roots of the plants to work.

This hydroponics project, powered by electricity – but fuelled by coconut oil – is an example of how renewable energy can help improve living standards in the islands. It's another 'ray of hope' for the future.

Discussion Points

- 1) How could the increased use of coconut oil as an energy source benefit the Cook Islands and other Pacific Island countries?
- 2) What other ways could coconut oil reduce the island countries' dependence on fossil fuels?
- 3) Why did the early solar systems in the Cook Islands not succeed?

FIJI ISLANDS

With a population base of nearly 800,000, Fiji is the Pacific's second largest country. Most of the population is centred on the two main islands, which take up most of Fiji's 7,000 square miles of land. As in the rest of the Pacific, Fiji has moved into renewable sources of energy due to the high cost of fossil fuels.

In the early 1980s, Fiji began operating a medium-sized hydro-electric facility at Monasavu, in the centre of the island. It is the biggest renewable energy project in the country. Up until recently, it has been able to supply all of the electricity needs for the country.

During the turbulent year of 2000, Fiji was embroiled in a coup attempt and a widespread series of illegal takeovers and disturbances. Indigenous landowners took this opportunity to take over the Monasavu hydro facility and made demands for more compensation. Although the people involved were eventually arrested, the electricity authority learned valuable lessons for future large-scale energy projects.



Joe Mar – Chairman, FEA
'If you are going to go into new hydro sites, you involve land. If you go into wind farming, it involves land. And one of the problems is that the expectations of the landowners for compensation are very, very high.'

While Fiji's electricity authority deals with large-scale electricity supply, the government's Department of Energy is initiating smaller community projects that – for the most part – involve renewable energy. The Department of Energy has developed a plan to initiate renewable energy projects in a more efficient way by involving the private sector.



**Makareta Sauturaga –
Project Manager, Dept. of Energy**

'Our future plan is to have wide-spread implementation of renewable energy-based rural electrification. How we are going to do that is through the involvement of the private sector called Renewable Energy Based Companies or RESCOS.'

In the village of Bukuya, deep in the interior of Fiji's main island, a smaller hydroelectric project provides electricity for over 200 homes. The project shows that – even with relatively little water flow – a hydroelectric project can efficiently provide power for rural communities.

Although the Chinese government funded the system, the project is run as a cooperative. Income collected from users of the power is put back into the maintenance and upgrading of the system. The electricity produced provides lighting for homes and the school, as well as for TVs and other minor power uses.

In Fiji's rural areas, more renewable energy projects like those in Bukuya are being implemented to improve the lives of rural people. In Fiji and other island

countries, it is in the rural areas where people are most in need of the development benefits that electricity can bring.

One organization that is examining the energy needs of women in the rural areas is called *ECOWOMAN*. *ECOWOMAN* is an organization made up of women in science and technology who have a vested interest in the needs of rural women and also in issues relating to gender in science and technology.

One of *ECOWOMAN*'s activities was a UNESCO funded project that assessed available energy resources and identified the best way to provide renewable energy to the rural areas. The project then looked at the gaps between the two and identified ways of closing those gaps. One of the main goals is to determine ways to improve the lives of rural women through the availability of energy.

At the national level, the Fiji Electricity Authority (FEA) has stated that in ten years time, the company will be a 'fundamentally renewable energy company.' For FEA's chairman, the reasons for Fiji to go renewable are more than just simple economics.



Joe Mar

'I'm very passionate about this. If you're a world citizen, it's a moral and personal responsibility to look after the world in terms of the environment, and one of those things is to stop burning fossil fuels.'

To assist Pacific island countries in their quest to develop better and more efficient renewable energy models, a number of regional and international organizations provide help. One of these organizations is SOPAC, the South Pacific Applied Geoscience Commission.

SOPAC has a mandate by the regional agencies to coordinate energy programmes in the region. The organization does research and advises countries in biomass, solar, wind, ocean, wave energy, etc. SOPAC actually covers a wide range of renewable energy resources for the region.

The Pacific regional organizations have developed an *energy working group* to coordinate assistance to island countries in the development of renewable energy projects. The group coordinates various energy programmes and examines gaps in what assistance each organization provides. It then attempts to fill that gap.

The Secretariat of the Pacific Community, SPC, is another regional organization that has been involved in promoting renewable energy.



**Solomone Fifita –
Pacific Community**

'To me, the end product is whether the people are getting the service or not. It doesn't really matter how many people are involved as long as we ensure that our activities and our resources are used in the most efficient manner and complement one another.'

SOPAC and SPC convened a Regional Energy Meeting in 2002 in Rarotonga in the Cook Islands. The Meeting brought together those in the island countries who have the responsibility to oversee the development and operation of energy in their respective countries. One of the main purposes of the meeting was to finalize a Regional Energy Policy for the Pacific.



**Anare Matakaiviti –
Energy Advisor, SOPAC**

'The regional energy policy was developed taking into account what is happening in countries in the region. This regional energy policy will be a sort of beacon, a guiding light for the member countries in developing their policies.'

The development of this regional energy policy has created a framework for Pacific island countries to emulate in developing their own national policies and plans.



Robert Guild

'National energy policies set the rules by which the energy sector will be developed. And so countries find it very useful to go through the prioritization process of developing a policy, so that they know where to concentrate their resources and their activities.'

To help promote renewable energy on a national level, one of the goals of a national energy policy could be the reduction in import duty on renewable energy technology.



Tony Marjoram – UNESCO

'If you want to promote renewable energy technology, you have to make them attractive and affordable.

Reducing the duty on such things is one way of doing this.

If renewable energy technologies are lower rated, then they appear to be cheaper and are more likely to be used.'

As has been seen throughout the Pacific islands, the high cost of fossil fuels as an energy source is a strong motivating factor to introduce more renewable sources of energy. But another factor, which is possibly just as strong, is the harmful effects on the environment from using fossil fuels.

One cause of these harmful effects is the large diesel generators used in island countries to produce electricity. The waste oil from these generators becomes a waste product that is dangerous to the environment.

In Kiribati, the powerhouse on Betio generates power for most of the southern part of Tarawa. On a property near the powerhouse, a well was dug to tap into the groundwater.

It was discovered that waste oil from the powerhouse generators had contaminated the groundwater system, making the well unusable. This then becomes an environmental as well as a health issue.

A larger concern for the Pacific islands environment is the change in climate patterns from global warming. In 2001, many countries in Europe and other parts of the world signed the Kyoto Protocol. This agreement formally committed countries to abide by a structured plan to reduce their greenhouse emissions by a certain date.

Unfortunately, the United States and Australia, two of the biggest contributors to greenhouse emissions, did not sign that protocol (by the time this guide went to print). Pacific island countries have been quite vocal in their concern over this fact.



Taito Nakalevu – SPREP

'I think the call from the Pacific is for the global community to reduce their emissions of greenhouse gases, especially carbon dioxide, methane and nitrous oxide. Because we are facing the impact right now in terms of adverse impacts on our climate.'

Member states of the European Union *did* ratify the Kyoto Protocol, which gave a strong message to countries in the Pacific that they are committed to addressing the problems of global warming. In the Pacific, the island countries themselves, assisted by developed countries, appear to be leading the way in reducing their own greenhouse emissions through the increasing use of renewable energy.

But renewable energy projects are expensive. Some energy experts see an imbalance when developed countries, which are the main contributors to greenhouse emissions, push sustainable energy projects upon island countries, which are perhaps the least contributors to this pollution.



Anare Matakaiviti
'The fact remains that renewable energy technologies are capital intensive, and most of the small economies in the region can't really afford them. Asking them to use renewable energy to develop their small economies, in a lot of ways, I think is unfair.'

Climate change experts now see that reducing emissions will not solve the

problems already caused by global warming.



Taito Nakalevu
'I think the Pacific will need to look at adaptation now. Because even if the global community reduces its emissions of greenhouse gases, it won't reduce the adverse impact of climate change in one night or even in one year. Definitely there would have to be adaptation.'

What does the future hold for the energy scene in the Pacific islands? Is there a 'ray of hope' that will light the way for more renewable energy in the future?

Many energy experts realize that, to get renewable energy projects onto the priority list for national development, they must make politicians and the general public more aware of renewable energy possibilities.

It has been said, '*nothing succeeds like success.*' To raise awareness in the Pacific of the renewable energy's potential, successful models are needed as examples. If decision makers can see that renewable energy sources are successful and can be financially sustainable as well, it will go a long way

towards gathering support for these new energy sources.

Once politicians and decision makers see and understand the importance of renewable energy as a means of improving national development, the next step is to integrate this understanding into national policy.



Suliana Siwatibau – Foundation for Peoples of the South Pacific (FSP)

‘If each of our countries makes a statement, makes a policy that looks at how far we can go with renewable energy in the next three years to five years, then we can do it.’



Robert Guild

‘As more of us understand energy as a fundamental building block of economic development, it becomes a bigger part of national decision making to put local resources into energy development.’

Renewable energy could be the great hope for the Pacific Islands. These countries have little industry, few commercially viable resources and populations that – for the most part – are still struggling with raising the level of development in their countries.

Greater reliance on renewable energy would lower the reliance of island countries on expensive fossil fuels for generating electricity. These renewable energy sources would also help keep island environments cleaner and less polluted.

But this will be a challenge, a challenge to develop cost-efficient renewable energy models that produce cheap, reliable energy with minor environmental impact. Another challenge will be to convince decision makers in island countries to put precious financial resources into developing these renewable energy projects.

Finally, it will be a challenge to raise the awareness of the general public in island countries to support the development of these renewable projects. Only then can renewable energy truly be considered a ‘ray of hope’ for the Pacific.



Marlene Kalmet – PREFACE

'Renewable energy is a way for us to be able to use what we have... indigenous resources of energy we have in the region.'



Suliana Siwatibau

'I think one of the most important ways in which we could address the increase in greenhouse gases is to go for renewable energy, as much as we can, and as quickly as we can.'



Thomas Jensen – UNDP

'It will improve the environmental conditions, it will improve the economies, it will increase energy security, make them more energy self-sufficient and become part of the path to sustainable development.'

Discussion Points

- 1) How can small-scale hydro projects, like those in Bukuya, work in other Pacific island countries?
- 2) Why is it important to involve rural women in discussions on renewable energy projects?
- 3) Why do you think some landowners disrupt renewable energy projects that actually benefit them?



GLOSSARY

Bio-gas	A renewable energy source that uses methane gas produced from biological sources such as pig manure.
Biomass	A renewable energy source that includes firewood, wood chips, leaves and manure.
Fossil Fuel	An energy source that consists of hydrocarbons from living matter. Examples are petroleum, propane and methane.
Global Warming	The gradual warming of the Earth's atmosphere as a result of the Green house effect.
Green House Effect	The atmospheric effect of solar radiation entering and heating the atmosphere. This heat is not lost due to the effect of greenhouse gases in the atmosphere. The holes in the ozone layer, caused by chlorofluorocarbons (CFCs), are also a concern because they let in more ultra-violet rays, raising the risk of cancer.
Green House Gases	The main ones are carbon dioxide, methane and propane. Carbon dioxide is produced from combustion while methane is produced from decomposition. These contribute to the green house effect.
Hybrid	Energy derived from more than one renewable source, such as a combination of wind power and solar.
Hydro Electric	An energy source that uses the pressure of water falling to turn turbines and generate electricity.
OTEC	Ocean Thermal Energy Conversion: a process that converts the heat stored in the ocean into electricity. This process uses the ocean's natural temperature gradient to drive a turbine, generating electricity. It works like a refrigerator in reverse.
Photovoltaic	Literally 'light electricity'; refers to the mechanical equipment which converts sunlight into electricity, such as photovoltaic solar panels.
Renewable Energy	Energy from the sun, and its derivatives, such as wind, rain and from the moon, tidal energy.
Solar Power	Energy source which converts sunlight into electricity. Solar power is also used to refer to renewable energy as a whole.
Thermal Energy	A natural energy source found in geothermal areas such as hot springs, etc..
Wave Energy	An energy source that uses the power of ocean waves caused by the wind to drive a turbine that creates electricity.