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THE PACIFIC RESPONSE: ELECTRIFYING ISOLATED ISLANDS

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

Case Study 7

ENVIRONMENT AND ENERGY

We would like to take this opportunity to recognize the Fiji government partners who have made financial and other contributions to the energy sector programme described in this report. These include the Fiji Electricity Authority, the Public Works Department and the Department of Energy.

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Contents

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Acronyms

AC	alternating current
ADB	Asian Development Bank
APRC	Asia-Pacific Regional Centre
CATD	Centre for Appropriate Technology and Development
DC	direct current
DoE	Department of Energy
FEA	Fiji Electricity Authority
FJD	Fijian dollar (currency)
GDP	gross domestic product
GEF	Global Environment Facility
GoF	Government of Fiji
HIES	Household Income and Expenditure Survey
km²	square kilometre
kWh	kilowatt hour
NEP	National Energy Policy
O&M	operation and maintenance
PIC	Pacific Island country
PWD	Public Works Department
REP	Rural Electrification Policy
RESCO	renewable energy service company
REU	Rural Electrification Unit
SEEDS	Sustainable Economic and Empowerment Development Strategy
SPREP	South Pacific Regional Environment Programme
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States dollar (currency)

Synopsis

Project title: Fiji Rural Electrification Programme

Country and region of implementation: The Republic of the Fiji Islands, Pacific

Focus area (technology/energy service): Access to electricity in rural areas

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Key partners: Department of Energy, the Fiji Electricity Authority and the Public Works Department

Cost: Approximately FJD 80 million (1974-2009), provided by the Government of Fiji[1]

Project brief: In 1986, 30.6 percent of Fiji's rural population had access to electricity; by 2007, this figure had increased to 81.4 percent. This achievement is due to a combination of increased urbanization ('bringing people to electricity') and government efforts in rural electrification ('bringing electricity to the people'). The latter has consisted of the following enabling elements:

- a consistent political goal of achieving 100 percent electricity access, supported by successive government administrations over several decades;
- a dedicated government institution focused on rural electrification;
- recurrent allocations from the national budget (with significant funding from 2003 onwards), supported by resources from development partners; and
- supportive policies, in particular the 1993 Rural Electrification Policy.

However, some challenges remain, including the poor functioning of village-level diesel systems and the negative impact of the uniform national tariff on the expansion of grid electrification.

This report documents rural electrification efforts of the Government of Fiji over the 1986-2009 period. The report is based on a 2009 desk review of available documents; to the extent possible, a balanced view of both achievements and challenges is presented.

[1] FJD 1 = USD 0.56570 as of 9 September 2011 (www.xe.com).

Acknowledgements

The Pacific response: Electrifying isolated islands 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.

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[2] It should be noted that this is a significantly edited version of the report initially prepared by Mr. Jensen.

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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. 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.

Pacific Island countries such as Fiji experience additional problems. The lack of Fiji's oil resources makes it highly dependent on imported fuel, and therefore vulnerable to fluctuations in oil prices. High transportation costs due to the remote nature of many islands also present an obstacle to electrification.

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 the Fijian Government's achievements in expanding access to electricity in rural areas over the 1986-2009 period. It identifies key government institutions in rural electrification, assesses the objectives and implementation of the 1993 Rural Electrification Policy, and identifies good practices, challenges and lessons learned.

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1. Background

1.1 Geographic and economic background to Fiji

Geographical situation. Fiji is an island nation in Melanesia (South Pacific Ocean) with a land area of 18,333 km^2. It consists of around 320 islands rising over 1,000 metres above the sea level, of which about one third are inhabited. More than 87 percent of the land is concentrated on the islands of Viti Levu and Vanua Levu. Fiji has a tropical climate and is considerably richer in natural resources than its Polynesian and Micronesian neighbours, with extensive timber, fertile soils, mineral deposits and fish stocks. However, it is subject to earthquakes, landslides, cyclones, flooding, tsunamis and storm surges, and is second to Papua New Guinea as a Pacific Island country (PIC) most affected by natural disasters since 1990.

Urbanization trends. According to the 2007 census, Fiji has a population of 837,271 (see Table 1). During 1986-2007, the population grew by an average of 0.75 percent per year.[3] Current urbanization trends indicate that, by 2030, 61 percent of Fiji's population will be urban.[4]

Table 1: Rural-urban composition of Fiji's population, 1966-2007

Year	Total population (no.)	Rural population		Urban population	
		No.	Share of total	No.	Share of total
1966	476,727	317,468	66.6	159,259	33.4
1976	558,068	369,573	62.8	218,495	37.2
1986	715,375	438,350	61.3	277,025	38.7
1996	775,077	415,582	53.6	359,495	46.4
2007	837,271	412,425	49.3	424,846	50.7

Source: GoF, 2008b, p. 29

Economic situation. Fiji's economy is dominated by tourism, sugar production and processing, and garment production. Agriculture makes up 16 percent of the economy, and there is still a large subsistence sector. Recent economic growth has been slow, with real gross domestic product (GDP) growth of -0.1 percent, -3.0 percent and 0.1 percent in 2008, 2009 and 2010 respectively. In 2010, an estimated per capita GDP was USD 4,400.[5]

Incidence of poverty. According to the 2002-2003 Household Income and Expenditure Survey (HIES), the incidence of poverty at the national level has increased from 24.3 percent in 1990-1991 to 38.1 percent in 2002-2003.[6] According to the Asian Development Bank (ADB) figures, in 2008 poverty affected an estimated 39 percent of the population.[7]

While pockets of serious poverty persist in urban areas, it is more widespread in rural areas, where cash incomes are lower. In addition to the one-third of all rural households that are poor, many more live just above the poverty line, and are in danger of falling below it. Rural households mainly engage in subsistence agriculture, and are thus more vulnerable to external shocks such as natural disasters and poor national or district economic growth.[8]

3 GoF, 2008b, pp. 1-2.
4 GoF, 2008b, p. 29.
5 Central Intelligence Agency, 2011.
6 Abbott, 2006, pp. 2-3.
7 ADB, 2009, p. 111.
8 ADB, 2005a, p. 12.

However, it is widely acknowledged that the conventional income-based definition of poverty does not work well for PICs.[9] Firstly, the majority of rural households in PICs are part of the informal economy where barter and subsistence farming and fishing dominate. Secondly, the relatively strong social structures provide, at least to some extent, insurance and security for the old and needy. Hence income is a poor indicator of community well-being.

Consequently, in 2003 the Government of Fiji (GoF) conducted a Participatory Assessment on Hardship, surveying the needs, perceptions and aspirations of 20 rural and urban communities. Both rural and urban communities characterized 'hardship' as sharing the following features:

- low income, which limits ability to provide for family needs and traditional and church obligations;
- lack of access to basic services, including education, safe water supply, roads, transport and electricity; and
- landlessness.[10]

1.2 Rural electricity access and barriers to expansion

Rural electrification rates. The proportion of rural households in Fiji with access to electricity increased from 30.6 percent in 1986 to 81.4 percent in 2007 (see Table 2). This achievement was made possible by a combination of rural electrification efforts ('bringing electricity to people'), low population growth and increasing urbanization ('bringing people to electricity').

Table 2: Access to electricity, rural and urban households, 1986-2007

Year	Household electricity access (percent)		
	Rural	Urban	Total
1986[11]	30.6	75.5	48.5
1996[12]	48.9	87.1	66.8
2003-2004[13]	69.0	92.0	80.0
2007[14]	81.4	96.1	88.9

Impacts of lack of electricity access. Lack of electricity access constrains development in Fiji's rural areas.[15] Villagers are forced to spend a large proportion of limited household cash on high-cost, inefficient energy sources such as diesel for lighting and batteries for radios. Poor women are particularly affected, since they perform many daily roles where electricity could assist them.[16] These include household tasks (e.g. food preparation and helping children with homework), agriculture and business activities, and fulfilling village obligations. Women are exposed to inadequate lighting and smoky kitchens, have limited access to outside information (e.g. via radios or televisions), and spend long hours at manual household chores. Children have limited time for studying due to poor light. Some medical supplies and animal vaccines cannot be stored.

Advantages of different types of power systems. The type of power systems used is also important, since some have greater limitations than others. Over two-thirds of electrified rural households in Fiji have access to urban-quality power from main electricity grids managed by the Fiji Electricity Authority (FEA) (discussed below). However, a significant proportion of households still get power from other sources, including village-level diesel and hydro systems, and solar photovoltaic (SPV) home systems. The limitations of these systems are discussed in Section 2.4.

[9] UNDP, 2007, p. 7.
[10] ADB, 2003, pp. 4-5.
[11] GoF, 1989, p. 146.
[12] GoF, 2004, p. 25.
[13] GoF, 2006c, p. 63.
[14] Preliminary data from 2007 Census. Personal communication, Fiji Islands Bureau of Statistics, GoF.
[15] ADB, 2005a, p. 3.
[16] ADB, 2005a, p. 50.

Generally speaking, the extent to which electrification brings benefits varies according to the following factors:

- the type of power generated – alternating current (AC) or direct current (DC) – which determines which appliances can be used;
- hours of supply; and
- reliability of the service (usually linked to the technical competence to maintain the system).[17]

Challenges to expanding energy access. Challenges faced by Fiji's energy sector in expanding energy access include the following:[18]

- **Geographical barriers common to PICs.** Fiji shares many challenges common to its Pacific neighbours, including a small population dispersed over many islands, dependence on a narrow range of primary commodities, exposure to frequent natural disasters, difficult access to capital and other markets, and the emigration of scarce managerial and entrepreneurial skills;
- **Transport limitations.** Travel to Fiji's outer islands is expensive, often irregular and time-consuming. This, combined with small populations, makes it difficult to develop economically viable energy systems in these areas;
- **Institutional limitations.** Although Fiji is a small economy with limited institutional capacity, numerous GoF agencies have responsibilities for energy sector management and regulation. The concerned institutions (discussed in Section 1.3) are often small and lack the required capacity;
- **Limited private-sector participation.** Past project failures suggest to potential investors that renewable energy development is risky. This makes it difficult for the GoF to obtain private-sector involvement in energy expansion without offering risk-abatement incentives; and
- **Lack of long-term access to land for projects.** Uncertain land ownership rights are a barrier in securing access to native land for development projects, including rural electrification.[19]

1.3 Key national energy institutions

Fiji Electricity Authority (FEA). The FEA is a 100 percent GoF-owned utility. It is the primary body responsible for generation, transmission and distribution of electricity in Fiji. Specifically, the FEA is responsible for the construction of the national electricity grid and supply of grid-based electricity where it is economically viable, and collects revenues based on the uniform national tariff per kWh provided.[20] It currently operates only in those islands with sufficient demand and population density to justify grid systems (Viti Levu, Vanua Levu and Ovalau).[21]

Department of Energy (DoE). Situated within the Ministry of Public Utilities, Works and Transport, the DoE is responsible for overall national energy policies and plans, rural electrification, and promotion of renewable energy, energy efficiency and energy conservation.[22] In regards to rural electrification, the DoE is responsible for the provision of decentralized electricity to rural areas that lie beyond the reach of FEA's grids. The DoE has a total of 52 staff in four units, including the Rural Electrification Unit (described below).[23]

[17] ADB, 2005a, p. 51.

[18] GoF, 2006a, pp. 6, 14, 15, 16; SPREP, 2005, p. xvi.

[19] By law, most of the land is owned communally by indigenous Fijians and may only be leased, not purchased.

[20] Significant energy policy and legislative changes regarding FEA's operations were introduced in 1998 via the FEA Reorganization Charter (1998) and the subsequent Electricity Reform Bill (1998). Specifically, the FEA was split into three commercial companies: PowerGen Fiji (power generation), PowerLines Fiji (transmission and distribution), and MegaPower Fiji (wholesale and retail sales of electricity to end-users). Any independent power producer could gain access to the grid on transparent terms. The national tariff was to be abolished, with a regulatory mechanism to establish geographically-based maximum tariffs depending on local island costs. This strategy intended to extend electricity to more rural areas and other islands (e.g. Taveuni). However, these changes were short-lived: after the 1999 elections the legislation was rescinded, and the three companies were merged back into the old FEA.

[21] According to SPREP 2005, the costs (per kWh) of the FEA grid supply to other islands 'may well exceed ten times' the cost of supply to Fiji's urban centres (Suva, Nadi and Lautoka) (SPREP, 2005, p.27).

[22] SPREP, 2005, p.13.

[23] DoE organigram dated 8 October 2009. 10 positions were vacant as of October 2009.

Rural Electrification Unit (REU). The REU was established under the DoE by the 1993 Rural Electrification Policy (REP 1993), which is discussed in detail in Section 2. The REU's main responsibility is implementation of REP 1993. Given that many renewable energy projects are aimed at providing rural electrification, the REU and the rest of the DoE tend to work as a single unit.[24]

Public Works Department (PWD). Situated within the Ministry of Communication, Works and Energy, the PWD is responsible for extension and operation of small diesel-based power grids at five provincial centres.[25] It is also responsible for construction and maintenance of national roads, water supply schemes, hospitals and health centres.

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Men spearfishing at night, Suva.

Ministry of Finance and Planning. This ministry is responsible for ensuring that financial resources are available for investment in rural electrification, in accordance with the GoF priorities.[26]

1.4 Key national energy policies

REP 1974 and REP 1993. Since independence in 1970, Fiji has had two formal rural electrification policies, REP 1974 and REP 1993.[27] REP 1974 was implemented by the PWD and extended two electricity options: diesel generators and FEA grid extensions. REP 1993 is described in detail in Section 2.

RESCO Charter 2002. In February 2003, Fiji's Cabinet endorsed the Charter for Renewable Energy Based Rural Electrification with Participation of Private Enterprise.[28] The charter seeks to speed up rural electrification by stimulating private sector participation and the use of renewable energy resources. Specifically, it proposes the establishment of renewable energy service companies (RESCOs) and describes a process for creating public-private partnerships for rural electrification. It also proposes a fee-and-tariff structure for rural areas that reflects the actual long-term energy cost, to replace the uniform national tariff.

The supporting legislation for the charter has been drafted but is yet to be passed. As a result, the RESCO concept has been only partially operationalized and has no legal status. Consequently, while there are several private suppliers of renewable energy systems and one quasi-RESCO on Vanua Levu, there are no private companies dedicated solely to providing energy access.

National Energy Policy (NEP) 2006. In 2006, the Cabinet endorsed its first stand-alone National Energy Policy[29] and an associated Strategic Action Plan.[30] The NEP provides a common framework for the utilization of energy resources in Fiji. It focuses on four key strategic areas: national energy planning; energy security; power sector development; and renewable energy development. The NEP confirms the GoF's commitment to rural electrification, and identifies the following areas as priorities for electrification:

- villages which contribute more than the mandatory 10 percent of up-front investment in electrification (stipulated in REP 1993);
- villages where joint infrastructure development is possible and infrastructure service packages promise to trigger economic development;
- villages identified as most likely to optimize income-raising and socio-economic benefits from electricity supply;
- areas where environmental protection and rural development measures are complemented by electricity supply;
- villages where organizational initiative is demonstrated as adequate to assure reliable and expanded supply; and

[24] SPREP 2005, p. 13.

[25] APCTT-UNESCAP, 2009.

[26] ADB, 2005b, p.1; GoF, 2006a, p. 7.

[27] The Annex provides an overview of both policies.

[28] The full title of the charter is 'Renewable Energy Service Companies (RESCO) Charter for Renewable Energy Based Rural Electrification with Participation of Private Enterprise – Proving Electricity to Rural Fiji' (GoF, 2002a).

[29] Energy policies (national and rural) have been embedded in the national economic policies and plans since the mid-1970s. In addition, in 1999 the DoE developed a Corporate Plan 1998-2000, which in part articulated an energy policy.

[30] GoF, 2006a; GoF, 2006b.

- villages where electrification complements social, economic and environmental priorities of localities.[31]

The NEP also set out the following measures in support of the RESCO Charter 2002:

- the GoF will apply central procurement measures, equipment subsidies and tax exemptions, such that RESCOs and off-grid managers can balance costs and revenues at affordable tariff levels; and
- the GoF will allow RESCOs to adjust tariffs to ensure that reliable performance is viable on a site-by-site basis, and to ensure there are adequate financial incentives to encourage the expansion of supply in rural areas. RESCO tariffs will remain subject to the GoF approval in order to balance consumer and supplier interests.[32]

However, these measures have only been partially realized, with no adjustable tariff policy or financial incentives or RESCO establishment currently in place

In addition, 'social and gender equity' is specified as one of six guiding NEP principles.

Economic and fiscal update: supplement to the 2009 budget address. In effect since 1 January 2009, this supplement seeks to promote renewable energy by imposing zero fiscal and import-excise duties on a range of renewable energy equipment. The latter includes:

- resource monitoring equipment for wind, hydro and solar energy;
- wind and hydro turbines;
- accessories including solar panels, batteries and lights; and
- solar prepayment metres.[33]

National development strategies. Since the 1970s, national economic policies and development strategies have also addressed energy access and rural electrification. For example, the Sustainable Economic and Empowerment Development Strategy 2008-2010 (SEEDS) contains an objective of increasing secure community access to affordable and reliable energy supplies. SEEDS also contains 2010 targets of 98 percent urban electrification, 80 percent rural electrification and 88 percent overall electrification.[34]

2. Programme overview

The following sections document the GoF's efforts in rural electrification over the last two decades, with focus on objectives and implementation of REP 1993.

2.1 Objectives and targets

The objective of REP 1993 is "to provide 24 hour continuous electricity to all potential consumers in Fiji".[35] Rural electrification is to primarily serve social development, but also promote economic development wherever possible. Specific REP 1993 targets include:

- electrifying all villages by 2004;
- electrifying at least 90 villages each year; and
- in the long-term, establishing a user-pay system where villages become fully responsible for costs of maintenance, repair and replacement of electrical equipment (without the need to resort to government subsidies).[36]

[31] GoF, 2006a, pp. 20-21.
[32] GoF, 2006a, p. 10.
[33] GoF, 2008a, p. 121.
[34] GoF, 2007, pp. 72-73.
[35] GoF, 1994a.
[36] GoF, 1994a.

2.2 Institutional arrangements

The implementation of REP 1993 is overseen by the REU. The roles of the DoE, the FEA, the PWD, RESCOs and villages in implementation are described in Section 2.4.

2.3 Funding arrangements

Government budget allocations. REP 1993 stipulates an annual rural electrification budget of FJD 6 million. However, the actual allocations have ranged between FJD 1 million and FJD 6 million (see Table 3), at an annual average of FJD 3.6 million. Overall, between 1994 and 2007, a total of FJD 54.2 million has been allocated to rural electrification.[37] Over the period 1974-2009, this figure rises to over FJD 80 million.[38]

Table 3: GoF annual budgetary allocation for rural electrification, 1994-2007

Year(s)	Annual budgetary allocation (FJD)
1994-1997	1,000,000
1998	3,100,000
1999	3,280,000
2000	1,500,000
2001	3,000,000
2002	5,000,000
2003-2006	6,000,000
2007	4,347,248
Total	54,227,228

Source: GoF, 2008c, p.3.

Consumer contributions. REP 1993 stipulates that 90 percent of the capital cost of electrification schemes is to be contributed by the GoF, regardless of the electrification option. The remaining 10 percent is to be contributed by the consumers. According to the DoE website, the latter figure has since been reduced to 5 percent. However, a maximum allocation of FJD 4,000 per household is used as a ceiling limit, and for projects in which the total costs exceed this limit, the communities are required to pay the difference.[39]

External assistance from partners. Development partners have provided significant external assistance to Fiji's rural electrification efforts, including soft loans for hardware and civil works, and technical assistance. These include the following:

- a rural electrification study funded by the ADB (1984);[40]
- a power study for Fiji's outer islands funded by the Government of Australia (1986);[41]
- an interest-free loan for four electrification projects provided by the Government of the People's Republic of China (late 1980s);
- electrification of Rewa Delta villages funded by the Government of China through interest-free loans (2000);[42]

[37] According to the DoE (personal communication), about FJD 20 million was made available in 2009.
[38] GoF, 2009.
[39] DoE, 2009.
[40] GoF, 1984, p. 5.
[41] GoF, 1984, p. 5.
[42] GoF, 2000, p. 11.

- UNDP and the Global Environment Facility (GEF) supported a project to develop a regulatory framework providing the legal and economic guidelines required for the establishment of RESCOs for the rural sector, and for the creation of in-country capacity to provide more reliable and sustainable renewable energy services to Fiji's rural sector (2001-2007);
- a review of REP 1993 funded by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2003);[43]
- an extensive rural-energy survey funded by UNESCAP and the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2005);[44] and
- a preparatory-phase study to develop a new rural electrification policy and investment in expanded rural electrification implementation funded by the ADB (2005).[45]

2.4 Electrification options offered

Under REP 1993, any village can request GoF assistance with electrification.[46] The choice of power system to be installed is made with DoE guidance, taking into account village location in regards to the electricity grid, the needs of the community and the costs to the consumers. The options offered under REP 1993 are discussed below.

Option 1: FEA grid extensions. The FEA grid provides 24-hour AC power suitable for all applications. The grid assets are the property and responsibility of the FEA.

According to REP 1993, villages close to the FEA grid are to be grouped into 'schemes' and electrified through grid extension. If the internal rate of return (IRR) of investment in grid extension is more than 15 percent, the FEA considers the extension financially viable and does not require customer contributions.[47] For an IRR of 0-15 percent, the capital cost is shared between the FEA and the customer. For a negative IRR, the customer must meet all capital costs. However, the GoF does subsidize some uneconomic grid extensions each year in order to reach its electrification targets.[48]

When connecting to the grid, each household must pay for all equipment beyond the metre box (i.e. all internal wiring, fuses and fixtures). This cost ranges between FJD 700 and 1,500.[49]

The FEA collects revenues based on the uniform national tariff per kWh provided. However, only main urban centres in Viti Levu pay the full cost of supply, and hence cross-subsidize the rural customers of Viti Levu and all FEA customers in Vanua Levu and Ovalau.[50]

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A wind turbine on a wind farm, Viti Levu.

[43] GoF, 2003a, p. 9.

[44] Jensen, 2009.

[45] ADB, 2005a; ADB, 2005b.

[46] GoF, 2006a, p.4

[47] According to personal communication with the DoE, this IRR has recently been reduced to 4 percent.

[48] ADB, 2005a, p.14.

[49] Personal communication, DoE.

[50] FEA Annual Report 2007, p. 7.

This electrification option is strongly preferred by all communities applying for electrification assistance. However, it is capital-intensive, and installation is limited to suitable terrain.[51]

Option 2: PWD grid extensions. Like the FEA grid, small diesel-based provincial grids provide 24-hour power supply. These grids are extended and managed by the PWD in cooperation with the REU, as part of rural government stations. Household connection costs are equivalent to those for the FEA grid.

Option 3: Village-level diesel systems. These systems consist of a diesel generator and a village-level grid. The equipment is installed by the DoE and operated by the village committee. The request for GoF support is limited to areas not accessible by the FEA.[52]

The system typically generates power only for four hours per day (6pm-10pm) for evening lighting and powering small electrical appliances.[53] The main advantage of the system is its low capital cost, which makes it easier for the village to raise the necessary 10 percent contribution.[54] Household connection costs are equivalent to those for the FEA grid.

The GoF funds maintenance, repair and replacement costs of the system for the first three years of operation. From thereon, these duties become the responsibility of the village, and are usually contracted out to a private company.[55]

Option 4: SPV home systems. These household-level systems are typically installed by RESCOs. Specifically, the equipment is owned by the DoE, and installed and maintained by a RESCO (selected competitively by the DoE). Each household pays a portion of the installation cost, and then pre-pays a monthly fee that is designed to cover maintenance and component replacement.[56] The three-year grace period for maintenance, repair and replacement used in village-level diesel systems also applies.

Each system consists of a 100 watt solar panel, lights and one 12 volt power point.[57] While designed to provide 24-hour power access, these are small DC-based power systems, limited in the type and size of appliances they can serve. The installation cost is around FJD 100 per household.[58] The request for GoF support is limited to Vanua Levu and Rotuma Islands.[59]

Option 5: Village-level hydro systems. These systems consist of a small hydroelectric plant and a mini-grid, operated by a village committee.[60] The three-year grace period for maintenance, repair and replacement also applies. The request for GoF support is limited to areas not accessible by the FEA.[61]

2.5 Capacity-building

REP 1993 specifies that villages "…will be shown how to care for their electricity schemes to keep the costs of maintenance as low as possible".[62]

According to the DoE website, the department has delivered operations and maintenance (O&M) training to most communities with village-level diesel systems.[63] Training is conducted with assistance from the Centre for Appropriate Technology and Development (CATD). For instance, in 2005 three four-day workshops were held at CATD in Nadave (Viti Levu island), with 33 participants attending. Distance and transport problems, however, make participation from remote islands (e.g. Rotuma and Rabi) problematic; consequently, onsite training has been conducted as well.

51 ADB, 2005a, p. 5.
52 DoE, 2009.
53 GoF, 2006d, p. 18.
54 SPREP, 2005, pp. 28-29.
55 GoF, 2006d.
56 SPREP, 2005, p.19.
57 REEEP, 2010.
58 ADB, 2005a, p. 9.
59 DoE, 2009.
60 SPREP, 2005, p. 17.
61 DoE, 2009.
62 GoF, 1994a.
63 DoE, 2009.

In addition to the training for diesel operators, management training for 'electrification chairman' and 'treasurers' has also been delivered.[64]

2.6 Implementation to date

Table 4 shows the expansion of different rural electrification systems under REP 1993.

Table 4: Rural electrification systems installed, 1994-2007

	FEA grid extension	Village-level diesel system	SPV home system	Village-level hydro system	PWD grid extension	Total
Number of systems	473	409	32	6	2	992
Share of total (%)	51.3	44.3	3.5	0.7	0.2	100

3. Impacts

3.1 Expansion of electricity access

The overall improvements in energy access for rural households during 1986-2007 are presented in Table 5. By 2007, almost 70,000 rural households have been electrified, which consist of 81.4 percent of the total (compared to 30.6 percent in 1986 and 48.9 percent in 1996). In addition, approximately 1,200 SPV house systems have been installed as of mid-2009.[65]

Table 5: Electricity access of rural households, by source of electricity, 1986-2007[66]

Source of electricity	1986[67]		1996[68]		2007[69]	
	number	percent	number	percent	number	percent
FEA grid	16,601	72.9	25,515	68.1	46,612	67.4
Village-level diesel system	1,812	8.0	5,105	13.6	11,938	17.3
Own plant	2,387	10.5	6,104	16.3	9,248	13.4
PWD grid	960	4.2	449	1.2	1,079	1.6
Other	1,002	4.4	268	0.7	249	0.4
Total	22,762	100	37,441	100	69,126	100

Overall, it has been judged that REP "has had mixed success, with poor maintenance and frequent power outages common for all classes of systems except FEA grid extensions".[70] This conclusion is expanded upon below.

64 DoE, 2009.

65 GoF, 2009.

66 Some differences appear in categories used in the various censuses. The 1986 census used the following categories for 'Electricity Supply by Source': FEA, Village Plant, PWD, Own Plant, Others, and Not Stated. The 1996 and 2007 censuses used the following categories: FEA, FSC, Vatukoula, Village Power, PWD, and Own Plant. Making the categories as comparable as possible, Table 5 assumes that 'Village Plant' and 'Village Power' are identical, and that the category 'Other' includes 'Others' and 'Not Stated' from the 1985 census, and 'FSC' and 'Vatukoula' from the 1996 and 2007 censuses.

67 GoF, 1989, p. 146.

68 GoF, 2004, p. 25.

69 Preliminary results. Personal communication, Fiji Islands Bureau of Statistics, GoF.

70 SPREP, 2005, p. 17.

3.2 Benefits of electricity access

Surveys conducted. In 2001-2003, a GoF/UNDP/GEF household survey was undertaken in 89 villages, of which 58 were non-electrified and 31 electrified with village-level diesel systems. The survey covered a total of 813 households, 542 of which were non-electrified.[71]

In 2005, the DoE undertook a rural household energy survey with financial assistance from UNESCAP and UNESCO. The main objective was to investigate the uses, impacts and O&M of electrification systems in remote areas. The survey included 74 villages (33 with FEA grid electrification, 37 with village-level diesel systems and five with SPV home systems) covering all four administrative divisions, i.e. Central, Western, Northern and Eastern. A total of 2,387 households were surveyed: 958 with FEA grid electrification, 1,201 with diesel electrification and 228 with solar power.[72]

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A wind turbine on a wind farm, Viti Levu.

Overall benefits of electrification. Households covered by the above-mentioned 2005 survey indicated that electrification has had lasting effects on their lives.[73] The reported impacts included the following:

- reduced expenditure on batteries and kerosene;
- increased opportunities for income generation and facilitation of small businesses;
- extended work hours (particularly for women);
- household work made generally easier;
- enhanced recreational opportunities (e.g. watching television);
- increased security in the village due to improved lighting in the household and outside;
- improved study environment for children; and
- storage of frozen goods made possible.[74]

Benefits of village-level diesel systems. The above-mentioned 2001-2003 survey found that 56 percent of users of village-level diesel systems were satisfied with electricity services provided, while 38 percent were dissatisfied. The main reason for dissatisfaction was the fact that electricity was provided only from 6pm to 10pm, meaning that villagers had to purchase other fuels (petrol and kerosene for lighting, batteries for radio and torches) for use outside these hours.[75]

In the 2005 survey, users of village-level diesel systems complained about "dim or flickering lights", power outages and that "there was not enough power". The outages usually lasted "for a short time" with frequency ranging between "less than once a month" to "several times a week". Most users also stated that the quality of maintenance services provided by the DoE during the first three years of operation was very good.[76]

Benefits of SPV home systems. The 2005 survey found that lighting was the most important use of SPV home systems, followed by powering of radios. The lighting provided by the systems was much cheaper than purchasing batteries or kerosene. Users stated that the 24 hour electricity supply provided by the systems was an important benefit, but simultaneously expressed a desire for "more power to be provided".[77]

[71] GoF, 2003a, p. 20.

[72] GoF, 2006d, pp. 6-8.

[73] These impacts were reported by users of village-level diesel systems. Users with access to FEA grid electrification and SPV home systems provided similar responses.

[74] GoF, 2006d, p. 49.

[75] GoF, 2003, p. 20.

[76] GoF, 2006d, pp. 18-24.

[77] GoF, 2006, pp. 38-43. As mentioned above, SPV home systems are small DC-based power systems, limited in the type and size of appliances they can serve.

Income generation. The 2005 survey investigated the productive use of electricity in electrified villages. Specifically, households were asked the following questions:

- "Is electricity needed for any business or money-making activity in the village?"; or
- "Does anyone in your household make money in a way that needs electricity for their work?"

Of the FEA-connected households in the Central administrative division, 18 percent indicated that they used electricity for income-generating activities. This share dropped to 12 percent for FEA-connected households in the Northern and Western divisions and Vanua Levu, to less than 5 percent for households using village-level diesel systems (all divisions), and to almost zero percent for households with SPV home systems. The most widely reported activity was storing frozen goods (ice blocks, ice-cream, fish, etc.) for sale.[78]

These findings indicate that, overall, it is not clear that the provision of electricity increases income in Fiji, at least when defined in strictly monetary terms.[79]

4. Challenges and causes

Lack of capacity at the national level. A 2005 UNDP assessment concluded that "… in general, despite coups and waves of emigration, Fiji has a better capacity to manage its energy sector (including rural electrification) than other PICs".[80] However, REP 1993 noted the limited capacity of the FEA and the PWD, stating that it was not sufficient to implement the GoF's commitment to rural electrification.[81]

Between 1994 and 1996, the DoE reported that the lack of personnel at the REU was severely restricting the implementation of REP 1993.[82] After 2004, however, approval was granted to the DoE to set up the required staffing, which has greatly assisted in meeting the workload.[83]

Lack of budget allocations to rural electrification until 2003. As shown in Table 3, REP 1993 was significantly underfunded between 1994 and 2003. The impact of this was noted by the DoE in 2004, when it stated that "funds allocated annually to DoE are not adequate to meet the current demand for rural electrification in isolated rural communities or to address the huge backlog in demand".[84] The NEP also noted that the GoF budget constraints were limiting expansion of rural electrification.[85]

Inadequate maintenance of village-level diesel systems. Maintenance of village-level diesel systems is an on-going problem, primarily due to lack of funds and skills at the village level. Specifically, villages often lack funds to purchase diesel and to pay for maintenance and repair of generators.[86] The fuel and maintenance requirements are particularly difficult to meet in remote areas where transportation costs are high and technical training levels are low.[87] As a result, systems are sometimes inoperable for months.[88]

In addition, the DoE and the PWD lack sufficient funds to regularly monitor the operational status of the installed generators, making accurate information regarding numbers of functioning systems and population served unavailable.[89] Overall, the approach of having recipient communities responsible for O&M of generators has not worked well.

78 GoF, 2006d, p. 16-39.

79 UNDP, 2007, p. 9.

80 UNDP, 2005, p. 159.

81 GoF, 1994a.

82 GoF, 1996, p. 11; GoF, 1994, p. 7; GoF, 1995, p. 8.

83 Personal communication, DoE.

84 SPREP, 2005, p. x.

85 GoF, 2006a, p. 14.

86 GoF, 2006d, pp. 23-24; GoF, 1996, pp. 11-12.

87 ADB, 2005a, p. 5.

88 SPREP, 2005, p. x. The Fiji Times reports a recent example: "Rotuman islanders have been without a boat service for more than seven weeks [and] … water would be shut down within a week if no fuel is received" (Fiji Times, 2009).

89 SPREP, 2005, p. 33.

The use of a single national tariff. As mentioned above, the FEA maintains a uniform national grid tariff which is far below the actual generation and distribution costs. As a result, the provision of grid electricity to rural areas is in effect subsidized. This policy has slowed the expansion of FEA and PWD grids (due to budget constraints) and has prevented the development of private grid systems in areas where neither the FEA nor the PWD maintain a subsidized grid.[90] A 1992 multi-agency energy assessment in Fiji suggested that the funds used to subsidize electricity could be better used for other purposes.[91]

While some cross-subsidization of tariffs may be socially desirable, this practice should be transparent and well-targeted, and should not prejudice efforts to improve economic efficiency and cost reductions.[92] To this end, the extent to which consumers in urban centres (Suva, Nadi and Lautoka) subsidize the rest of FEA's customers should to be assessed.

5. Programme sustainability

Improving private- and public-sector capacity. A 2005 UNDP study found that further expansion of rural electrification will require significantly enhanced capacity for planning, management and O&M in the public and private sectors (from rural community O&M to negotiating and monitoring large-scale contracts with private providers).[93] This will entail substantial, long-term investment in well-designed training and education.

Even if assuming a stable political and economic future in Fiji, reducing emigration of skilled Fijians to more affluent countries (Australia, Canada, New Zealand and the United States of America) will require major policy changes in these nations. Since much of the Pacific sub-region relies on Fiji for both training and technical services, this has implications for electrification in neighbouring PICs as well.

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Climate Change and Energy Access for all – Parliamentary Hearing for Legislators from Pacific Island Countries, Lautoka, 1-3 October 2010.

Promoting emergence of RESCOs. Large-scale, RESCO-operated, solar-powered rural electrification (as proposed by the DoE) will require the development of several rural-based RESCOs along the lines of Labasa-based RES.[94] Currently, training is not readily available for private-sector rural project management and RESCO business operations. In addition, new laws are needed to provide a legal basis for RESCO operations and legal protection for all parties.[95]

Rapid expansion of SPV home systems under RESCOs will also require development of a wide range of technical, financial, planning and project implementation and monitoring skills within the DoE.[96]

Enabling income generation. Access to electricity can increase opportunities for wealth generation. But other factors such as poor market access, lack of capital and low skill levels often prevent the development of income-generating activities that take advantage of newly available energy sources. In other words, access to modern or improved energy services is a necessary, but far from sufficient, condition for moving people out of poverty. Without other essential conditions – including access to markets and capital, and business skills – there is a very high probability that the opportunities will be lost.[97] Therefore, a mix of activities is needed to promote economic development.

[90] UNDP, 2007, p. 15; GoF, 2006a, p. 14.

[91] World Bank et al., 1992, p. 36.

[92] UNDP, 2002, p. 106.

[93] UNDP, 2005, pp. 150-159.

[94] The RES was initially contracted by the DoE to manage approximately 300 rural SPV home system installations on Vanua Levu (UNDP, 2005, p. 153).

[95] SPREP, 2005, pp. xvi-xvii.

[96] SPREP, 2005, p. xvii.

[97] ESMAP, 2008, p. 1.

Developing a user-pay system. As mentioned above, REP 1993 contains a long-term objective of developing a user-pay system of rural electrification; this objective is reiterated in the NEP.[98] While fee structures and levels depend on which electrification option is chosen, current user contributions towards installation cover only a small percentage of the actual installation costs (except for some commercial FEA grid extensions). Similarly, in regards to consumption, current tariffs do not cover the real cost of electricity delivery in rural areas. Consequently, the major problem in full recovery costs is the current level of electricity tariffs.[99]

Contracting out to private companies. Historically, conventional government-owned operations (including the conventional utility model and government-owned isolated grids and generating plants) have dominated Fiji's electricity sector. However, REP 1993 contains a proposal to contract out electrification projects to private companies, in order to speed up electrification and in view of the limited capacity of the PWD and the FEA.[100] The DoE has employed this strategy not only to speed its work, but to introduce much-needed cost efficiencies, new designs and other system planning improvements.[101] Currently, all electrical work including upgrading, service and maintenance, house-wiring and installation is contracted out to the private sector.[102] However, past project failures are making it difficult for the GoF to attract private companies without offering risk-abatement incentives.

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

Fiji's achievements in expanding electricity access in rural areas since the introduction of REP 1974 highlight the importance of the following factors:

- a long-term government commitment to rural electrification, supported by successive administrations;
- supportive government policies such as REP 1993;
- clear, quantifiable electrification targets (see Table 6);
- a government institution dedicated exclusively to rural electrification; and
- regular and sufficient national budget allocations and donor support.

Table 6: GoF electrification targets, 1994-2007[103]

Document	Electrification target
REP 1993	Electrification of all rural villages by 2004.
Strategic Development Plan 2003-2005	95 percent of the urban population to have access to electricity by 2005.
Strategic Development Plan 2007-2011	90 percent national electrification by 2011, with urban electrification increased from 95 percent to 100 percent and rural electrification from 70 percent to 85 percent.
National Energy Strategic Action Plan 2006	100 percent electrification by 2016.
SEEDS 2008-2010	88 percent national electrification coverage by 2010, with urban electrification increased from 95 percent to 98 percent and rural electrification from 70 percent to 80 percent.

[98] The NEP states: "In principle the provision of energy goods and services should be financed through user fees, without recourse to subsidies from taxpayers or donor funding [and the] … principle of user-pay especially in the operation and running of energy projects shall be enforced" (GoF, 2006a, p. 14).

[99] ADB, 2005a, p. 13.

[100] GoF, 1994a.

[101] Personal communication, DoE.

[102] DoE, 2009.

[103] Admittedly, some of these targets were overly ambitious and have not been met.

7. Conclusions

Fiji's achievements in rural electrification demonstrate that the challenge of electrifying rural areas is formidable but surmountable. Between 1986 and 2007, the proportion of rural households with access to some form of electricity increased from 30.6 percent to 81.4 percent. This is due to both increased urbanization ('bringing people to electricity') and a dedicated rural electrification programme ('bringing electricity to the people').

A combination of enabling factors made this achievement possible:

- a political goal, supported by successive GoF administrations and FEA management, to achieve 100 percent electricity access;
- a dedicated GoF institution focused on rural electrification;
- recurrent allocations from the national budget, supported by resources from development partners; and
- supportive policies, in particular REP 1993.

Nonetheless, challenges to rural electrification remain. These include inadequate maintenance of village-level diesel systems due to the lack of funds and skills at the village level, and the distorting effects of a single national grid tariff. Addressing these constraints is essential in achieving universal electrification in Fiji.

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Annex: Overview of Fiji's rural electrification policies[103]

	1993 Rural Electrification Policy	1974 Rural Electrification Policy
Aim	– Supply electricity to rural consumers on a 'user pays' basis while keeping costs as low as possible – Increase the rate of expansion of electrification; and – Develop load centres which are necessary	– Supply electricity to rural consumers
Electricity options	– Solar PV lighting – Diesel gensets – FEA grid extensions – Hydro (if potential exists)	– Diesel gensets – FEA grid extensions
Capital costs	– Consumers = 10% of capital costs; all options – Government = 90% of capital costs; all options Note: FEA grid-extensions option include house-wiring costs	**Diesel gensets:** – Consumers = FJD 50 per household or one sixth of project cost, whichever is less. – Government = remaining costs of project **FEA grid extensions:** Viable level of costs borne by consumer but always included house-wiring costs
Additional features	– For non grid extensions, a 3 year grace period – Government subsidies maintenance costs and repair/replacement cost contributions while consumers pay operation costs – Aims to improve the socio-economic standards of the rural people to encourage income generating activities to finance the 'user pays' electrification scheme – Private sector involvement encouraged through contracting out	
Government commitment and non-capital costs	Non Grid Extensions: finite; after grace period recipients will be fully responsible for the operation, repair, replacement and maintenance costs of the scheme FEA Grid extensions: consumers	**Diesel gensets:** – infinite: government committed to heavily subsidizing repairs, maintenance and replacement of diesel plants. – recipients pay operating costs **FEA grid extensions:** Consumers pay full FEA tariffs for all units consumed
Approval date	1993	1974
Implementing agency	Government thorough Rural Electrification Unit of Ministry of Lands, Mineral Resources and Energy	Government through PWD

[103] Wording directly from DoE, 1993 (Table 3).

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