

# Pacific Lighthouses

*Renewable energy opportunities and challenges in the Pacific Islands region*

## Vanuatu



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The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

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**Note on currency:**

On 23 October, 2012, one United States dollar (USD) exchanged for Vatu (VUV) 90.85.

# Preface

In the Abu Dhabi Communiqué on accelerating renewable energy uptake for the Pacific Islands (of 13 January 2012), leaders from the Pacific Island Countries and Territories (PICTs) called on the International Renewable Energy Agency (IRENA) to “...map the Renewable Energy Readiness of the Pacific Islands Countries and Territories to ascertain the status of renewable energy opportunities and identify pathways to close gaps” and to integrate all IRENA activities in the region “...into a coherent roadmap for the Pacific Islands”. In response, IRENA has carried out a wide range of activities of specific relevance and application to the PICTs as well as other Small Island Developing States (SIDS). This work has now been integrated into the IRENA report: ***Pacific Lighthouses: Renewable Energy Roadmapping for Islands***.

The report consists of an overview roadmap framework and 15 island-specific studies on the respective energy

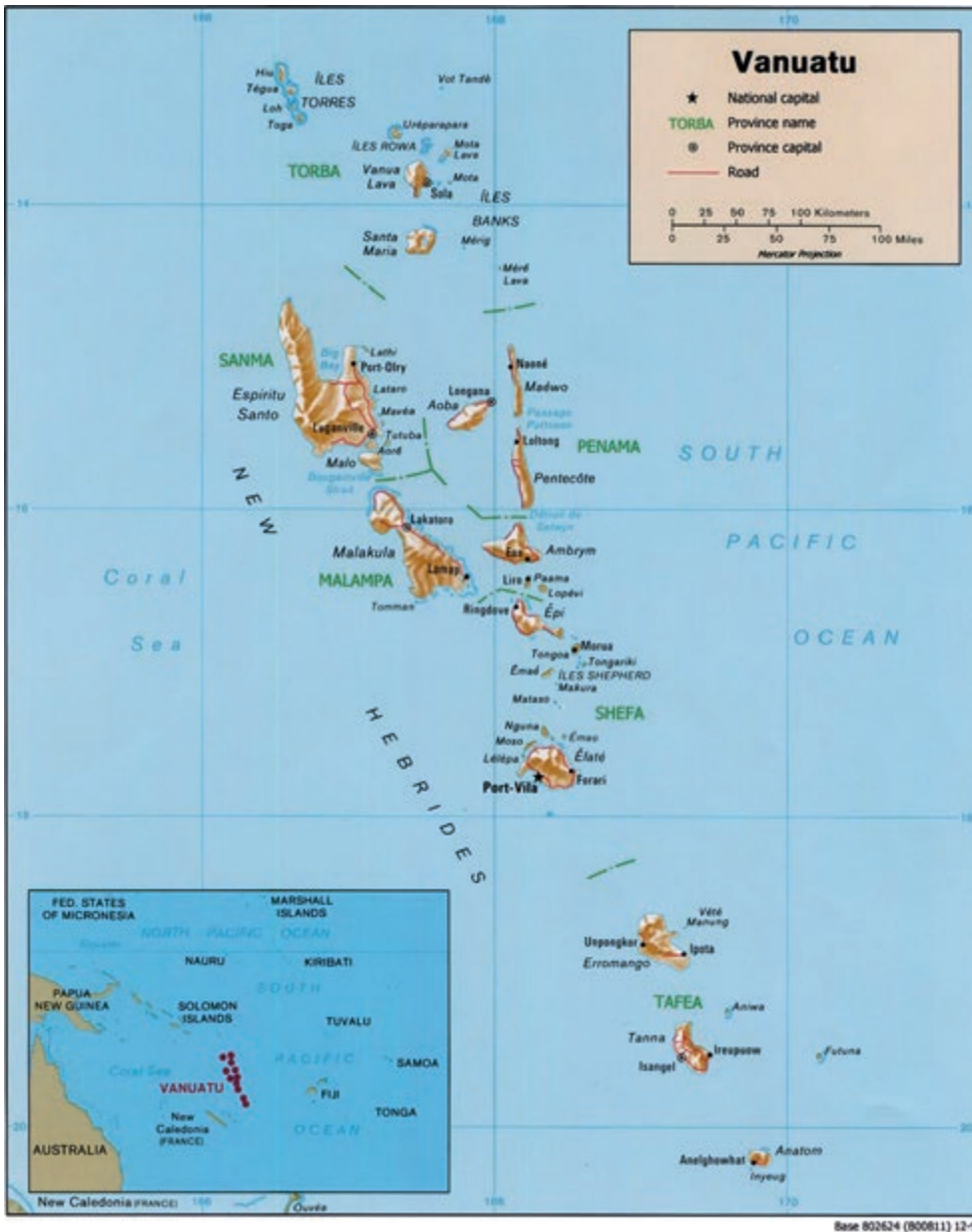
situations, and the challenges and opportunities for renewable energy deployment, around the region. These studies are available for the Cook Islands, the Federated States of Micronesia, the Republic of Fiji, Kiribati, the Republic of the Marshall Islands, the Republic of Nauru, Niue, the Republic of Palau, Papua New Guinea, Samoa, the Solomon Islands, the Kingdom of Tonga, Tokelau, Tuvalu and the Republic of Vanuatu. The IRENA Pacific Lighthouses report draws on those studies, as well as an additional study on a diesel-renewable energy hybrid power system, intended as a transition measure to a renewables-based energy future for the PICTs, which is also part of the series.

IRENA, in collaboration with its members and other key development partners, will continue to support the development national roadmaps and strategies aimed at enhanced deployment of renewables in the Pacific and other island states and territories.

# Acronyms

<b>ADB</b>	Asian Development Bank
<b>AUD</b>	Australian dollars (currency)
<b>DEMM</b>	Department of Energy, Mines and Minerals
<b>EU</b>	European Union
<b>GoV</b>	Government of Vanuatu
<b>GWh</b>	Gigawatt hours (thousands of millions of Watt hours)
<b>IUCN</b>	International Union for Conservation of Nature
<b>kW</b>	Kilowatt (thousands of Watts)
<b>kWe</b>	Kilowatts equivalent energy
<b>kWh</b>	Kilowatt hours (thousands of Watt hours)
<b>LPG</b>	Liquefied Petroleum Gas
<b>ML</b>	Megalitres (millions of litres)
<b>MW</b>	Megawatt (thousands of kilowatts)
<b>MWh</b>	Megawatt-hours (thousands of kilowatt-hours)
<b>NERM</b>	National Energy Road Map
<b>NEPF</b>	National Energy Policy Framework
<b>PIREP</b>	Pacific Islands Renewable Energy Project
<b>PV</b>	Photovoltaics
<b>SOPAC</b>	South Pacific Applied Geoscience Commission
<b>SSRF</b>	Sarakata Special Reserve Fund
<b>UNELCO</b>	Union Electrique du Vanuatu Limited
<b>URA</b>	Utilities Regulation Authority
<b>USD</b>	United States dollars (currency)
<b>VANREPA</b>	Vanuatu Renewable Energy and Power Association
<b>VERD</b>	Vanuatu Energy for Rural Development
<b>VUI</b>	Vanuatu Utility Infrastructure, Ltd.
<b>VUV</b>	Vatu (Vanuatu currency)

# 1. Country context



**Figure 1. Map of Vanuatu**

Source: [www.lib.utexas.edu/maps](http://www.lib.utexas.edu/maps)

*The boundaries and names shown on this map do not imply official acceptance or endorsement by the International Renewable Energy Agency.*

**Physical.** The Republic of Vanuatu, formerly the New Hebrides, is located approximately three-quarters of the

way from Hawaii to Australia, centred near 16° degrees south latitude and 167° east longitude. Vanuatu consists

of 80 islands, 65 of which are populated. The islands are of volcanic origin, mostly mountainous, with narrow coastal plains. About 41% of Vanuatu's total land area of 12 200 km<sup>2</sup> is cultivable, although only 14% is utilised. The climate is hot and wet from November through April, and cooler and drier from May through October. In the capital, Port Vila, the average temperature is 26°C and the annual rainfall is 2 300 millimetres. Natural hazards affecting Vanuatu include tropical cyclones, earthquakes, volcanic activity and occasional tsunamis.

**Population.** Between the 1989 and 2009 censuses, the population of Vanuatu grew at 2.3% per year, reaching 234 023 in 2009. In that year approximately 80% of the population lived on just seven of Vanuatu's 80 islands. The census showed that 24.4% lived in the urban centres of Port Vila and Luganville and that the average annual urban growth rate was 3.5%. Vanuatu's current development plan identifies population as a key development issue – a young population showing rapid growth indicates the need for strong investments in health, education and environment. In 2009, the Asian Development Bank (ADB) estimated that electricity was accessible to only 27% of the total population. Given the low population density and remoteness of rural villages, grid extensions are generally too expensive and electricity must be generated at the community level. Exceptions are parts of Efate and areas of Santo near Luganville.

**Economic overview.** Vanuatu has a classic dual economy. There is a small, high-cost modern sector but most ni-Vanuatu (the local name for the Melanesian people originating in Vanuatu) earn their living from subsistence or small-scale agriculture and fishing, largely outside the cash economy. The main exports are copra (coconut kernel or “meat”), beef, timber, kava and coconut oil. Approximately 80% of the population engage in subsistence agriculture, contributing only 10% to Vanuatu's gross domestic product (GDP), which was estimated by the World Bank in 2010 to be USD 710 million (VUV 64 504 million). Real GDP growth averaged 6.6% for 2004–2008, then slowed to 3.8% in 2009. Vanuatu's favourable tax regime, relative political stability, sound macro-economic management and recent institutional reforms have begun to attract foreign investment in tourism and land development. The economy grew by 4.3% in 2011, driven by increased remittances and tourist arrivals.

The Government of the Republic of Vanuatu's *Priorities and Action Agenda 2006-2015* aims to achieve better macro-economic stability by creating a stable investment climate, increasing economic growth and improving the welfare of Vanuatu's people through better health, education and transport services in rural areas. Access to modern, secure and affordable energy services has a key role to play in achieving these priority actions.



## 2. Energy landscape

### Institutional and regulatory arrangements for energy

#### **Union Electrique du Vanuatu Limited (UNELCO).**

UNELCO is a privately owned utility that has been providing electricity to Port Vila and Luganville for several decades and has recently extended its services to parts of East Malekula and Tanna. However, UNELCO's concession for Luganville ended in 2010, a new power utility, Vanuatu Utility Infrastructure (VUI), Ltd, won the concession.

**Vanuatu Utility Infrastructure (VUI), Ltd.** VUI Pernix, a US-based company, is a more recent player in Vanuatu's power sector. In January 2011, through competitive bidding the company won the concession for power generation and supply for Luganville, on the island of Espiritu Santo after UNELCO's concession expired. VUI's installed capacity in 2011 was 4.1 MW and generation was approximately 8570 MWh. Demand was 7600 MWh and forecast to grow at 2–3% annually. There are 2302 customers, of which 614 are high consumers. The customer base is growing at around 300 per year.

**Sarakata Special Reserve Fund (SSRF).** Until 2009–2010, the renewable energy activities of the Department of Energy, Mines and Minerals (DEMM) were financed primarily through the Sarakata Special Reserve Fund (SSRF), replenished from fuel savings from the 600 kW hydroelectric system built near Luganville. This system was financed from Japan and is operated by Union Electrique du Vanuatu Limited (UNELCO) since 2005. Customers were charged the regular diesel generation rate and the value of the fuel saved by the hydro installation was placed in the SSRF to support renewable energy projects. The installation was upgraded to 1.2 MW in 2009.

**Utilities Regulation Authority (URA).** The Utilities Regulation Authority (URA) was established in 2008 as a semi-autonomous body to mediate between the Government and electricity and water utilities. The URA also acts as an economic regulator for pricing, energy access, standards and monitoring of concession agreements

**Other organisations.** The Vanuatu Energy for Rural Development (VERD) programme by the Australian Agency for International Development (AusAID) is a

project aimed at expanding rural electricity access and promoting economic development. VERD has a budget of AUD 20 million (about USD 21 million) and is designed to support the Government in accessing, coordinating and implementing rural energy projects and developments over the next six years. Although VERD is meant to be Vanuatu's flagship endeavour to address its rural electrification problems, it has been delayed due to inadequate staffing in the DEMM,

Pacific Energy (formerly known as BP Southwest Pacific, Ltd.) imports petroleum products from New Caledonia and sometimes Fiji. The Government has the legal right to control fuel prices but this power has not been used since 1989. The Government has considered tendering for the supply of petroleum fuel products – using an approach similar to Samoa's – and in 2012 the World Bank began a detailed study of the opportunities, costs and benefits of such a scheme.

A non-governmental organisation (NGO), Vanuatu Renewable Energy and Power Association (VANREPA), has been active since 2003 in bringing wind power to rural areas, managing renewable energy projects for donors and selling solar lighting kits and energy-efficient stoves through Green Power, a retail spinoff. Through Green Power, VANREPA has teamed up with the Vanuatu Women's Development Scheme (VANWODS) to provide micro-finance for pico-solar kits. VANREPA also provides renewable energy generating systems to communities under its Community Powerhouse model. Solar-generated electricity is stored in batteries at the charging station from where it is made available through a mini-grid to schools, health centres, community centres and commercial enterprises that pay a monthly fee for their electricity. Households are supplied with LED (Light Emitting Diode) lights that can be recharged at the charging station for a fee. However, communities are expected to maintain these facilities once operational, an institutional model that has not worked well in the past.

A project by VANREPA is currently underway to reduce or eliminate the use of kerosene for lighting in 70 households on the island of Futuna, where as much as a third of household income was being spent on kerosene for lighting. Leaders of the island agreed to work with VANREPA to provide renewable energy in the form of a Community Powerhouse, supply of pico solar lighting

kits and solar electrification of community facilities. The project is scheduled for completion in 2013.

**National Energy Policy Framework (NEPF).** In 2000, the Council of Ministers endorsed a “Vision for a 100% Renewable Energy Economy by 2010”, although no follow-up activities or supporting budget resulted. In 2006, the South Pacific Applied Geoscience Commission (SOPAC) helped the Government of Vanuatu develop a National Energy Policy Framework (NEPF), which was endorsed by the Council of Ministers in August 2007. This has since been superseded by the Vanuatu National Energy Roadmap.

**The National Energy Roadmap 2013-2020.** In October 2011 the Government of Vanuatu launched the development of the Vanuatu Energy Roadmap 2013-2020. The roadmap was published in March 2013 and passed by the Vanuatu Council of Ministers in June 2013. It has the overall vision to “energise Vanuatu’s growth and development through the provision of secure, affordable, widely accessible, high quality, clean energy services for an Educated, Healthy, and Wealthy nation”. The roadmap focuses on the following five key energy priorities:

Achieving access to secure, reliable and affordable electricity for all Citizens by 2030 through connection to electricity of 75% of household within concession areas by 2015, 90% by 2020 and 100% by 2030; for households close to concession areas the corresponding figures are 33%, 90% and 100%, respectively, while for off-grid areas the target is 100% of households having access to modern electricity via individual homes systems and basic power products by 2020.

- Achieving energy security for Vanuatu at all times through diversifying energy sources and providing the enabling framework for investments in energy. The target to diversify energy sources includes increasing the share of renewables in power generation mix by 40% by 2015 and 65% by 2020.
- Mitigating climate through enhanced deployment of renewable energy technologies and energy efficiency.
- Ensuring that energy services in Vanuatu are affordable and low-cost.
- Reducing reliance on imported fossil fuels and ensuring that needed petroleum supply is reliable, secure and affordable throughout Vanuatu.

## Energy supply and demand

**Petroleum.** Vanuatu is almost totally dependent on imported petroleum for commercial energy. An energy balance prepared in 2012 estimated that biomass

provided approximately 66% of gross national energy production in 2011, while solar and hydro together amounted to less than 1%, with the remainder provided by petroleum.

The transport sector in Vanuatu accounts for approximately 64% of the total petroleum fuel use in the country (including jet fuel). Electricity generation consumes about 30% and direct household use 4%. Overall, around 61% of urban households are electrified, and 36% of them use kerosene for lighting. Approximately 106 kilotonnes of fuelwood are estimated to be consumed each year for cooking. A household survey published in 2012 indicates that 78% of households can access a firewood supply in less than one hour, 17% in one to two hours and 4% spend more than two hours to access firewood<sup>1</sup>.

Petroleum imports, while varying considerably year-to-year were about 47 megalitres (ML) in 2003, having grown at about 4% annually over the previous decade. Almost all liquefied petroleum gas (LPG) is used in Port Vila and Luganville with sales static at 1300 tonnes per year. Between 1999 and 2002, petroleum imports were equivalent to 56-86% of domestic exports, considerably more than in the early 1980s (30-60%).

In 2009, Vanuatu imported 45.3 ML of refined petroleum fuels, of which 80% was diesel fuel and 18% gasoline, with small amounts of kerosene. In 2011, according to Pacific Petroleum, imports had risen to 54.9 ML (70% diesel, 15% petrol and 15% jet fuel). About 80% of fuel imported to Vanuatu is for Efate and most of the rest for Espiritu Santo. Apart from jet fuel, which is mainly for export, petroleum consumption has stayed relatively static for the past decade.

**Electricity generation and demand.** A draft Rural Electrification Plan prepared by UNELCO identified over 3000 sites for 1700 possible generating facilities. Although the plan has not yet been approved by the Government, detailed design work on 100 generating facilities has been completed. The European Union (EU), the Government and UNELCO funded one of these prototype projects, the Port Olry Biofuel project. Launched in 2007, it is intended to generate electricity for over 300 families using coconut oil as fuel. The project has worked satisfactorily, although there have been minor problems with oil supply and clogging fuel filters. Initially, the system was run for nine hours a day during the week and 15 hours on Sundays.

Table 1 gives the total generation and sales data for UNELCO between 2008 and 2010. In 2010, the utility had a

<sup>1</sup> *The Alternative Indicators of well-being for Melanesia reporting the results of this survey can be accessed at, for example, [http://www.vnsso.gov.vu/index.php/component/docman/doc\\_download/193-well-being-survey-2012?Itemid=18](http://www.vnsso.gov.vu/index.php/component/docman/doc_download/193-well-being-survey-2012?Itemid=18).*

**Table 1. UNELCO total generation, sales and fuel use**

Year	MWh generated	MWh sold	Diesel fuel used (ML)	Coconut oil used (ML)
2010	68 671	61 640	14.319	0.251
2009	64 716	55 130	14.727	0.167
2008	62 798	55 130	15.902	0.150

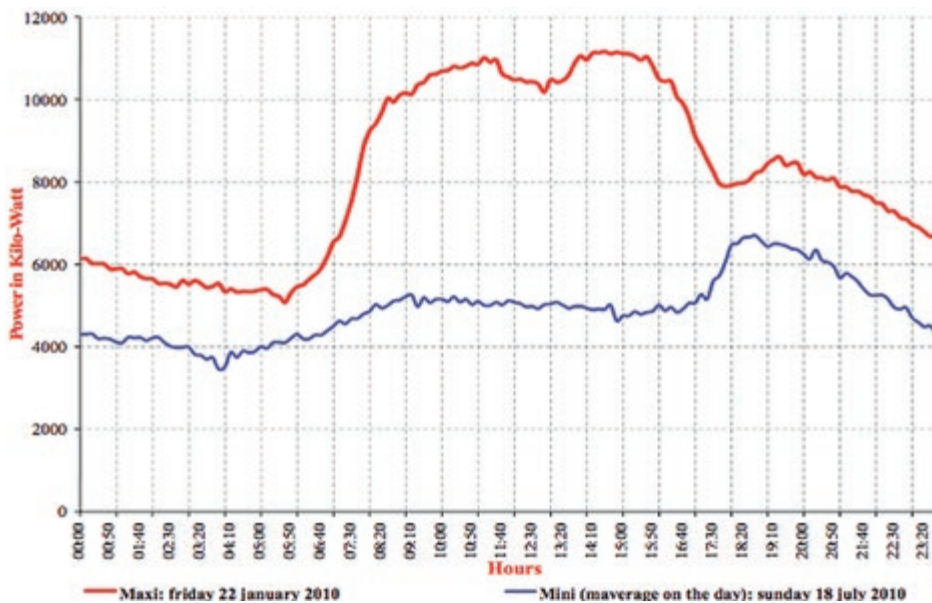
Source: Provided through communication by UNELCO.

peak demand of 11.3 MW, generated 59.2 GWh and sold 53.1 GWh in Port Vila alone, which accounted for 85% of demand and 70% of customers. Vanuatu’s electricity charges are among the highest in the world, although they are comparable to those of other, smaller Pacific island countries. The tariff is VUV 150/kWh (USD 1.65/kWh) and uses pre-paid meters.

The Government has been concerned for a number of years over the high cost of electricity. Apart from areas served by UNELCO and VUI, the DEMM is responsible for rural electrification (overseeing design, installation, finance, operation and maintenance, often through contractors) using solar photovoltaics (PV) for solar home systems in public facilities such as schools and health centres. Rural electrification is done on an *ad-hoc* basis and depends on available donor funding.

According to a 2012 report on the feasibility of a geothermal power plant (Vanuatu Efate Geothermal Power; Castlerock/World Bank, January, 2012<sup>2</sup>), Efate island in Port Vila is by far the largest electricity user, accounting for 86% of total generation of 64 716 MWh, and 73% of the 12 645 consumers in the country in 2010. The UNELCO concession area extends to 15 km from the city limits of the capital city, Port Vila. UNELCO holds the concession until 2031. The rest of Efate outside of the Port Vila concession is currently unserved by grid electricity<sup>1</sup>. With regards to power demand there is a sharp mid-day peak during the week, reaching over 11 MW. On Sundays the demand profile shows a lower peak occurring in the evening as shown in Figure 2.

<sup>2</sup> See, for example, [http://www.kuthenergy.com/index.php?item=file&target=world\\_bank\\_report\\_exec\\_summary](http://www.kuthenergy.com/index.php?item=file&target=world_bank_report_exec_summary); <http://www.kuthenergy.com/vanuatu/>



**Figure 2 – Load curves**

Source: Provided through communication by UNELCO (2012).

**Electricity tariffs.** Electricity tariffs in Vanuatu are complex, involving a mix of security deposit, kWh charges for a variety of different types of customers, demand charges for larger consumers, and fuel charges. The basic kWh charges as of early 2012 were as shown in Table 2. Security deposits apply to all users and added charges apply to businesses based on kVA requirements.

**Table 2. UNELCO electricity tariffs (as of August 2012)**

Consumer type	Tariff (VUV/kWh)	
<b>Residential</b>	0-60 kWh/month	18.43
	61-120 kWh/month	65.58
	over 120 kWh/month	162.60
<b>Commercial</b>	Low voltage	47.70
	High voltage	37.94

Source: Provided through communication by UNELCO.

### 3. Renewable energy opportunities

**Geothermal power.** Twelve of Vanuatu's islands have thermal springs and, therefore, geothermal potential. Exploration of the potential of this renewable energy resource started as far back as in 1999 and has resulted in the identification of technical and economic potential for geothermal power development at Takara Springs in the north-east of Efate. A licence to further explore and develop geothermal power in the area was issued to an Australian company, KUTh Energy, in 2009. The company proposes to develop 8 MW of capacity in the area by 2019 in two stages, starting with a 4 MW plant, designed to displace an equivalent amount of existing diesel powered capacity, is planned for completion in 2015<sup>2</sup>.

**Hydropower.** Vanuatu has some hydro potential for supplying urban grids and small rural demands. Studies suggest a technical potential on Efate, e.g. 1.2 MW at Teouma, but with prohibitively high development costs. There is potential for additional hydro on the Wambu River (4 MW) and Brenwei (1.2 MW) on Santo, although the resource has not been studied in detail. The DEMM has used EU funding to investigate micro-hydro potential at 13 sites on six islands, establishing about 1.5 MW of total available power. Four of these sites – Lowanau in Tanna, Mbe Tapren in Vanua Lava, Waterfall in Pentecost, and Anivo in South Santo – have been assessed to be the most viable for further feasibility on techno-economic potential.

**Ocean energy.** In the early 1990s, Oceanor of Norway monitored Vanuatu's seawave potential. Data from buoys suggested an average potential of 13.5 kW per metre of wavefront off Efate, while satellite data suggested between 9–20 kW/m at various sites. Other ocean energy potential include ocean thermal energy (OTEC). However, no measurements of deep sea versus surface water temperatures, which are necessary to determine near-shore potential of OTEC. If the deployment of ocean energy technologies was commercially available, Vanuatu could produce much of its demand from just a few small plants.

**Wind power.** There is very limited data on wind energy potential in Vanuatu. A Pacific Islands Forum Secretariat project monitored wind speeds at a site on Efate in the mid-1990s, finding average speeds of 5.0 m/s in 1995 and 4.2 m/s in 1996, well below the 6 m/s generally considered to be necessary for economic electricity production. However, only 63% of data was recovered in 1996, so these results should be treated with caution.

The DEMM, with the support of the Pacific Island Greenhouse Gas Abatement and Renewable Energy Project (PIGGAREP) and the International Union for Conservation of Nature (IUCN), has installed wind-monitoring towers in each of Vanuatu's six provinces. The installations began operating in March 2012 and data collection is expected to be completed by the end of 2014. The project's objective is to produce a wind atlas for Vanuatu and identify favourable sites for turbines.

**Solar power.** There is substantial solar potential in Vanuatu. Annual sunshine hours range from 2 000–2 300 hours per year, with a solar insolation of approximately 6 kWh/m<sup>2</sup>/day, although this needs to be further verified by ground measurements.

**Bioenergy.** Vanuatu is heavily forested. The amount of timber cut annually between 1996–1999 was 36 000–41 000 m<sup>3</sup>, although the figure fell considerably over the decade that followed as resources on the easily accessible eastern part of Santo were depleted<sup>3</sup>. In 1995, the Food and Agriculture Organization of the United Nations (FAO) estimated forest cover at 73.8%, but this had dropped to 36.1% by 2005<sup>3</sup>. Two large companies and a few dozen portable sawmills currently harvest logs. At the larger companies, wood recovery is about 40–45%, and so the volume of residue potentially available for energy is at least equal to the volume of timber produced. However, a significant portion of the residue is already used as compost or sold as fuelwood.

With regards to biogas (methane from animal wastes) or energy from municipal wastes at landfills, there is very limited technical potential in Vanuatu.

There is considerable experience in Vanuatu with the use of coconut oil as a biofuel to replace diesel fuel for electricity and transportation. In recent years, copra output exceeded 40 000 tonnes per year<sup>4</sup>, sufficient to produce about 27 000 tonnes of coconut oil. In energy terms, this volume of coconut oil is equivalent to approximately 28 ML of diesel, which, in principle, is enough to replace about 70% of Vanuatu's diesel fuel imports. However, the Vanuatu National Statistics reports a 50% drop in copra production between 2011 and 2012.<sup>5</sup>

<sup>3</sup> See, for example, <http://www.fao.org/docrep/003/x6900e/x6900e0y.htm>

<sup>4</sup> See, for example, <http://faostat3.fao.org/home/index.html#VISUALIZE>

<sup>5</sup> <http://www.vns0.gov.vu/>

## 4. Experiences with renewable energy technologies

At the end of 2012 the installed capacity of power generation from renewable sources was 4.3MW as indicated in Table 3.

**Geothermal energy.** Although some studies have been made of Vanuatu's geothermal resources no geothermal power has yet been developed. However, as noted above, a memorandum of understanding was signed in 2009 between UNELCO and KUTh Energy (Vanuatu), which led to a proposal to develop 8 MW of geothermal capacity.

**Hydropower.** The Government's only hydro plant is the 1.2 MW Sarakata system, which was upgraded from 600 kW in 2009. The IUCN, with funding support from Austria and Italy, is implementing a micro-hydro project on Maewo Island.

**Ocean energy.** Vanuatu has no experience so far with the deployment of wave, tidal or any other ocean-based energy technology.

**Wind power.** VANREPA was awarded a project to provide 420-watt wind turbines, using fold-down towers for cyclone protection, for Futuna and Anelyum in the south. VANREPA has installed a number of small wind turbines in association with its Community Powerhouse concept and as stand-alone battery chargers. UNELCO installed 3.025 MW of Vergnet 275 kW tilt-down wind turbines at Devil's Point, near Port Vila, and wind monitoring is underway at another site. At the Devil's Point

wind farm, which produces around 7% of Efate's electricity, the turbines are synchronised with advanced diesel generators so that wind variability does not cause grid stability problems. The IUCN, with support from Austria and Italy, is carrying out a programme for nationwide wind energy monitoring.

**Solar energy.** Approximately 100 solar water-heating systems have been imported for home and hotel use since 1999. The EU has funded at least eight rural PV projects since 1992, with a total of about 63 kWp (peak kilowatts) output. An estimated 500 solar installations have been completed, but the number still operational is unknown. A number of these installations have failed owing to due to inadequate maintenance mismatch of components. Table 4 gives a summary of solar PV programmes installed by the Energy Unit up to 2002.

Although solar power recipients are required to pay a monthly fee for maintenance, this has often been in arrears. A Pacific Islands Renewable Energy Project (PIREP) mission in 2004, visiting two villages that were solar electrified in 2000, found that 15 of the 81 PV systems originally installed had been removed due to non-payment of the monthly fee.

At least one PV project has been implemented through a local NGO, which installed 20 systems at aid posts in Tafea Province. Telecom Vanuatu Limited (TVL) has installed 283 PV systems for to power various telecommunications equipment. Overall, donors provided ap-

**Table 3: Renewable energy installations in Vanuatu as of the end of 2012**  
(Source: website of the Utilities Regulation Authority<sup>6</sup>)

Location	Year of installation	Type	Installed Capacity (kW)
Efate	2010	Wind	3 020
Efate	2011	Solar	70
Santo	1995	Hydro	1 200
Malekula	2012	Solar	20
Tanna	2012	Solar	20
<b>Total (kW)</b>			<b>4 330</b>

<sup>6</sup> [http://www.ura.gov.vu/index.php?option=com\\_content&view=article&id=38&Itemid=89&lang=en](http://www.ura.gov.vu/index.php?option=com_content&view=article&id=38&Itemid=89&lang=en)

**Table 4. Summary of Energy Unit's solar PV programme, 1992–2002**

Year	Summary	Location	Size	Funded by
1992	2 health facilities	2 sites	0.3 kWp	British High Commission (UK)
1995–2000	Community-based	4 sites	2 kWp	Energy Unit (GoV)
1995	Community-based	6 sites	1 kWp	ACCT (France)
1996–1997	13 schools	5 islands	5 kWp	ACCT/FONDEM (France)
1999	220 solar home systems	5 sites; 4 islands	22 kWp	JICA (Japan)
2000	45 solar home systems	Efate	4.5 kWp	Energy Unit (GoV)
2000–2001	About 200 systems at 27 schools and 18 health facilities	45 sites	22 kWp	AFD (France)
2001–2002	12 schools, 8 health facilities and 40 staff houses	60 sites	6 kWp	PREFACE (France, Australia)

Source: Pacific Regional Energy Assessment 2004 – Vanuatu National Report.

Where: U.K. is United Kingdom; GoV is Government of Vanuatu; ACCT is the Agence de coopération culturelle et technique, France; JICA is the Japan International Cooperation Agency; AFD is the Agence Française de Développement; PREFACE is the Pacific Regional rural Energy France Australia Common Endeavour; FONDEM is Fondation Énergies pour le Monde.

proximately USD 1 million (VUV 90.85 million) for PV equipment and installations between 1992 and 2002.

The IUCN is carrying out a repair programme for PV systems on Santo and Malekula. In 2012 work also began on a 40 kW grid-connected solar PV project in Luganville Santo funded through the Asian Development Bank.

**Bioenergy.** A 25 kW<sub>e</sub> (kW electrical) wood-fuelled biomass gasifier was installed at Onesua Presbyterian College in the 1980s. It functioned well for eight years with nearly 10 000 operating hours, and was refurbished and operated again, but has fallen into disuse in recent years.

A biogas digester fed by livestock waste is planned for Pentecost to supply gas for cooking and lighting.

Two companies on Efate have produced coconut oil on a small scale as a substitute for diesel fuel for power generation and transport. In 2002, about 200 minibuses were using the oil daily with no serious technical difficulties. However, government legislation and regulation in 2003 dramatically reduced the use of coconut oil as a diesel fuel substitute. A change in tax laws raised the price of fuel blends. The new rules made it illegal to blend fuels without a licence.

UNELCO is blending 30% coconut oil with diesel fuel for some of its generation.

## 5. Challenges for renewable energy deployment

- Insufficient capacity and financial resources within the DEMM to properly develop and implement renewable energy systems.
- Limited cash availability in rural areas to pay for services.
- Vanuatu consists of many islands and has inadequate transport facilities to reach remote rural villages.
- Very limited technical capacity in rural areas.
- Low population density making grid extensions uneconomic and the cost of access for maintenance high.
- Limited capacity for rural energy businesses.
- Lack of standard specifications for renewable energy components to help ensure that donor projects provide equipment suited for the maintenance capacity and environment of Vanuatu.
- Lack of local training available for the sustained availability of technical capacity in managing and maintaining renewable energy projects.
- Relatively high susceptibility to natural disasters, particularly cyclones that can damage equipment and greatly reduce production of biofuel feedstock.
- Limited land availability owing to land tenure issues.

IRENA continues to suggest pathways to overcome these barriers in a regional context, through its Global Renewable Energy Islands Network (GREIN), working together with the existing regional and national stakeholders to achieve the transition to renewable energy and secure a sustainable energy supply.



# References

In the preparation of this report, primary sources were used as much as possible. Some information was obtained through written questionnaires, some through interviews and some through email correspondence. Where primary sources were not available, the following secondary and tertiary sources were used.

## Publication References

- ADB (Asian Development Bank) – SMEC (2011), Interim Report; Promoting Access to Renewable Energy in the Pacific, TA 7329-REG.
- ADB (2011), Promoting Energy Efficiency in the Pacific – Appendix E – Vanuatu, TA 6485-REG.
- ADB (2012), Newsletter: Pacific Economic Monitor.
- AusAID (2009), Pacific Economic Survey, engaging with the world.
- Castalia/ADB (2010), Enhancing Effective Regulation of Water and Energy Infrastructure and Utility Services (Small Island Country Component), Interim Pacific Report, ADB.
- Cloin, J. (2006), Torba Province Electrification Feasibility Study, SOPAC (South Pacific Applied Geoscience Commission).
- Cloin, J (2007), Liquid Biofuels in Pacific Island Countries, SOPAC.
- Cox, M. *et.al.* (2007), The Unfinished State: Drivers of Change in Vanuatu.
- Deamer, T. *et.al.* (2005), Using Coconut Oil as a Fuel in Vanuatu.
- Di Vietri, T. (2012), Public-Private Partnership for access to renewable energy in rural areas of Vanuatu.
- Pacific Islands Forum Secretariat, – SMEC /Barnes & McKenzie (2007), Baseline Study on Opportunities under the Clean Development Mechanism (CDM).
- GoV (Government of Vanuatu) (2011), Vanuatu Energy Roadmap Inception Report, GoV.
- Jensen, T.L. (2010), Port Orly Biofuel Project in Vanuatu, A Case Study, Household Survey Report, Pacific Regional Group on Food Security and Climate Change.
- Johnston, P. (2005), Pacific Regional Energy Assessment 2004, Volume 16, Vanuatu, Secretariat of the Pacific Regional Environment Programme/PIREP (Pacific Islands Renewable Energy Project).
- Johnston, P. (2008), Expanding and Updating the Pacific Islands Renewable Energy Project (UNDP (United Nations Development Programme)/GEF (Global Environmental Fund)/SPREP (Secretariat of the Pacific Regional Environmental Programme) /PIREP), Reports and Data.
- Pacific Regional Group on Food Security and Climate Change (2010), Port Orly Biofuel Project, A Case Study.
- Pacific Power Association (2011), Performance Benchmarking for Pacific Power Utilities.
- Pacific Power Association-KEMA (2010), Quantification of Energy Efficiency in the Utilities of the U.S. Affiliate States (excluding US Virgin Islands).
- Pacific Power Association-KEMA (2012), Quantification of the Power System Energy Losses in Southern Pacific Utilities.
- Pacific Regional Infrastructure Facility (2011), Pacific Infrastructure Performance Indicators.
- Polack, A. (2010), Drivers and Barriers of Renewable Energy in the Electrification of Vanuatu, Murdoch University.
- Pool, F. (2012) Vanuatu Rural Tourism Energy Needs and Renewable Energy, Presentation.
- Resources and Logistics EU (European Union) (2011), Support to the Energy Sector in 5 Pacific Island States, REP-5. Final Evaluation Report Vol. 1, Main Report.
- SPC (Secretariat of the Pacific Community) (2011), Towards an energy secure Pacific, Framework for Action on Energy Security in the Pacific, SPC.
- Syngellakis, K. (2011), UNIDO-SPC Assessment of Renewable Energy (RE) and Energy Efficiency (EE) Potential in Selected Pacific States.

Levantis, T. *et. al.* (2006), Are Pacific countries coping with surging oil prices? AusAID.

Toimoana, I. (2010), Technical Evaluation Report, The Port Orly Biofuel Project in Vanuatu, A Pacific Case Study, PPA (Pacific Power Association).

UNELCO (Union Electrique du Vanuatu Limited) (2011), Annual Technical Report Electricity, UNELCO.

United States Central Intelligence Agency, (2012), The World Fact Book 2012-2013, <https://www.cia.gov/library/publications/download/>

Utilities Regulatory Authority of Vanuatu (2010) Sarakata Hydroelectric Scheme, Luganville Santo, Audit Report.

Utilities Regulatory Authority of Vanuatu (2011), Annual Report 2010.

Vanuatu National Statistics Office (2007), Vanuatu Main Report on the Household Income and Expenditure Survey 2006.

Vanuatu National Statistics Office (2012) Alternative Indicators of Well-being for Melanesia.

World Bank (2011), Vanuatu: Efate Geothermal Power and Island, Ring Grid Development Framework, Final

Report, 18 January, 2012, pp. 17, Castlerock Consulting Pte Ltd, One Fullerton.

World Bank, East Asia and Pacific Region, Pacific Islands Country Management Unit (2006), A review of obstacles and opportunities for improving performance in the Pacific Islands.

## Internet Reference Sources

Secretariat of the Pacific Community, Pacific Regional Information System, Statistics for Development Programme (2012), <http://www.spc.int/nmdi/MdiHome.aspx>

Secretariat of the Pacific Regional Environment Programme, Pacific Regional Energy Assessment: Country Reports (PIREP) (2012), <http://www.sprep.org/Pacific-Environment-Information-Network/country-profiles-directory>

The World Bank, Indicators (2012), <http://data.world-bank.org/indicator/all>

United States National Aeronautics and Space Administration (2012), solar and wind data website URL: <http://eosweb.larc.nasa.gov/cgi-bin/sse/sse.cgi?>



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