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Better or worse? The role of solar photovoltaic (PV) systems in sustainable development: Case studies of remote atoll communities in Kiribati

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ABSTRACT

The Republic of Kiribati, formerly known as the Gilbert Islands, is a Micronesian (One of the three groups of islands in the Pacific. The eight territories that make up Micronesia are Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Republic of Kiribati, Republic of the Marshall Islands, Republic of Nauru, Republic of Palau, Territory of Guam and Territory of Wake Island. The other two groups of islands in the Pacific are Melanesia and Polynesia) country in the Pacific. The energy sources utilised in Kiribati include petroleum products, biomass, solar energy and wind power. Solar energy was introduced in Kiribati in the early 1980s (Wade H. Survey of RESCO projects – prepared for OPRET, Fiji Department of Energy, 2003; p. 36). Currently, it makes a very insignificant (less than 1%) contribution to the total annual primary energy supply (South Pacific Regional Environment Programme (SPREP). Pacific Islands Renewable Energy Project (PIREP) – Pacific Regional Energy Assessment (PREA) 2004. Kiribati national report, Vol. 5, 2005). Solar energy in Kiribati is used mostly in the form of solar photovoltaic (PV) technologies for the provision of lighting and electricity.

This study examines the role of PV technologies in the sustainable development process in Kiribati, with particular reference to remote atoll communities. Initial results from on-site surveys carried out are reported in this paper. These surveys have sought to identify the reasons why people use or do not use PV systems.

1. Introduction

The provision of energy services has often been justified on the basis that it results in economic and/or social development. In developed countries (or modern societies), the increase in per capita energy consumption has been regarded as a measure of economic development. In most developing countries (especially in rural and remote communities), lack of access to energy services is seen as an obstacle to development.

Over the past two decades, many developing countries have attempted to sustain and improve their energy services through a number of approaches such as the introduction of modern forms of energy supplies, restructuring power utilities and educating communities about energy supply systems [3].

In countries, with adequate solar radiation, PV technologies have been chosen as the best energy option for areas that are not covered by the centralised power grid. PV technologies were introduced in Kiribati in early 1980s [1,2]. Over the last two decades, the number of PV systems in Kiribati has increased. The applications of PV technologies in Kiribati include:

- lighting: indoor (in houses and community halls), outdoor and street lights.
- pumping water in villages and schools; and
- powering electrical devices: communication devices (phone, fax machine and citizen band (CB) radio), torch, fan, refrigerator and radio.

This study attempts to examine the role of PV technologies in the process of sustainable development in Kiribati, with particular reference to rural and remote communities. The objectives of this work sought to address the following two questions:

1. In what ways have the PV systems already in place contributed to the development of the communities in the outer atolls of Kiribati? and
2. Have PV systems been a reliable and viable alternative in the remote atoll context (of Kiribati) within which it operates?

The first part of the paper gives an overview of the assessment criteria used. The section that follows presents the case of SHSs on Abemama Atoll and its role in the sustainable development process of the rural and remote communities. Finally, conclusions from this initial analysis have been presented.

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2. Assessment criteria

The results presented in this paper are based on data collected through field surveys carried out in Kiribati during August and September of 2006. To address the objectives of this study, an inter-related approach as shown in Fig. 1 was used (adopted from [4]).

In this approach, both the effect of the PV technologies on the lives of the people and the influence of the people on the viability of the PV technologies were assessed. Ten indicators were identified and used to structure interviews for the following three groups of households:

1. households with an SHS;
2. households with an SHS in the past (but without one currently); and
3. households that have never had an SHS.

Participants in groups 2 and 3 were targeted in order to illustrate the differences between the households with an SHS and those currently without. A total of 102 participants were recruited from two different atolls (Abemama and North Tarawa Atoll) in Kiribati. These two atolls are in the Gilbert Group[1] which lies to the west of the country (Fig. 2) [5].

3. Case study of Solar Home Systems (SHSs) on Abemama Atoll

The major focus of this study was SHSs. In addition to the SHSs, other PV systems that were encountered on the atoll were also considered.

This section presents the case of SHSs on Abemama Atoll. Forty-three participants were recruited from five different villages. Of these 43 participants, 26 had an SHS, one had an SHS in the past (but did not have it at the time of the interview) and 16 never had an SHS. Sub-sections 3.1–3.4 present the results obtained using four indicators – suitability, affordability, technological capability and livelihood diversification.

3.1. Suitability

One of the main concerns of any technological innovation for rural livelihoods should be the extent to which the technology is able to meet the needs of the people. Need (or requirements) here is understood in terms of the suitability of the technology in the given context. This indicator was used to assess the ability of the SHSs to meet the immediate needs of the people.

Approximately 52% ($n = 26$) of the households needed an SHS for lighting. Most of the households did not specify a reason for which they needed lighting. For the ones that specified a reason, some of them were:

1. brighter light;
2. light for children to study at night;
3. light for cleaning fish at night; and
4. light for security purposes.

A further 35% of the participants thought that it was cheaper to have an SHS than other forms of lighting such as kerosene lamps, petrol and/or (diesel) generators.

For the remaining households (13%), some of the reasons for having an SHS included:

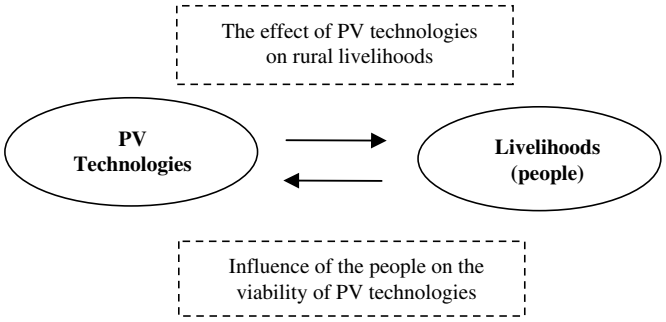

Fig. 1. PV technologies and the people: an inter-related approach.

1. convenient form of lighting;
2. safer form of lighting; and
3. purchasing second hand solar panels at a reasonable price.

One of the participants mentioned that the SHSs did not provide the flexibility of carrying the light around which is possible with a kerosene lantern. The villagers often use a kerosene lantern to travel from one village to another at night. A kerosene lantern is also used during the fishing trips.

3.2. Affordability

SHSs are expensive devices and the cost is recognised as one of the main barriers for its use. This indicator was used to assess the capacity of the target users to afford the acquisition and maintenance of SHSs.

In terms of cost/funding, the SHSs on Abemama Atoll belonged to one of the following three categories:

1. *Private systems*: the users owned the system and therefore met both the acquisition and maintenance costs;
2. *School systems*: the systems were part of a school community. The users did not pay any fee for this system. The cost for these systems were met by a catholic mission; and
3. *Kiribati Solar Energy Company (KSEC) systems*: the users rented the system from KSEC for which they paid an up-front cost (AU$50) and monthly fee (AU$9) [6]. The up-front cost and the monthly fee cover half of the cost of the KSEC SHSs and the remaining 50% of the cost is subsidised [6].

Of the households that had an SHS, seven were privately owned, four belonged to a school community and 15 were rented from KSEC.

Five private SHSs were owned by a relatively affluent part of the population (government officials, policemen, seamen, and small business owners) and one was owned by a person residing in the urban area with a second home on the atoll. Only one private system was owned by an ordinary villager.[2]

At the time of the visit, the system that belonged to the ordinary villager was not working and the family was using a kerosene lamp for lighting. The system had not been working for two weeks. The family did not take any initiative to have the system repaired due to the costs that would be involved.

Table 1 summarises the responses from the participants regarding the up-front cost and monthly fee they had to pay for the SEC systems.

[1] Kiribati consists of 33 atolls divided into three groups: Gilbert, Phoenix and Line Islands.

[2] A villager with whose only source of income is copra and fishing (in some cases).