

## *Te Atamoa o te Uira Natura*

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## **The Cook Islands Renewable Electricity Chart**

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Renewable Energy Development Division  
Office of the Prime Minister  
Government of the Cook Islands  
Avarua, Rarotonga, Cook Islands  
Phone: 682 -29300 & 25494  
Email address: [renewable.energy@pmoffice.gov.ck](mailto:renewable.energy@pmoffice.gov.ck)  
Web site: [www.pmoffice.gov.ck](http://www.pmoffice.gov.ck)

# Minister's Foreword

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**"We did not inherit this country from our ancestors; we borrowed it from our children"**

**Now is the time to shape our nation into something our children will be proud to inherit. There is no doubt the way of the future is in the use of renewable energy. Some technologies are proven and perfected for the use of renewable resources and others are just being discovered. The Cook Islands, as part of its commitment to the Kyoto Protocol to reduce its carbon emission, will move down the path of renewable energy, not partially, but totally.**

**For too long, we have compromised the quality of our environment and our livelihoods through the use of fossil fuels to generate electricity, and operate vehicles and appliances. We have reached a point where we are totally dependent on fossil fuels, however, realizing the negative impact it has on our economy, environment, and people, this Government will do all we can to reduce this dependency and move us towards cleaner, greener solutions.**

**This is a conscious decision made by the Government on behalf of our people. It is also a pledge made by us today to leave behind an environment that is worthy of our children and their children.**

**I give you this chart as the first step towards building a better Cook Islands through changing our approach towards the electricity sector and the way we work within it. This change is necessary to ensure our Cook Islands people live comfortably in their own country with great respect for the environment.**

**This is a bold initiative and we will work strenuously towards achieving it. There are risks and uncertainties in the process but I am confident that with the collaboration and expertise of our partners nationally, regionally and internationally, we can achieve our aspirations to pass on to our children a better Cook Islands.**

**Kia Manuia**

**Hon Henry Puna  
Prime Minister and Minister of Renewable Energy**

# Introduction

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This document is called the Cook Islands Renewable Electricity “Chart”. Other countries have called similar documents a “Road map” – and these are countries that are either landlocked or have many kilometres of road between settlements. Our environment is different. We have many kilometres of sea between islands. Traditionally, our forefathers navigated their passage from one island to another using the stars, wind direction, clouds, birds and other natural resources. Today, we use paper to plot our path; a Chart. This Chart will plot our planned journey from one island to another as we transform our electricity source island by island.

We anticipate that the journey will take us 10 years. This requires a change in direction; and a new way of doing things. This new course will affect the lives of our people in this and succeeding generations. Every care will be taken at each stage to tailor our services so that they meet each island’s unique needs. This new course stops us from mistreating our environment with continuous carbon emissions.

Our journey is a radical one requiring a change in thinking and behaviour and it is articulated in the chart through policy goals. The goals are supported by Governing principles that ensure clarity in translation from policy to implementation.

The goals will transform the electricity sector from one dependent on imported petroleum to an independent, vibrant sector dominated by the efficient use of renewable energy.

This Chart articulates our general direction. Details of how we will achieve our goal are outlined in an accompanying Implementation Plan.



# The Cook Islands

As a small island developing state, the Cook Islands has unique attributes that considerably enhance the benefits to be gained from renewable electricity.

Located in the South Pacific Ocean, the Cook Islands is sandwiched between Tonga to the west, Kiribati to the north and French Polynesia to the east. The Cook Islands has 15 islands with a total land area of 240 square kilometres, spread across 1.8 million square kilometres of ocean. It has two main groups; the north consisting of six true atolls and the southern group of nine volcanic or almost atoll islands.

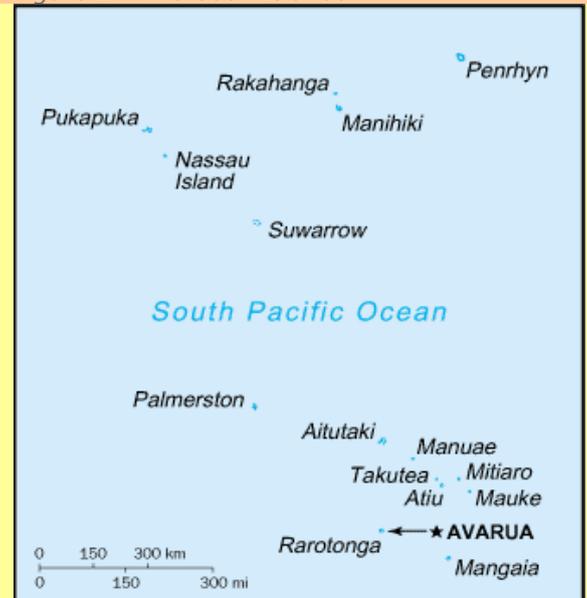
The Cook Islands is home to about 15,000 permanent residents. Most live on the largest island, Rarotonga. In comparison, the outer islands are sparsely populated, and there is a trend of internal migration from the outer islands to Rarotonga, and an external migration from the Cook Islands to New Zealand, Australia and further afield.

Tourism is the main industry in the Cook Islands, contributing 68 percent towards GDP. Approximately 100,000 tourists visit the Cook Islands each year, spending their time mostly on Rarotonga and Aitutaki.

Real gross domestic product (GDP) per capita is approximately US\$10,000, and the Cook Islands has enjoyed an average growth of 3.5 percent per annum since the mid-1990s.

Like many countries in the Pacific, the Cook Islands face challenges based on its geographic isolation and small population.

Figure 1 - The Cook Islands



Source: CIA Factbook 2003

Though a draw card for tourists, the country's isolation exposes it to vulnerabilities, in particular higher costs associated with importing and exporting goods. All petroleum fuel is imported for transport, aviation and electricity at high and often volatile prices.

# Our energy sector

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Energy is a fundamental prerequisite to the sustainable socio-economic development of a nation. As such, the Cook Islands Government considers that *environmental protection, energy security* and *economic growth* are inseparable key pillars of our country's development.

Until recently, the Cook Islands economy has largely based its development on fossil fuels. From an environmental perspective, the Cook Islands Government is committed to reducing the use of fossil fuels and meeting its climate change obligations whilst also preserving our pristine environment and fragile ecosystems. Our continued heavy reliance on imported petroleum is therefore unsustainable – economically and environmentally.

There are three main sectors dependent on imported energy in the Cook Islands; these include transport, electricity and aviation. Of the total number of imported fuels into the country, 43% is used by transport; 30% by aviation and 27% by electricity.

The Cook Islands has decided to work with one sector at a time, beginning with the electricity sector. It believes transforming electricity first will build a strong foundation for the conversion of other sectors. The technology and market for electric transport is maturing and slowly advancing to small developing countries like the Cook Islands. In terms of households and businesses, transforming electricity can also make the most difference at least cost.

# Our electricity sector

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The Cook Islands has a financially healthy electricity sector with technical and commercial challenges requiring on-going investment.

With the exception of Pukapuka, Nassau and Suvarrow, the Cook Islands has some form of electricity network. Power supply on Rarotonga is the responsibility of the government-owned utility Te Aponga Uira ("TAU"). TAU is a State Owned Enterprise legislated<sup>1</sup> to provide electricity to Rarotonga reliably and economically. TAU is financially healthy, and pays taxes and dividends to the Government. Aitutaki electricity is managed by the Aitutaki Power Board, whilst other islands are managed by island councils or island administrations.

Electricity is supplied through diesel-powered generators, with some isolated sources of renewable electricity, such as that on Mangaia and private installations of solar photovoltaic arrays on Rarotonga. Imported diesel is expensive<sup>2</sup> and strongly influences electricity prices.

## Drivers for change

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As an imported fuel, the price of diesel is subject to international fluctuations. These high and often volatile prices fluctuations have a destabilising effect on businesses and households, and limit growth - particularly in the more isolated islands.

Diesel is expensive in the Cook Islands as compared to other Pacific countries. The price for diesel on Rarotonga is \$2.52, the southern group islands, \$3.44 and the northern group \$3.60. As the generation of electricity is dependent on imported fuel, the price of a unit of electricity is very expensive. The outer islands are unable to recover the full cost of electricity and these are under written as social costs to Government. For example, Government spends \$4.2 million on outer islands electricity and incurs a 36% net loss (subsidy). This has been the trend for many years.

On average, electricity comprises 25 percent of total household expenditure and for businesses, up to 30 to 40 percent depending on the business operation. This can be a disincentive for living and conducting business in the Cook Islands.

In addition, our demand volume for fuel is comparatively small by international standards. This remains the case even when our demand is combined with the fuel requirements of other small Pacific nations.

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<sup>1</sup> See the Te Aponga Uira Act 1991.

<sup>2</sup> The price of diesel in the Cook Islands can be upwards of NZ\$3.50/litre.

Electricity demand however, continues to increase. Energy efficiency measures have helped reduce demand, but more can be done. The introduction of energy efficient lights has seen a demand reduction, but growth in air conditioning has led to a new midday peak demand, compounded by the increase in use of computers, televisions and other household electrical goods.

The Cook Islands economy, culture and society are inherently linked to the health of the physical environment – land, ocean and atmosphere. Although small on a global scale, the Cook Islands is a carbon-emitter and contributing to climate change.

The country's physical characteristics also make it particularly vulnerable to the effects of a changing global climate. Over the past decade, this has manifested itself in the form of 18 cyclones, with devastating consequences for the economy, environment, homes and livelihoods of Cook Islands people. Using renewable energy for electricity generation is a key strategy for mitigating and adapting to the effects of climate change.

Moving from an economy based on fossil-fuels to one powered by renewable energy makes both economic and environmental sense for the Cook Islands.

## **Our renewable electricity future**

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**By using an indigenous renewable resource, we reduce our vulnerability to external shocks and disruptions.**

Using our own resources and reducing our dependence on diesel means we can ease the pressure on our economy and our households caused by high and volatile electricity prices.

Access to clean, affordable, and efficient energy is a fundamental prerequisite to sustainable socio-economic development. Tackling the Cook Islands' dependence on diesel, through renewable electricity and energy efficiency is essential to ensure our country continues to develop and prosper.

This Cook Islands Renewable Electricity Chart ("Renewable Electricity Chart") sets out the Government's high level and strategic direction for the electricity sector in the form of energy policy governing principles, renewable electricity policy goals, supporting principles of those policy goals, and implementation strategies.

# Renewable Electricity Chart

The table below is an overview of the key principles, goals and implementation strategies that make up the Renewable Electricity Chart.

<b>Renewable Energy Vision</b>	To enjoy sustainable livelihoods by using clean electricity sources and respecting our environment.								
<b>Renewable Energy Mission</b>	To work together with our partners to change our energy source from fossil fuels to renewable energy as a matter of priority								
<b>Renewable Energy Objectives</b>	To save environment by reduced carbon emission	Achieve quality of life by reduced dependence on imported fuel	Better access to clean electricity by using proven technologies and natural resources	To maintain our environment that can provide for us this and succeeding generations	To show that a whole country can be independent of fossil fuels for electricity generation.				
<b>Renewable electricity policy goals</b>	<p><b>The 50/15 – 100/20 policy goals:</b></p> <ul style="list-style-type: none"> <li>- 50 percent of the Cook Island’s electricity to be provided by renewable energy in 2015; and</li> <li>- 100 percent of its electricity to be provided by renewable energy in 2020</li> </ul>								
<b>Energy policy governing principles</b>	<p><b>Environmental Protection</b></p> <ul style="list-style-type: none"> <li>- Climate change obligations</li> <li>- Environmentally friendly technologies</li> </ul>		<p><b>Energy Security</b></p> <ul style="list-style-type: none"> <li>- Energy independence</li> <li>- Sufficient and reliable energy services</li> </ul>			<p><b>Economic Growth</b></p> <ul style="list-style-type: none"> <li>- Promoting a clean green image</li> <li>- Affordable energy</li> </ul>			
<b>Supporting principles of policy goals</b>	<b>Many partners, one team</b>		<b>Whole-of-government approach</b>		<b>Primacy of energy security</b>		<b>Island-specific</b>		
<b>Implementation strategies</b>	Proven and commercial renewable energy technical options	One-goer Approach and Phased Approach	Tariff reviews	Institutional restructuring	Policy and regulatory adjustments	Community education, awareness and advocacy	Capacity building	Financing and partnerships	

## **Our Vision for renewable electricity**

**“To enjoy sustainable livelihoods by using clean electricity sources and respecting our environment”**

We realise that in this modern day and age, living sustainably is a pre-requisite for ensuring a bright future and high quality of life. In acquiring this living standard, we will maintain the functions and ability of our environment to serve and sustain our livelihoods. Electricity is now an integral part of modern life; a basic necessity. In the provision of electricity, we are committed to respecting the environment by reducing the use of fossil fuels through the use of proven technologies that use local renewable and natural resources as its energy source.

## **Our Mission**

**“To work together with our partners to change our energy source from fossil fuels to renewable energy as a matter of priority”**

We acknowledge that while we are small in size and capacity to achieve our vision, we have friends in bigger and developed countries that have the capacity to help us. We will depend on our partners nationally to provide local knowledge and resources, regionally for expertise and lessons learnt in the region and internationally for expertise and capacity in the area of renewable electricity technologies. We will take the lead to facilitate collaboration between the partners in working towards our common goals.

## **Our Objectives**

The objectives for taking a totally renewable electricity pathway are as follows:

- To save our environment through the reduction of carbon emissions into the atmosphere;
- To allow our people to live a better quality of life by reducing our dependence on expensive imported fuel for electricity generation;
- To ensure our people have better access to clean electricity at all times by exploiting proven technologies that use natural resources available to us in abundance;
- To maintain our environment at a level that can provide for us now and for many future generations;
- To showcase to the world that a whole country can be totally independent from fossil fuel for electricity generation.

# Renewable electricity policy goals

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The Cook Islands Government has set a “50/15 - 100/20” policy goal for renewable electricity, which means:

***50 percent of our inhabited island’s electricity needs to be provided by renewable energy in 2015 and 100 percent in 2020.***

The Cook Islands has 15 islands of which 12 are inhabited. Our plan is to convert 50% (6) of those islands from using diesel fuel to renewable sources by the end of 2015 to achieve our midpoint target. The conversion of these small islands will be total in one conversion. The other 50% of the islands are converted by the end of 2020. This goal can be achieved if we take into account the size of our islands, our population, our electricity demand, and the strategies and technologies employed to convert to renewable electricity.

The conversion will start in the Northern Group where the islands are more isolated, small in size, population and demand; and where access to fuel supply is unreliable, problematic, and expensive. Electricity generation is wholly reliant on imported fuel and the sustainability of the small economies of the Northern Group is dependent on its electricity sector.

The 50/15 - 100/20 policy goal complements the Government’s commitment to reduce the Cook Islands yearly carbon emission. Electricity generation accounts for approximately 80 percent of the Cook Islands carbon emission into the atmosphere. It is imperative these figures are reduced to support sustainable development whilst also promoting environmental security.

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# Energy policy principles

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We must reduce our heavy reliance on imported petroleum.

The Cook Islands has adopted the following inter-related principles to guide our energy policies; climate change obligations; energy independence; and to promote a clean, green image. It is against these principles that we seek to develop our country responsibly and sustainably; reduce the cost of business and the cost of living; and increase disposable income.

## **Environmental Protection**

*Meeting our climate change obligations, and using environmentally friendly technologies.*

The Government acknowledges that while its greenhouse gas emissions are small on a world scale, it is committed to joining the global community, acting locally and voluntarily to meet its climate change obligations.

## **Energy Security**

*Improving our energy independence, and having sufficient and reliable energy services.*

The Cook Islands' economy depends on high standards of energy security. Our residents and visitors expect access to sufficient, affordable, reliable and environmentally-friendly modern energy services. Our electricity system must also be resilient.

## **Economic Growth**

*Promoting a clean and green image, and having affordable energy.*

Tourism is the backbone of the Cook Islands' economy. Our policies are directed at enhancing our clean and green image and, consequently, our appeal to tourists.



# Policy Principles

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The renewable electricity policy goals have four supporting principles: many partners, one team; partnership approach; primacy of energy security; and island-specific.

## **Many partners, one team**

Realisation of the 50/15 - 100/20 policy goals will require the combined efforts of the many different stakeholders in the Cook Islands – government, private sector and civil society – as well as support from development partners.

The Cook Islands Government fully appreciates that there are government agencies, TAU, Island Councils, the private sector, non-governmental organisations, development partners and other stakeholders with interests in the Cook Island electricity sector. It is therefore the Government's wish that these stakeholders coordinate their efforts and work together to implement this Renewable Electricity Chart.

The Government is taking a leadership role in coordinating this effort. It has already established a Renewable Energy Development Division ("REDD") within the Office of the Prime Minister. REDD is responsible for leading policy and planning of the Renewable Electricity Chart and its supporting implementation Plan.

REDD also co-ordinates a Renewable Energy Committee chaired by the Prime Minister to lead and drive initiatives resulting from the Renewable Electricity Chart. REDD's responsibilities include raising public awareness of the 50/15 – 100/20 policies locally and internationally. REDD will require additional capacity to fulfil its responsibilities. This capacity is unfunded, and support will be sought from our development partners.

TAU has an important role to play. The Government expects that TAU will take a lead in ensuring renewable energy is rolled out and prudently managed on Rarotonga and in the outer islands provided that: TAU implements and operates the projects in the outer islands without job losses; and with a net reduction in electricity costs to outer islands consumers.

Changing from diesel generation to renewable electricity will involve a significant shift in the way TAU operates and its business model. These changes will have to occur to ensure policy goals of government are achieved within the given timelines.

While TAU has considerable experience with diesel generation, it has less experience in renewables. The Government acknowledges that implementing the 50/15 – 100/20 policies will require strengthened capacity within agencies; particularly so for TAU and outer island agencies. Policy on the management of the private sector into renewable energy is currently being considered.

## **Partnership approach**

REDD has been established under the Prime Minister's Office to lead, drive and coordinate the pursuit of the 50/15 - 100/20 goals. There are many different partners in this field willing to assist in their own way to ensure the Cook Islands achieves its policy targets; be it government sector, private sector, civil society, land owners, community organisations, regional and international. They are all partners and all have a part to play.

## **Primacy of energy security**

Renewable energy development in the Cook Islands will require a multi-faceted and integrated approach, taking into consideration energy efficiency, pricing and electricity distribution. Underpinning this will be a drive to ensure energy security for all Cook Islanders, including access to sufficient, affordable, reliable, modern and environmentally friendly energy services.

## ***Energy efficiency***

The Cook Islands has significant potential to improve its energy efficiency. Although fuel prices and electricity tariffs are strong market signals, consumers have responded slowly to these signals as less efficient energy appliances continue to be used and retained, compounded by the perceived higher cost of energy efficient appliances, and with public awareness of energy efficiency and conservation still in its infancy.

As previously mentioned, many of the diesel generators currently in use are aging and are less efficient than modern generators. As the Cook Islands moves to greater levels of renewable electricity, these diesel generators will play less of a role, but will still be important, at least in the interim, in maintaining security of supply. When generators need to be replaced, preference will be given to generators that use diesel efficiently and can complement growing levels of renewable electricity.

## ***Affordable prices***

The medium and long-term sustainability of the Cook Island electricity sector will depend on the tariffs that apply. While current electricity tariffs in Rarotonga cover the full cost of supply, there is widespread concern that relatively high prices are slowing economic growth and undermining the Cook Islands' competitive position as a tourist destination.

However, the tariffs on the outer islands, which are set by the Island Councils or Island Administrations, are significantly below the cost of supply, necessitating a continuous flow of fiscal support from central government. The electricity subsidy for the outer islands distorts the true cost of diesel generation.

Pricing is a key tool for influencing consumer behaviour. An appropriate price needs to be set that encourages energy efficient behaviour and reduces the costs to the Government, whilst also achieving its vision of reducing the costs of living and business for residents and attracting Cook Islands people to live and invest in their homeland.

### ***Distribution networks***

Renewable electricity poses considerably different challenges to that of sole reliance on diesel-fired generation. Solar and wind energy are intermittent energy sources; dependent on the weather. Backup storage and alternate generation is needed along with a more sophisticated distribution network to maintain security of supply.

### **Island-specific**

This framework seeks a balanced approach which considers the special needs of all islands. Each island has different electricity requirements, and a case-by-case approach is required.

Priority for change will start in the outer islands. These islands are more isolated, have smaller populations and electricity demand, with access to fuel supply unreliable, problematic and more expensive. The changes will include management of power utilities, environmentally friendly and cost effective renewable electricity sources, and energy efficient strategies.



## **Implementation strategies**

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The pursuit of the 50/15 – 100/20 renewable electricity policy goals in the Cook Islands electricity sector will occur through the following key implementation strategies:

### **Proven and commercial renewable electricity technical options**

The Cook Islands will be careful in its selection of renewable electricity options and will not entertain unproven or non-commercial technologies. The attached Summary Table provides some indicative and preliminary information on the types and costs of the renewable electricity technologies we are considering.

## **One-goer Approach and Phased Approach**

Based on prior experience and assessments, renewable electricity will be pursued through a two pronged approach: the one-goer approach, and the phased approach:

- The ***One-goer Approach*** will be a one-off complete transformation of the electricity supply to renewable energy for islands whose populations are currently less than 600 and/or whose power consumption is less than 50,000 kWh per year; and
- The ***Phased Approach*** will be for the three remaining islands of Rarotonga, Aitutaki and Mangaia.

## **Tariff reviews**

Electricity tariffs will be reviewed so that they, as a minimum, ensure on-going operational viability and account for disadvantaged sections of communities.

## **Institutional restructuring**

The Cook Islands Government will review the institutional arrangements to best achieve the 50/15 – 100/20 renewable electricity policy goals for the electricity sector. This work has already begun with the establishment of the Renewable Energy Development Office, with further work to be carried out in conjunction with the review and assessments of the existing related policies and legislation.

## **Policy and regulatory adjustments**

Current policies, legislation and regulations will be reviewed, and where necessary, adjusted to align with the renewable electricity policy goals. This includes reviewing any incentives for fossil fuels and renewable electricity, and standardising the quality of electricity installations.

## **Community education, awareness and advocacy**

An awareness and advocacy program will be undertaken to prepare the community, including Island Councils, for the benefits to be gained from renewable electricity. It will also include energy efficiency and conservation advice for individuals.

## **Capacity building**

We will be strengthening capacity within the agencies involved, including Rarotonga government-owned utility TAU and the Renewable Energy Development Division in the Office of the Prime Minister. From time to time short term assignments may also be required and requests may be made to regional and international agencies.

## **Financing and partnerships**

We will be developing funding and investment proposals and creating partnerships with development partners, the communities and the private sector.



## What has happened to date?

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While significant progress is being made, there is still much more to do and we are seeking to confront these challenges with assistance from our development partners.

Of the 13 inhabited islands of the Cook Islands, eight have donor agencies committed to them but five do not including Rarotonga, Atiu, Aitutaki, Mauke and Mangaia.

The Cook Islands is looking for partners who can help achieve its targets through funding the conversion of one or more of the islands from diesel generation to renewable energy.

We acknowledge the support we have already received from our partners.

The Government of Japan, under the Pacific Environment Community Fund ("the PEC Fund"), has committed funds (through the Pacific Islands Forum Secretariat) to assist Pacific countries with the purchase and installation of renewable energy technologies, specifically for solar photo voltaic (PV) electricity supply or for water desalination. The Cook Islands is a recipient of the Fund and has committed to installing Solar (PV) systems for the islands of Rakahanga, Pukapuka, Nassau, Suvarrow and part of Manihiki.

The New Zealand Government has made the commitment to funding the remaining islands of the Northern Group - Manihiki and Penrhyn - while Palmerston Island will be supported under the Small Island Development States Stock fund. The New Zealand government will consider providing policy support if requested.

The island of Mitiaro has also been tagged for New Zealand funding, and the existing Mangaia wind energy project will also be refurbished.

On Rarotonga, New Zealand has also committed to installing approximately 100kW of solar PV connected into the electricity network, to help build experience and expertise in grid-integration of PV.

## Other Energy Technologies

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The Cook Islands has abundant solar radiation, which makes solar electricity PV an attractive option. On average, about 80 percent of households already use solar water heating, and we are committed to increasing the use of photovoltaics for electricity generation and to reduce reliance on diesel.

Wind monitoring tests conducted in the Southern Group found wind to be a viable resource for renewable electricity. Wind has the potential to contribute significantly towards energy generation. In addition, there are opportunities to investigate biomass and waste to energy as another possible renewable energy source.

Managing the intermittency of renewable energy will be a challenge for us. Both solar and wind are intermittent energy sources. Economies depend on reliable, secure electricity, so frequent outages due to cloud cover or lack of wind cannot be tolerated.

In future, new energy technologies such as marine energy may offer new opportunities for the Cook Islands to generate electricity from other renewable sources. Developments in energy storage or in energy efficiency may also further reduce the Cook Islands' reliance on diesel.

The Cook Islands prefers to use proven and economic energy technologies. However, there may be niche opportunities to demonstrate low risk new energy technologies. The Cook Islands Government will consider such technologies on a case-by-case basis, and may engage the assistance of our international partners. Careful attention will be paid to assessing sufficiency, reliability, environmental impact, and cost of any new generation source.

# Summary Table

Island	Total households	Population	Expected Energy Demand (kWh)		Proposed Technology	Estimated Cost (NZ\$M)
			2015	2020		
<b>Northern Group</b>						
Rakahanga	24	140	64,400	78,300	Solar (PV) with diesel backup	1.10
Pukapuka	97	510	20,900	25,500	Solar (PV) with diesel backup	2.40
Nassau	32	120	TBC	TBC	Solar (PV) with diesel backup	0.35
Suvarrow	1	<5	TBC	TBC	Solar (PV) with diesel backup	0.04
Manihiki	97	370	TBC	TBC	Solar (PV) with diesel backup	2.50
Penryhn	66	260	79,000	96,200	Solar (PV) with diesel backup	2.50
<b>Southern Group</b>						
Palmerston	18	60	28,500	34,600	Solar (PV) with diesel backup	0.35
Mitiaro	145	220	62,300	75,800	Solar (PV) with diesel backup	1.50
Mangaia	177	640	579,000	705,000	Wind, Solar (PV), biomass, with diesel backup	3.50
Atiu	158	570	456,000	555,000	Solar (PV), biomass with diesel backup	3.20
Mauke	106	390	288,000	351,000	Solar (PV) with diesel backup	4.00
Aitutaki	535	2250	3,060,000	3,190,000	Solar (PV) with diesel backup	8.00
Rarotonga	3,009	13,900	TBC	TBC	Solar (PV), wind, waste to energy, grid storage and bio diesel backup	200.00
<b>Total</b>						229.44



