GEOTHERMAL RESOURCES OF FIVE PACIFIC ISLAND NATIONS

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Geothermal Resources of Five Pacific Island Nations

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SUMMARY - In 1993 several member countries of the South Pacific Applied Geoscience Commission, (SOPAC), requested a survey of regional geothermal potential. This request reflects a growing interest in the countries of the southwest Pacific to find reliable domestic energy resources which could result in less dependence on imported fossil fuels. With financial assistance from the New Zealand government a report was prepared for SOPAC by Geothermal Energy New Zealand Limited, (GENZL), on the resource data available and potential development of the geothermal fields. The report, published in June this year, includes a proposed exploration programme to complete pre-commercial studies in five countries. This paper describes the findings of the report and comments on the potential uses of geothermal energy in the developing countries of the South Pacific.

1 INTRODUCTION

Volcanic systems are the heat source for most high temperature geothermal systems. 95% of all subaerial volcanism is associated with active plate margins. Thus many of the developed geothermal areas are located along the boundaries between adjacent plates.

Many Pacific Island nations are located on the boundary between the Australian and Pacific Plates. To the north and northwest geothermal fields have been developed and utilised, e.g. in Japan and the Philippines. To the south New Zealand has used the resource for many years. It would seem reasonable therefore to assume that geothermal resources exist within the Pacific Islands, many of which are in the form of island arcs with present or recent volcanism. Other authors have expressed a similar opinion regarding the existence of the resource, for example Cox (1980) and Mahon (1987).

At least five countries within the South Pacific have shown interest in the potential of their geothermal resources. National energy development programmes have included a range of initiatives in the area of geothermal resource investigation. Of the five countries Fiji and Vanuatu are the most advanced in terms of investigation levels. Solomon Islands, Papua New Guinea and Western Samoa are at less advanced stages. To promote the development of the resource within the region a report was commissioned to detail work carried out so far and outline a programme to bring the investigations to a stage where development can occur.

2 METHOD OF COMPILING THE REPORT

The report was compiled in two stages. The first of these involved a thorough literature search of information available in the five countries. This was followed by a workshop held in Suva for representatives of the countries to consider the report and contribute any further data on the resource. The results of the two stages were then combined into the final report published in June 1995. The resources of the individual countries are summarised below.

3 RESULTS OF THE REPORT

3.1 Fiji

Natural thermal areas have been described and recorded throughout the Fiji Group of islands. Although the greatest population and energy requirements are on the island of Viti Levu geothermal resources there have not been investigated further because of the existence of cheap hydro power. On the other main island of Vanua Levu there is little prospect of hydro power. The highest assessed subsurface temperatures occur on Vanua Levu, (maybe 160°C), and there are industries which could use process heat, whether or not the resources are suitable for electrical power. A 1994 consultants' report reviewed the information available in the areas of Savusavu and Labasa on Vanua Levu, (figure 1), and recommended a deeper drilling programme to allow measurement of reservoir conditions down to 800 metres. Slimhole technology is the preferred
method with three holes to be drilled in each area at an estimated cost of around US$2.5 million.

![Figure 1 Thermal Spring Locations on Vanua Levu, Fiji.](image1)

3.2 Vanuatu

Thermal springs have been identified and recorded on twelve of the islands making up the archipelago of Vanuatu. Several of these are on the island of Efate on which the capital Port Vila is located, (figure 2). From recent investigations assessed temperatures for two of these thermal areas on Efate are higher than is required for electricity generation. At present power is generated for Port Vila using imported diesel with a resulting high cost to the consumer.

Surface investigations for the two identified thermal areas on Efate are regarded as adequate at this stage. A report by GENZL/KRTA in 1991 recommended two production size wells of 1500 to 1800 metres in depth at a total estimated cost of US$3.5-4.0 million.

![Figure 2 Thermal Spring Locations, Efate, Vanuatu.](image2)

3.3 Papua New Guinea

PNG has widespread active volcanism particularly on the island of New Britain where Rabaul is situated. High surface temperatures have been recorded throughout the country although there is little prospect of geothermal power in the vicinity of the major urban areas of Port Moresby and Lae, which are served by hydro power stations to a large extent. The preferred location for further investigation is on the northern coast of New Britain, (figure 3), where several agricultural industries could benefit from available process heat in addition to the possible generation and use of electricity. Further surface investigations including geochemical assessment and geophysical surveys are required to identify the most suitable locations for more study.

![Figure 3 Thermal Spring Locations, New Britain, PNG.](image3)

3.4 Solomon Islands

There are a number of thermal areas identified in the Solomon Islands. Of these the government has nominated two for further investigation, (figure 4). Paraso on the island of Vella Lavella in the Western Province has been studied in some detail and appears to have some potential for electricity generation. The major drawback appears to be the lack of population or industry to utilise the resource. The Nggurara area in the northwest of Guadalcanal some 40 kilometres from the capital, Honiara, also may have temperatures high enough for electricity generation. Honiara currently uses diesel for power generation. Access to the Nggurara area is difficult both for investigation and development and this may be a major drawback to the use of the resource. Further desk and surface investigations are required to ascertain the viability of the two geothermal areas for development.

![Figure 4 Potential Geothermal Areas, Solomon Islands.](image4)
3.5 Western Samoa

The major interest in geothermal resources in W Samoa is on the island of Savai'i, (figure 5). The island, containing about 25% of the country's population, is described as a volcanic complex with lava flows occurring as recently as 1911. At this stage the only investigations have been geological. There is a need to locate and record any hot springs and fumaroles throughout the whole country and to carry out chemical analyses of surface waters.

![Figure 5 The Islands of Western Samoa.](image)

4 DISCUSSION OF THE RESOURCE POTENTIAL

From the results of the report by GENZL, (1995), it is clear that the potential to utilise an existing renewable resource exists in the five developing island nations investigated. There are good reasons to develop geothermal resources as an alternative to fossil fuels for small scale electrical generation. The availability of small modular binary cycle generating units suitable for moderate temperatures and for the modest power requirements of Pacific Island nations adds to the attraction of using geothermal power. (Olson, 1989). In addition the small growing industries associated with primary production, such as sugar refining in Fiji, can also benefit from the development of the resource. Other direct uses of the geothermal energy can be expected and has been considered in some countries. Salt production is under consideration in Vanuatu using the heat available and a number of agro-industrial needs in Papua New Guinea such as copra and cocoa drying and palm oil processing could be met by geothermal energy and could conserve biomass and fossil fuels presently being used.

5 CONCLUSIONS

The present interest in the South Pacific to develop the geothermal potential that obviously exists should lead to some small scale developments which will undoubtedly benefit the economies of the five nations involved. Fuel import costs could be reduced significantly and small scale industries could be expanded to produce export revenue.

In addition the reduction in the emission of environmentally hazardous gases into the atmosphere and the generally low environmental impact of geothermal development will encourage Pacific Island nations to consider the resource increasingly more favourably.

6. REFERENCES


