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Renewable energy in the Pacific Islands: Its role and status

Tony Weir

Fenner School of Environment and Society, Australian National University, Canberra, Australia



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ABSTRACT

The small island developing states of the Pacific suffer from both the high cost of fossil fuel imports and from numerous climate-related disasters. These vulnerabilities will worsen unless there is a substantial global shift away from fossil fuels towards renewable energy (RE) sources, coupled with significant improvements in energy efficiency. Apart from traditional biomass-fuelled cooking, the most substantial uses of RE in the Pacific in 2016 were hydropower in some of the hillier island countries and the thousands of household photovoltaic (PV) systems in the remoter parts of island countries. This paper considers also the prospects for grid PV, geothermal, and biofuels – all of which have good technical potential in at least some islands. Barriers to wider use of RE in the region are mostly institutional and financial, but also include opportunity costs, environmental factors, and the limited skills base in small island states. The paper examines the mixed progress since the 1990s towards overcoming these barriers. The Fiji Electricity Authority has a reasonably realistic plan to have 81% of its supply from RE by 2020, drawing on hydropower (~ 50% in 2015), biomass (including bagasse), and some solar and wind. Tonga has its Renewable Energy Roadmap with clear milestones. Several other Pacific Island countries have ambitious RE targets but some are rather vague about how they are to be achieved.

1. Introduction

The Pacific Island countries (PICs) comprise small islands with small populations and large distances between them (see Fig. 1). Their energy use, supply and resources are similar to those of other small island developing states [1], especially those which are likewise in the tropics. Per capita use of commercial energy is much lower than that in more industrialised countries. Most of the commercial energy used is imported petroleum products. Similar conditions prevail in some of the French island territories [2], although those territories are not explicitly analysed in this paper, because legally they are part of France and treated economically as such.

As explained in Section 2, these factors favour an increased commercial use of renewable energy (RE), in addition to the wide-spread non-commercial use of firewood.

This paper therefore reviews the current uses of renewable energy in the Pacific Islands, including the rapid increase in the past few years of small photovoltaic systems for rural households (Section 3), outlines the current policy settings on the subject (Section 4), and goes on to review some of the more prominent planned and potential uses of RE in the islands (Section 5). Most of these planned uses are for electricity generation, but the potential is also there for use in land transport (as biofuels) and marine transport (as wind power).

Much of the potential for renewable energy in the PICs has been recognised in periodic regional energy assessments since the 1980s [3–6], as have the barriers to its use, many of which are institutional and economic rather than technological. Section 6 reviews these barriers and progress made in overcoming them since the 1990s. This analysis leads us to conclude that RE has a clear and growing role in the development of the region, particularly when complemented by improved efficiency of energy end-use (Section 7).

2. Pacific Islands context

2.1. Geography

The 15 independent Pacific Island Countries (PICs), comprise many islands scattered across a very large area of ocean (Fig. 1). For example, Kiribati comprises some 50 islands, with about 3000 km between the most western of its islands and the most eastern. Fiji has over 300 islands, though two are much larger and more heavily populated than the rest. All the PICs are small in land area and population (except for Papua New Guinea); on a map the label is often far bigger than the mark for the island(s) to which it refers! Papua New Guinea (PNG) is the only PIC with a population exceeding 1 million; Tuvalu, Nauru, Cook Islands, Palau and Niue all have populations of less than 20,000

Abbreviations: LED, light-emitting diode; PIC, Pacific Island Country; PNG, Papua New Guinea; PV, photovoltaic; RE, renewable energy; SHS, solar home system; SIDS, small island developing state; SPC, [Secretariat of] the Pacific Community

E-mail address: tony.weir@anu.edu.au.

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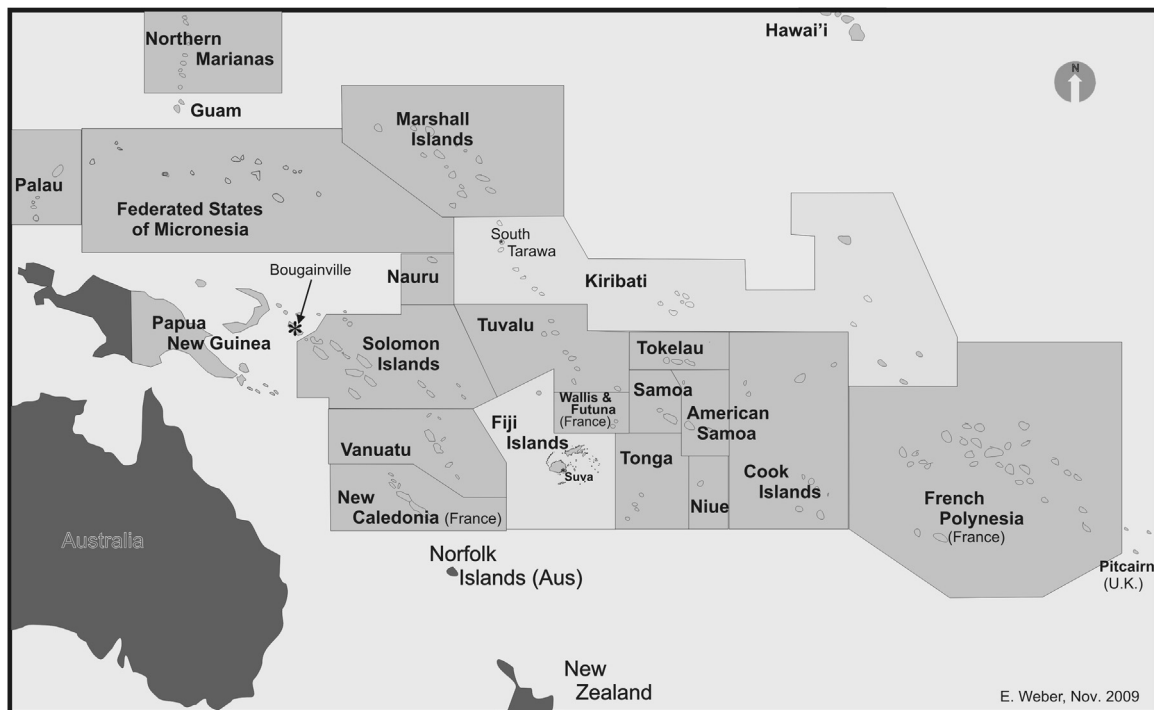


Fig. 1. Map of the Pacific showing the Pacific Island countries and some neighbouring countries. Note that New Caledonia, French Polynesia and Wallis and Futuna are French overseas territories and do not count as small island developing states; similarly for Tokelau (a territory of New Zealand) and Guam, Northern Marianas and American Samoa (territories of USA). [map by courtesy of E. Weber].

(SPC estimates for 2015 [7]). The geographical fragmentation of the Pacific island countries, their remoteness and their small size are fundamental constraints on their economic development [8]. Most Pacific island countries are heavily dependent on their marine resources, although some have relatively fertile agricultural land and tourist potential. Overseas aid and remittances for islanders working abroad make major contributions to the GDP of several PICs [8,9].

2.2. Energy use in the Pacific Islands

The per capita consumption of commercial energy in the Pacific island economies is closely linked to the per capita GDP, so that countries with low levels of commercial energy consumption also have low levels of GDP per capita. For example, Samoa has a per capita [commercial] energy consumption of about 0.3 toe/year and a corresponding per capita income of approximately US\$4000, compared to Australia with 5.4 toe/year and UD\$50,000 [10]. More than 80% of the population of Fiji, Samoa and Tonga have access to an electricity supply, but less than 35% in the populous PICs of the south western Pacific (PNG, Solomon Islands, and Vanuatu) [11]. Except in PNG, Fiji and Samoa (which are hilly and derive about half their electricity from hydroelectricity) virtually all this ‘commercial energy’ comes from expensive imported petroleum fuels. For many PICs, especially those that comprise many islands, energy use for transport (both on land and by sea) accounts for more fuel use than does electricity (SPC data quoted in [6]; see also [12]).

In all Pacific countries the economic activity is concentrated on the few biggest islands. Hence the majority of the places in any PIC can be considered to be isolated. In particular, in all but the smallest PICs, grid electricity exists only on the main island(s) of each country and/or in the main towns.¹ Villages in other places (where much of the population lives) are costly or impossible to connect to grid electricity.

¹ Those outer islands of Cook Islands, Tuvalu, and Palau that have a resident population have [very small] electricity grids.

2.3. Drivers of renewable energy

2.3.1. Economic

A major incentive to use renewable energy (RE) in place of fossil fuels is the cost of fossil fuels, as (except for the recent gas and oil projects in PNG) all fossil fuel is imported [13]. In those years when the oil price is high (say, > 100 USD/bbl) in the smaller island states, fuel imports account for around 30% of GDP, and in the larger PICs around 7–15% of GDP [14].² This dependency on imports of petroleum products, rather than local renewable energy sources, can also be seen as a weakness in energy security [16].

2.3.2. Climate change

Small island developing states (SIDS), including all the PICs, are recognised by both the UNFCCC treaty [17] and the IPCC fifth assessment report [18] as among the most vulnerable countries to climate change. Natural disasters (e.g. cyclones) already hit the economies and populations of SIDS hard, and climate change is expected to worsen this vulnerability [19–21]. Salt-water inundation threatens all atolls and coastal settlements, e.g. much of Kiribati could be uninhabitable within 30 years! [22].

Internationally accepted scientific reviews by the IPCC [23] recognise that one of the main causes of recent climate change is greenhouse gases emitted by the use of fossil fuels. This recognition underlies current international agreements (e.g. UNFCCC, Kyoto Protocol, and the 2015 Paris Agreement – texts available at [24]) and negotiations to extend the scope of these treaties, which seek to reduce the world’s use of fossil fuels – or at the very least to reduce their rate of increase.

The most effective ways to reduce greenhouse gas emissions are clearly (a) reduction in end-use demand for energy, (b) greater

² The exceptionally low crude oil prices of 2016 had comparatively little effect on retail prices in PICs because their total petroleum use is very small by world standards and so the cost of transport of refined fuel to the islands is high. Also tax on fuel is a substantial proportion of the retail price in most PICs [15].

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