MODERN ENERGY FOR A TRADITIONAL SOCIETY: APPLYING A COMMUNITY-DRIVEN MODEL IN VANUATU

Towards an ‘Energy Plus’ approach for the poor:
A review of good practices and lessons learned from Asia and the Pacific

Case Study 17

ENVIRONMENT AND ENERGY
We would like to take this opportunity to recognize the partners who have made financial and other contributions to the energy sector project described in this report. These include the Vanuatu Renewable Energy and Power Association (VANREPA), the European Union's ACP-EU Energy Facility, the WISIONS initiative and the Energy Unit of the Ministry of Lands and Natural Resources. In addition, the project would not have been possible without the co-operation and the contribution of the Government of the Republic of Vanuatu and local communities.

“UNDP partners with people at all levels of society to help build nations that can withstand crisis, and drive and sustain the kind of growth that improves the quality of life for everyone. On the ground in 177 countries and territories, we offer global perspective and local insight to help empower lives and build resilient nations.”

Cover photo courtesy of UNDP/Energy Access for Poverty Reduction
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### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>APRC</td>
<td>Asia-Pacific Regional Centre</td>
</tr>
<tr>
<td>EUR</td>
<td>euro (currency)</td>
</tr>
<tr>
<td>FIN</td>
<td>Futuna Island Network</td>
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<tr>
<td>FREC</td>
<td>Futuna Renewable Energy Committee</td>
</tr>
<tr>
<td>GoV</td>
<td>Government of Vanuatu</td>
</tr>
<tr>
<td>LED</td>
<td>light-emitting diode</td>
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<tr>
<td>RE</td>
<td>renewable energy</td>
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<tr>
<td>SPV</td>
<td>solar photovoltaic</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>USD</td>
<td>United States dollar (currency)</td>
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<td>VANREPA</td>
<td>Vanuatu Renewable Energy and Power Association</td>
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<tr>
<td>VUV</td>
<td>Vanuatu vatu (currency)</td>
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Synopsis

Project title: Vanuatu’s Community Powerhouse rural electrification model

Country and region of implementation: The Republic of Vanuatu (islands of Futuna and Aneityum, Tafea Province)

Focus area (technology/energy service): Energy provision, household and community lighting, and capacity development

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Duration: 2007-2010, with an extension until 2013

Cost: EUR 537,284 (USD 752,198), comprising funds from the European Union’s ACP-EU Energy Facility and WISIONS (an initiative of the Wuppertal Institute for Climate, Environment and Energy, organized with the support of the Swiss-based foundation ProEvolution).¹

Project brief: The Community Powerhouse is a model for community-based rural electrification in Vanuatu. The model is being developed and implemented, in collaboration with local communities, by the Vanuatu Renewable Energy and Power Association (VANREPA) in response to locally identified needs for rural energy services. The Community Powerhouse focuses on targeted application of technology within a community-ownership framework. This model treats electrification as a social and cultural issue, and thus emphasizes organizational and capacity development as a path to long-term management of local energy needs.

This model is being implemented in remote island communities, and includes two primary components:

1) sustainable provision of decentralized wind- and solar-generated electric power through a series of micro-grids and battery-charging stations; and

2) establishment of community energy utilities to ensure project sustainability and to manage future energy services for the target communities.

¹ EUR 1 = USD 1.40 throughout this report (www.xe.com).
Acknowledgements

Modern energy for traditional society: Applying a community-driven model in Vanuatu is one of 17 case studies which, together with a report titled ‘Towards an ‘Energy Plus’ approach for the poor: A review of good practices and lessons learned from Asia and the Pacific’ and an Action Agenda Note, comprise a review of good practices and lessons learned in energy service delivery to the poor. Commissioned and facilitated by the United Nations Development Programme Asia-Pacific Regional Centre (UNDP APRC), this case study identifies key characteristics that have helped poor households and communities gain access to modern energy services, and to derive valuable lessons for future energy access activities. This case study is the product of an intensive collaborative process and we wish to acknowledge the many contributors, without whose generous support this work would have been impossible.

We express special gratitude to the main researchers and writers of the case study, William Mohns and David Stein, whose expertise and knowledge established the basis of this report. UNDP also wishes to thank the rural communities in Futuna and the Futuna Renewable Energy Committee for their support in data collection.

Special thanks to Thiyagarajan Velumail, supported by Soma Dutta, Lara Born and Butchaiah Gadde, for his technical leadership and guidance in the conduct of the 17 case studies.

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UNDP APRC in Bangkok was responsible for the facilitation and conceptualization of the 17 case studies and the associated report. We thank the core team, comprising Saana Ahonen, Aalok Awalikar, Lara Born, Soma Dutta, Butchaiah Gadde, Thomas Lynge Jensen, Pratima Mathews, Wattanee Niyomyath, Thiyagarajan Velumail and Julien Wallet-Houget. Thanks to Srinatharat Wannawong, who has been instrumental in supporting the entire process administratively.

Finally, UNDP would like to thank Nikolai Beresnev and Collin Piprell for their excellent editorial support, and KEEN Publishing Co. Ltd. (Thailand) for logistical support and graphic design.
Preface

Asia-Pacific has achieved remarkable economic growth and socio-political progress in the past two decades, with almost every country in the region experiencing a concomitant decline in poverty.

Despite this progress, 800 million people in the region remain without access to electricity and almost 2 billion rely on the traditional use of biomass for cooking. While good progress has been made with expansion of electricity, many remote rural areas remain un-electrified, since connecting them to the national grid remains very expensive.

The poor often live in subsistence economies that do not generate cash surpluses, limiting their purchasing power and opportunities to shift to modern energy services. As a result, they have to invest more of their income and time in obtaining energy, and tend to use traditional energy services and fuels. Women and children are particularly affected, spending many hours a day collecting fuelwood and preparing meals in the kitchen. Smoke from inefficient stoves in poorly ventilated homes kills 1.6 million people worldwide every year; the majority of victims are women and children younger than five years. Indoor air pollution is the fourth-biggest killer in the developing world.

Asia-Pacific countries have applied many cutting-edge practices in providing energy access to the poor, including innovative financing mechanisms. Apart from satisfying basic needs, energy services can act as an instrument to empower women and disadvantaged communities; as an entry point to mobilize communities to take charge of their own development; and, most importantly, as a means to livelihood enhancement and poverty reduction. However, the scale of expansion of energy access projects has been far from sufficient.

UNDP has been working with its country partners to address these energy poverty issues, aiming to meet user needs, broaden energy supply options and link these efforts in achieving the Millennium Development Goals. Between 2009 and 2011, the UNDP APRC reviewed 17 energy access programmes and projects implemented by various development agencies and the private sector in the region. These projects were documented as 17 case studies (including this report), a report titled ‘Towards an ‘Energy Plus’ approach for the poor: A review of good practices and lessons learned from Asia and the Pacific’ and an Action Agenda Note. Together, these documents provide practical guidance for policymakers and development practitioners in designing and implementing future programmes and projects that ensure the delivery of low emission, affordable and reliable energy services for poverty reduction.

This case study documents an energy service delivery model that takes into account local social and cultural settings to ensure effective electrification. The Community Powerhouse model, implemented in remote island communities of Vanuatu, provides decentralized wind- and solar-generated electric power through a series of micro-grids and battery-charging stations, and establishes community energy utilities in target areas.

Nicholas Rosellini
Deputy Assistant Administrator & Deputy Regional Director
Regional Bureau for Asia and the Pacific
1. Background

1.1 Economic and social environment

The Republic of Vanuatu is an archipelagic nation in western Melanesia, containing 83 islands and 224,564 people. More than three quarters of the population live in rural areas where subsistence agriculture is predominant. The country has a young and growing population, and is experiencing rapid urbanization.

In contrast to the country’s significant cash poverty, Vanuatu maintains a well-developed and vibrant traditional economy, and presents great cultural and linguistic diversity. According to Ralph Regenvanu, Director of the Vanuatu National Cultural Council and a Member of Parliament, almost all of the rural inhabitants:

- live in villages with other members of their traditional extended families on land that is theirs under the rules of custom;
- satisfy most food and other requirements via traditional land, sea and resource utilization (e.g. gardening practices);
- speak the indigenous language;
- are governed by traditional leaders (chiefs and chiefs’ councils);
- have their disputes resolved within communities by traditional leaders using traditional dispute-resolution approaches; and
- participate in custom ceremonies that cement their place as members of their community.

While the national cash economy has suffered under the recent global recession, the traditional economy insulates many ni-Vanuatu from its impacts. Vanuatu is unique in that “there is no landlessness in Vanuatu… everybody has a place to live and work the land.” Community is the nucleus of life in Vanuatu: the society is organized around kinship, with strong social networks and indigenous governance structures. Emphasis is on community over individual, with consultation and inclusiveness highly valued.

1.2 Energy access

More than three quarters of ni-Vanuatu live in rural areas scattered across an archipelago of 83 islands, where electrification remains a challenge. Estimates of electricity access in Vanuatu range from 20 to 27 percent of the population. A private energy company UNELCO has a concession from the Government of Vanuatu (GoV) to supply grid-connected electricity to Vanuatu’s four towns – Port Vila, Luganville, Lenakel and Lakatoro – but is largely inactive elsewhere.
Inadequate energy sources. The electricity grid does not extend outside urban and peri-urban areas. The vast majority of rural households thus depend on kerosene for lanterns, disposable dry-cell batteries for flashlights, and wood for cooking. Some rural areas also operate small diesel generators and solar photovoltaic (SPV) systems. Nine households in Futuna Island have purchased SPV systems, the largest of which has an 85 W capacity.

Disproportionate household expenditures on energy. Limited access to modern currency – as opposed to traditional currencies such as pigs, mats, shells and yams – means that rural households spend a large portion of their cash income on lighting needs (typically kerosene and disposable dry-cell batteries). Unfortunately, these energy sources are expensive and inefficient. Moreover, supply ships visit outer islands infrequently and on inconsistent schedules, making the supply of kerosene, diesel and other fuels both prohibitively expensive and unreliable. These factors contribute to Vanuatu’s rank on the Oil Price Vulnerability Index: in 2007, it was ranked as the most vulnerable Pacific Island country, and second (only to the Republic of Maldives) most vulnerable country in the Asia-Pacific.

Rural grid electrification too expensive an option. Historically, extending the grid has been the preferred option for rural electrification in many parts of the world. However, Vanuatu’s small population and low population density, combined with the remoteness of many rural communities, makes centralized grid connectivity prohibitively expensive.

Resource constraints in providing access to energy. The Energy Unit of the Ministry of Lands and Natural Resources is responsible for rural electrification and for making energy supplies available at a ‘reasonable cost’. Unfortunately, the Energy Unit operates with limited staff, budgetary resources and legislative tools. According to UNDP, the country “has developed numerous draft national energy policies and plans over the past 20 years but none were endorsed or formally adopted… In late 2000, the Council of Ministers endorsed a ‘Vision for a 100 percent Renewable Energy Economy’ by 2010 but there have been no follow-up activities or budget”.

1.3 Energy consumption pattern: environmental and health implications

The current energy consumption pattern in Vanuatu has serious environmental and health implications, some of which are discussed below.

Disposable batteries and the reef. The large number of disposable batteries used for lighting, combined with inadequate disposal facilities, has a significant adverse impact on coral reef ecosystems, and thus on local subsistence and commercial fishing.

Climate change. Given its limited energy services and a small population, Vanuatu’s annual contribution to global greenhouse gas emissions is limited to 0.1 million tonnes of carbon dioxide, or 0.4 tonnes per capita.

Health implications. A significant health issue is poor indoor and outdoor air quality resulting from energy generation. Emissions of fine particulate matter, polycyclic aromatic hydrocarbons and other harmful substances from the use of diesel fuel, wood and kerosene contribute to a range of serious illnesses including asthma, heart disease, chronic bronchitis, emphysema, pneumonia, premature births and low birth weights. Women, children and the elderly are often most vulnerable to these emissions, as they spend more time indoors and at household tasks that require heat and lighting (e.g. food preparation). Another concern is that many health clinics (dispensaries) and first-aid posts in remote communities have neither the adequate refrigeration to keep medical supplies nor adequate lighting for medical procedures. Consequently, improving energy services for health clinics and first-aid posts is a high priority.

11 UNDP (2005) cites a 1999 census report showing that nearly 74 percent of all households, and 86 percent of rural households, use kerosene as their main lighting source (and that) 86 percent of all households, and over 95 percent of rural households, cooked primarily with wood or other biomass. Though more recent data is unavailable, it is unlikely that these rates have changed dramatically.
12 In January-February 2007, Vanuatu had the highest retail kerosene price in the Pacific region (USD 1.65) (Pareti, 2007).
15 UNDP, 2005.
16 UNDP, 2007b.
17 Bruce et al., 2002; Province of British Columbia, 2009.
2. Project overview

2.1 Vanuatu Renewable Energy and Power Association (VANREPA)

Founded in 2002, Vanuatu Renewable Energy and Power Association (VANREPA) is a Vanuatu-based non-governmental organization focused on finding innovative, sustainable solutions to local energy challenges. Based in the capital of Port Vila, the organization operates three national programmes:

- ‘Energy and Water’ focuses on renewable energy (RE) for water purification, heating, delivery and desalination;
- ‘Energy in Schools’ provides RE to primary and secondary schools; and
- ‘Green Power to the People’ focuses on grassroots energy initiatives and providing information in Bislama, the local language.\(^18\)

VANREPA’s programming features two cross-cutting themes:

- culturally appropriate energy development – integrating social and cultural impact assessments and collaboration into VANREPA’s energy projects, with the aim of developing socially and culturally sustainable solutions to locally defined energy needs; and
- energy and health – improving air quality and health services as a central component of improved energy services.

2.2 Community Powerhouse model

Under its Community Powerhouse model, VANREPA constructs decentralized wind, solar, micro-hydro or hybrid power generating systems within the targeted community. The produced electricity is stored in batteries at the charging station. This electricity is then delivered to community institutions (schools, health centres, community centres, etc.) and commercial enterprises via a mini-grid distribution network, which is also constructed by VANREPA. These customers pay a monthly fee for electricity received.

Meanwhile, households are supplied with light-emitting diode (LED) lights that can be recharged at the charging station. These customers pay a fee per charge.

After project completion, these energy facilities are expected to be maintained by the community.\(^19\)

2.3 Island of Futuna

Futuna is a mountainous volcanic island in south-east Vanuatu. The island rises almost vertically from the sea to a plateau at 643 metres. The island’s 400 residents are spread out over six communities that ring the outside of the island, connected by a rugged, undulating footpath more than 20 kilometres long.\(^20\)

\(^{18}\) Vanuatu’s three official languages are English, French and Bislama.

\(^{19}\) Stein, 2008.

Most of the population is engaged in subsistence agriculture and fishing, and lives in houses constructed mainly from local materials. The primary sources of income are a GoV contract for maintaining the footpath around the island, and salaries for five teachers and two GoV officers (see Table 1). Each village is responsible for a portion of the footpath around the island, dedicating one morning each week to maintenance with all able members participating. Island affairs are represented in the national capital by the Futuna Island Network (FIN), an association of the ni-Futuna living in Port Vila. The development of the Community Powerhouse model on Futuna involves close collaboration between VANREPA and FIN.

The island has a short airstrip but no motor vehicles. Goods are transported around the island on foot or by boat. The island has a primary school, a dispensary and two first-aid posts. There are a few small SPV panels and diesel generators on the island but no grid electricity.

A 2006 study by Futuna’s Council of Chiefs estimated that more than 28 percent of the island’s income is spent on kerosene, with the average household consuming 80 litres per year. Since 2006, kerosene prices on the island have risen by approximately 50 percent, while revenues have not kept pace.

Table 1: Futuna island annual revenue for 2006

<table>
<thead>
<tr>
<th>Income source</th>
<th>Description/examples</th>
<th>Approximate annual revenue in VUV (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government employees</td>
<td>Road maintenance, teachers (5), and provincial government officers (2)</td>
<td>5,200,000 (46,700)</td>
</tr>
<tr>
<td>Agriculture and forestry</td>
<td>Sandalwood, pepper, vanilla, fruit and vegetables</td>
<td>600,000 (5,389)</td>
</tr>
<tr>
<td>Fisheries</td>
<td>Fish, crayfish and coconut crab</td>
<td>600,000 (5,388)</td>
</tr>
<tr>
<td>Handicrafts</td>
<td>Mats, baskets, wooden crafts and local jewellery</td>
<td>400,000 (3,592)</td>
</tr>
<tr>
<td>Remittances</td>
<td></td>
<td>50,000 (449)</td>
</tr>
<tr>
<td>Tourism</td>
<td></td>
<td>50,000 (449)</td>
</tr>
<tr>
<td>Other</td>
<td>Cash donations</td>
<td>50,000 (449)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>VUV 6,950,000 (USD 62,416)</td>
</tr>
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</table>


2.4 Community Powerhouse project in Futuna and Aneityum

VANREPA’s partnership with the people of Futuna in improving energy services on their island began in 2006, with a project to supply electricity to the island’s only school.

In 2007, the current Community Powerhouse project in Futuna commenced, to be implemented by VANREPA, with funding from the WISIONS Sustainable Energy Project Support initiative. With additional funding from the European Union’s ACP-EU Energy Facility (2008 onwards), the project quickly grew in scope, and was expanded to include the Anelcauhat village of Aneityum Island.

Community and donor response to the project have been positive. However, the project has faced a series of challenges related to shipping, extreme weather and equipment problems that delayed installation and forced a rescheduling of project activities. While originally scheduled to conclude in 2010, the project has been extended to 2013.

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21 Equivalent to ni-Vanuatu, ni-Futuna refers to the people of Futuna.
22 USD 1 = VUV 111.35 throughout the report (www.xe.com).
23 The project was funded by the German Embassy in Canberra (Australia) and included installation of a 300 W wind turbine.
24 In 2007, an accident on a new cargo ship led the GoV to suspend the ship’s operations pending an inquiry, which resulted in significant delays to the project and additional storage costs for the equipment while it remained in the capital.
25 In early 2008, Futuna was hit by Severe Tropical Cyclone Gene, suffering extensive damage. Even though there were no fatalities, the cyclone had a significant and lasting impact on the community, and resulted in project delays.
2.5 Objectives and expected outcomes

The Community Powerhouse project seeks to achieve the following objectives in Futuna and Aneityum:

- establishing community energy utilities;
- conducting capacity-development activities; and
- replacing kerosene and disposable batteries with less expensive and higher-quality LED lighting. Such lighting is to be powered by wind and solar energy available through grid-connected electricity for community institutions, and through battery-charging services for individual households.

The project thus aims to provide the following key benefits:

- electricity for community institutions, including the school and medical clinic;
- electricity for households via the use of rechargeable LED lights for higher-quality, less expensive and safer lighting; and
- concomitant environmental and health benefits, including improved air quality.

The Community Powerhouse aims to benefit all members of the community. Certain project features, however, yield varying advantages across different community segments. Women and young children, for example, tend to have higher exposures to indoor air pollution and attendant risk of respiratory infection than men, and thus may experience greater benefits from replacing kerosene with LED lights.

Currently there are six ‘powerhouses’ in development: four on Futuna and two on Aneityum. They will serve a total of 1,100 residents.

2.6 Project partners and funding

The project involves a broad range of partners including the Energy Unit of the Ministry of Lands and Natural Resources, chief and elder organizations for the communities involved (Futuna Fatoriki Council of Chiefs for Futuna, and the Chief Representative and Family Elders of Anelcauhat Village, and Umej Council of Chiefs for Aneityum), FIN, the Aneityum Tourism Association and other organizations on the two islands.

The overall project budget is EUR 537,284. The project is financed by a combination of household, community and donor contributions:

- donor funds are directed to the initial capital cost of constructing the generating unit, the distribution network and, if required, the electrical fittings for community institutions. The project is funded by the European Union (EUR 402,963), the WISIONS initiative (EUR 55,150), and VANREPA and smaller donors (EUR 79,171);
- the community contributes labour and local materials for construction. It also provides funds for system operation and maintenance through fee payments for battery-charging and monthly fees to community institutions.

3. Implementation strategy

3.1 Project activities

The Community Powerhouse model involves the following phases:

1) community consultation;
2) feasibility study and needs assessment;
3) project design;
4) establishment of a community management framework;
5) community training and promotion;
6) installation of equipment; and
7) evaluation.

**Community consultation.** Community consultations are conducted at every stage of the model. For the Futuna project, consultations began with informal conversations with ni-Futuna in 2005, and advanced to include several formal meetings with the FIN and with other members of the community living in the capital.

**Feasibility study and needs assessments.** Integrated socio-cultural, environmental and feasibility assessments are crucial in the early stages of project development. This ensures that the project and timing are right for the community. This phase of the project focuses on:

- preparing a community profile;
- assessing community interest in the project and its basic suitability;
- gathering information regarding local energy needs;
- assessing local capacity; and
- assessing the energy potential of the geographic location.

An assessment of capacity needs is important at this stage. The community and VANREPA must develop a shared understanding of the commitments required from both parties, and be prepared to take responsibility for potential negative impacts of the project.

The social and cultural impact assessment aims to mitigate potential undesirable project impacts, and to make the community and VANREPA aware of its social and cultural impacts. To this end, discussions – in large groups, small groups, and one-on-one – were conducted with Futuna community members.

**Project design.** Not a discrete stage in itself, project design is an interactive process shaped through consultation, feasibility studies and needs assessments. Design is further refined by working with the community management organization. Community Powerhouse design involves defining in detail local energy needs and deficiencies, and examining what would work well with energy services currently available in the community. Examining what works helps to isolate needs, and reduces the risks of either over-design or imposition of foreign conceptions of how energy and light should be used, and thus of how work, social and domestic life should be ordered.

In taking this approach on Futuna, VANREPA and the community identified two aspects of pre-existing energy and lighting services that had worked well. These aspects became key design elements in the Community Powerhouse project, and are described below:

- **Portability.** While kerosene and non-rechargeable batteries were identified as weak elements of the system, the portability of lanterns and torches as primary lighting sources fits well with patterns of social relations and use of domestic space on Futuna (and in much of Vanuatu). For many ni-Vanuatu and ni-Futuna, the primary use of the house is for sleeping, while social life and many domestic chores take place outside or in other buildings, such as cook houses. Residents need lighting in these locations and while in transit, as well for fishing and mobility at night. Providing stationary lighting for all of these locations would incur significant costs (in terms of initial capital outlay and maintenance costs), jeopardising project feasibility and sustainability. Therefore, the solution was improved portable lighting in the households and in transit.
Pay as you go. Given the island’s limited cash economy, affordability was a key concern. The community identified high kerosene and battery prices as one of the main problems with the previous energy situation. As mentioned above, only seven residents on the island received fixed cash salaries. But one of the strengths of the prevailing system was that residents had control over their energy expenses, in that they consumed no more kerosene and batteries than they could pay for. A system that involved a monthly bill (as might be required by grid connection) could potentially present difficulties with repayment. In terms of other alternatives, pay-as-you-go meters would add significantly to overall project cost, while replacement or repair costs of household-level systems such as small SPV installations would be unaffordable for many households.

Consequently, centralized battery-charging stations were identified as the preferable delivery mechanism. The stations offer the advantage of appearing similar to the previous arrangements, and residents pay a fee to recharge batteries as needed. It was hoped that introducing a familiar (but less-costly) model (i.e. substituting more appropriate alternatives for kerosene and rechargeable for non-rechargeable batteries for households) would meet identified needs, leading to sufficient community uptake and long-term sustainability. Since 2007, VANREPA and the local community have been testing different lighting kits, determining the most appropriate and efficient model for local conditions and use-patterns.

Establishing a community management framework. In the Community Powerhouse model, following on-site consultations and after the community and VANREPA have agreed to work together on the project, a representative committee is formed. The role of the committee is to manage the Community Powerhouse facilities on behalf of the community. The structure and membership of the committee is determined in cooperation with the local community, and must be compatible with existing or indigenous governance systems.

In Futuna, management of the project is entrusted to the Futuna Renewable Energy Committee (FREC). FREC is an island-wide committee operating under the authority of the Futuna Council of Chiefs, and includes a representative, chosen by village consensus, from each of the six villages on the island. This conforms to the traditional form of governance on the island, which has proven reasonably successful and sustainable with island committees for health, fisheries, pathways and schools. FREC is a not-for-profit organization developed to manage the Community Powerhouse project, build local capacities, and manage future energy services on the island. It is Vanuatu’s first community energy utility.

At the first meeting of FREC, a chair, treasurer and secretary were selected. It was also decided that since no villages had chosen a woman as their representative, the committee would add two women representatives to ensure the committee best represented the people and interests of the island. The committee subsequently decided to accept three women representatives instead, added a vice-chair to the committee executive, and elected one of the women representatives to this position.

An extensive community consultation process laid the groundwork for FREC’s structure. It included meetings with a wide range of stakeholders including GoV officials, chiefs, elders, representatives of Vanuatu’s National Cultural Centre and FIN. VANREPA staff also presented the project at community functions around the island.
Community training and promotion. Ideally, community ownership entails its involvement in every aspect of the project, including design, implementation, operation, management and maintenance. However, many remote rural communities have neither the technical skills to design, install, operate and maintain such an energy system, nor the institutional or organizational skills to manage it. Capacity-building and institutional support, therefore, comprise key elements of the Community Powerhouse model. In Futuna, VANREPA’s training and capacity-development programme has included the following activities:

- workshops addressing committee officer responsibilities;
- developing the article of association and associated by-laws; and
- developing a tariff structure for provided electricity.

Workshop topics were determined in consultation with FREC and island residents with electrical training and experience. In addition, VANREPA has conducted a short course on entrepreneurship and sustainable development, and is producing two manuals, ‘Building our community energy utility’ and ‘Basic operations manual’. The work is conducted primarily in Bislama, ensuring that training and materials are accessible to the community at large.

The project has also produced a number of hand-outs which demonstrate the nature and benefits of the project; among them are those illustrated in Figure 1.

Equipment installation. In the Community Powerhouse model, the equipment is installed jointly by VANREPA and the community. The community is responsible for supplying local building materials such as coral and sand for concrete, and the labour for mixing concrete, digging trenches for cables, and constructing the ‘powerhouses’ that hold batteries, inverters and other electrical equipment. In Futuna, installation was delayed by the shipping, cyclone and technical difficulties mentioned above, and was completed in 2010.

Monitoring and evaluation. In Futuna, project monitoring by both VANREPA and FREC was instrumental in the replacement of wind power with solar energy for the community of Ihsia (once a turbulence-related problem was identified), and reserving a minimum of three committee positions for women (after realizing that every village had followed traditional biases in selecting only male representatives).

VANREPA plans to implement the following post-implementation monitoring and evaluation measures:

- facilitating the development of a network of community energy committees that will assume responsibility for maintaining the energy systems; and
- working with the communities, as part of project learning, to conduct a post-project community profile and impact assessment.

3.2 Financing mechanisms and costs

Once energy systems are fully operational, the RE committees on Futuna and Aneityum will be supported financially by:

- the sale of electricity to schools, health centres, aid posts and other public buildings; and
- the sale of portable LED lights and battery recharging services to the general public.

The first portable rechargeable LED light for each household is fully paid for by the project and supplied via FREC. Additional LED lights are sold by FREC at a subsidized price (not yet set) and with bulk purchase discounts.

Table 2 presents a general summary of the project budget.
Figure 1: Community posters: Win paoa projek blong yumi – Our wind power project
Table 2: Project budget, 2001-2010

<table>
<thead>
<tr>
<th>Cost category</th>
<th>Cost (VUV)</th>
<th>Share of total budget (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultation and assessments</td>
<td>6,787,634</td>
<td>9</td>
</tr>
<tr>
<td>Training and capacity development</td>
<td>16,321,052</td>
<td>21</td>
</tr>
<tr>
<td>Equipment and installation</td>
<td>37,694,190</td>
<td>50</td>
</tr>
<tr>
<td>Management and administration</td>
<td>14,615,277</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>75,418,153</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: ‘Management and administration’ refers to the costs of project auditing, evaluation, publications, promotional activities and organizational operations. ‘Training and capacity development’ refers to costs of establishing and training community management organizations. Much of the consultation work for the Community Powerhouse projects on Futuna and Aneityum was performed in advance (some of it in the process of applying for funding), meaning that the ‘consultation and assessments’ costs are slightly under-reported.

4. Project impacts

Evaluating project impacts is premature at this point, as this is a relatively new project that has faced delays. Nevertheless, given the community and donor support to date, it represents a promising approach to sustainable, community-managed improvements in energy supplies for rural communities in Vanuatu.

In particular, the transition from kerosene to RE for lighting enabled by the project will significantly reduce emissions, improve air quality and contribute to the attainment of Millennium Development Goals 4, 5 and 7 (reducing child mortality, improving maternal health, and ensuring environmental sustainability, respectively). While some kerosene will still be used after the project is fully implemented, at this stage it is difficult to assess the quantity of kerosene and related emissions that will be avoided. Women’s participation in FREC is expected to have a positive impact on women’s empowerment and benefit-sharing.

5. Expansion and replication potential

5.1 Expansion

By establishing community management organizations, the Community Powerhouse model aims to install a management structure for the future expansion of energy services (whether financed communally, privately, or by donors or governments). However, it is too early in the life of the community management organizations on Futuna and Aneityum to discuss detailed expansion plans.

5.2 Replication

While projects at Futuna and Aneityum are still in their infancy, enthusiastic initial responses from other communities in Vanuatu and donors have encouraged replication initiatives that are already underway.

In 2008, with AusAID funding, VANREPA completed a feasibility study regarding the replication of the Community Powerhouse model in four areas of the country:

- Shepherds Islands, Shefa Province, central Vanuatu;
- Torres Islands, Torba Province, northern Vanuatu;
- Aniwa Island, Tafea Province, southern Vanuatu; and
- Aneityum Island (replication at the areas of Umetch and Port Patrick).
This replication would require financial support from donors and the GoV. At the time of writing, however, neither of those sources seems certain, particularly as donor and GoV energy priorities in Vanuatu appear to be de-emphasizing funding for the capacity-development and community-management initiatives central to the Community Powerhouse model.

In addition, VANREPA and the residents of the island of Rah in Torba Province, northern Vanuatu, have completed planning and feasibility assessment for a solar-powered community rainwater and desalination system, with a battery-charging station that applies the Community Powerhouse approach. This initiative was a finalist for the World Bank’s Development Marketplace 2009 competition, but has not yet secured funding.

5.3 Integration into government policies

Expanding the Community Powerhouse project throughout rural Vanuatu would require substantial increase in the GoV or donor funding. This would entail either a greatly increased, more hands-on GoV role in rural energy provision – something it currently does not appear to have the staff or capacity for – or increased core funding for VANREPA.

The Energy Unit of the Ministry of Lands and Natural Resources has endorsed the project. For their part, while providing no financial support, government officials from Tafea Province have been active participants in facilitating community involvement in the project.

6. Sustainability of the model

6.1 Defining sustainability in the context of remote communities

For the Community Powerhouse model, ‘sustainability’ means the continued operation of the community management organization. This includes managing the generating and distributional infrastructure, long-term equipment replacement, setting and collecting tariffs, attending to social and environmental issues related to energy use in a culturally appropriate manner, and managing energy planning for their communities.

Financially, the model aims to be sustainable from the point of handover to the community organizations onwards. The fees collected have been structured to be sufficient to support day-to-day maintenance as well as long-term equipment replacement, while providing higher-quality lighting at a cost that is at or below household expenditures on kerosene.

6.2 Long-term support for community management organizations

VANREPA has presented a proposal to funding agencies for Community Powerhouse replication (discussed in Section 5.2). The elements of the proposal are discussed below.

Networked community energy utilities. VANREPA would expect to coordinate and support a network of community energy utilities. This would include bringing together representatives from the community management organizations for regular advanced training and knowledge transfer sessions.

Post-implementation monitoring and replication. VANREPA also foresees post-implementation monitoring that would involve using partners such as the members of FREC to set up and provide training for Community Powerhouse projects on other islands. VANREPA would also bring together representatives from each of the community management organizations for annual or biannual workshops.
6.3 VANREPA’s institutional sustainability

Currently, VANREPA is a project-funded organization, and its long-term financial viability requires effective relations with donors and the GoV, as well as with the communities it serves.

**Remaining both adaptable and principled.** This means adapting to the changing priorities of donors, the GoV and communities, whilst remaining dedicated to VANREPA’s own philosophy and approach.

**Meeting the challenge of long-term local staff capacity-building.** The organization must also adapt staffing levels to levels of work and funding available at any given time. This presents a challenge in terms of long-term training and capacity development within the organization. In the past, this has led to dependence on outside consultants and volunteers, rather than on training permanent local staff.

Through the Community Powerhouse projects, VANREPA has been able to hire more local staff, and the organization is beginning to move away from its dependence upon consultants and volunteers. In the 12 months prior to this writing, VANREPA grew to five full-time permanent staff from the one initial staff member. Nevertheless, the long-term sustainability of both VANREPA and its remote rural projects, e.g. the Community Powerhouse, will be best served if VANREPA can secure long-term core funding.

**Combining local autonomy with post-project support.** VANREPA’s focus on local training and capacity development aims to ensure that long-term project success does not depend heavily on VANREPA’s continued existence.

7. Lessons learned and good practices in expanding energy services for the poor

Project implementation at Futuna and Aneityum remains in progress, but a number of key lessons have already emerged, including the importance of the following elements:

**Community management of energy systems.** The importance of establishing sound community management processes in remote locations cannot be over-emphasized. This is primarily because of difficulties associated with the implementing agency providing long-term ‘handholding’ support. The Community Powerhouse model therefore places great emphasis on community management and capacity development. This has at times meant a longer timeline between project initiation and equipment installation, but it has also made a higher level of community involvement and support possible. It is essential that this different conception of ‘support’ is communicated clearly to community members and stakeholders from the outset and is reiterated throughout the project.

This approach imposes greater demands both on the community and on VANREPA. Part of VANREPA’s response was to conduct a feasibility study with interested communities (as a separate project) to assess both their suitability and the levels of training needed. This approach aimed to ensure project suitability while ensuring that appropriate resources were available for training and capacity development.

**Harmonizing project activities with traditional socio-cultural norms and practices.** Project activities in remote and isolated communities must be compatible with local governance systems that are often deeply rooted in traditional socio-cultural norms and practices. Establishing the Community Powerhouse management system within local forms of governance on the island helped to establish ‘buy-in’ and has assured a degree of social sustainability for the project.

**Solutions responsive to genuine local needs.** The project also emphasizes the value of clearly identifying the energy needs of the community, and then developing responsive solutions. In Vanuatu, energy service had to be portable, and it was important that the users could make small payments as and when they were able, consuming energy services only to the extent they could afford them. Centralized charging stations fulfil both criteria.
8. Conclusions

The Community Powerhouse presents a comprehensive approach to improving energy services while considering socio-cultural, economic and technological factors. The socio-cultural focus emphasizes broad consultation, training, capacity development and evaluation, while incorporating lessons from social marketing and social, cultural and environmental impact assessment. This broad approach – in particular, the detailed attention to social and cultural factors – makes this model unique. Another innovation in providing improved energy services for rural Vanuatu was the combination of a micro-grid and battery-charging station. This allowed the project to address community-identified needs and priorities, while maintaining the portability and pay-as-you-go model of pre-existing community energy systems.
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