

POTENTIAL FOR DIRECT UTILIZATION OF GEOTHERMAL ENERGY IN SRI LANKA

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Board of Study in Earth Science

Geothermal energy is the natural heat of the earth and is available as an indigenous source of energy in all countries over the world. At present, geothermal energy is being used primarily for the production of electric power, but it can be utilized in other forms, such as space heating and industrial heating. The geothermal energy may be of great value in the economy of many nations seeking development of alternative energy sources and conservation of fossil and nuclear fuels.

In Sri Lanka, Geothermal Energy has been manifested as 10 low enthalpy thermal springs (35 to 61 C⁰) along a narrow belt which runs approximately parallel to the Highland complex (HC) and Vijayan complex (VC) lithological boundary (Figure 01). These springs are not being used for any economic purpose while some have been used for recreational purposes.

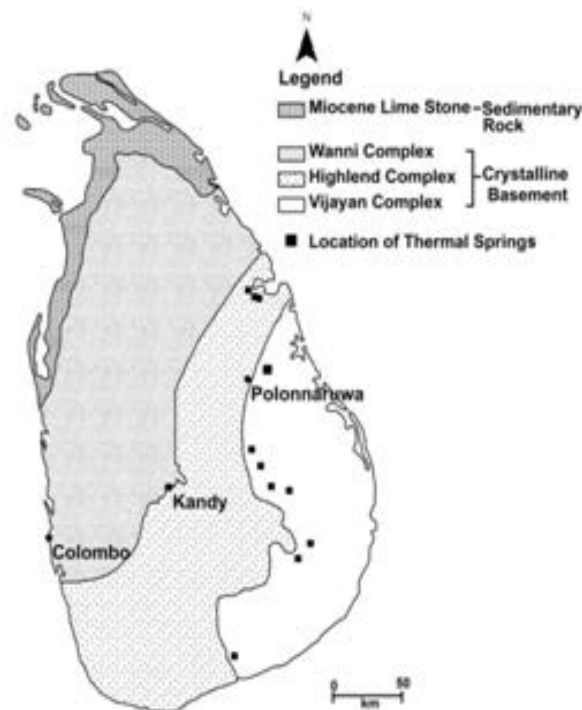


Figure 01: Location of thermal springs Sri Lanka

The energy demand of Sri Lanka is increasing day by day due to growth of industrial and household requirements of energy. According to statistics of sustainable energy authority, Sri Lankan total energy demand in 2012 is 38.3 PJ. Huge amount of fossil fuel, biomass and hydropower have been used for catering this energy consumptions. Involvement of these energy sources has been also made considerable contribution to environmental pollution in Sri Lanka. Hence, environmental friendly, pollution free, renewable energy is very important.

Geothermal energy can either be utilized for electricity generation or for direct heat utilization. Geothermometry studies of Sri Lankan thermal springs indicate that the reservoir fluids are in the low to medium enthalpy range (Chandrajith *et al.*, 2013; Disanayake and Jayasena, 1988) which means that the resource is best suited for direct use applications. This article aims to discuss possible direct application of the geothermal energy sources of Sri Lanka.

Direct application of geothermal energy can involve a wide variety of end uses, and it involves mostly existing technology and straightforward engineering. When the electricity is produced

from geothermal energy with direct utilization, there are several advantages such as much higher energy efficiency (direct use 50 – 70% and electric power 5 - 20% for conventional geothermal electric plants), generally shorter development time, and normally much less capital investment (Lindal, 1973). Direct application is, however, much more site specific for the market, as steam and hot water is rarely transported long distances from the geothermal site due to rapid heat loss during the transportation.

Potential for direct use of Sri Lankan geothermal fields

The areas around geothermal manifestations have a dry climate and the major economic activity in the areas is agriculture. It is also a popular tourist destination because of the wildlife and beach (specially Trincomalee to Hambantota). These sectors can be benefited immensely from the geothermal energy through direct utilization. The possible applications include drying of agricultural products (cereal), sugar processing, paper mill operation, cold storage and in recreational facilities such as warm pools, saunas and steam baths.

Steaming and drying of agricultural products

The geothermal manifestations have been located in Trincomalee, Polonnaruwa, Monaragala and Hambantota districts. The area is extensively agricultural. Rice, maize, soya, peanut, sugar cane, banana, and some *Cucurbitaceae* family crops have been cultivated. Rice and cereal production industries have been used thermal energy for steaming and drying. A part of energy consumption of this production can be supplied using these geothermal energy systems.

Sugar processing

Interesting field for the application of geothermal energy is found in sugar processing. Cane sugar production involves two process steps, each requiring considerable amounts of steam; first the production of raw sugar and then its refinement. The geothermal heat energy can be used for evaporation in multiple effect evaporators. Another interesting and closely related field is found with fermentation processes based on molasses. Among the products are ethyl alcohol, butanol, acetone and citric acid, all of which may benefit by the availability of liberal amounts of steam. It is reported that natural heat is already used in several countries for brewing and distillation. Cane cultivation in the area can be used as a cost effective and easy process to manufacture sugar or other valuable products using this geothermal energy.

Pulp processing for paper production and timber seasoning

There are two principal methods for processing essentially pure cellulose pulps out of wood, namely the Kraft and the sulphite process. The process is essentially chipping of the wood, digesting the chips by steam in the presence of chemicals, and separation cellulose from the digested wood by washing, drying etc (Shreve, 1956; Smith, 1970). This process takes substantial amounts of steam in the general process and drying operation. Maize and rice hay can be used to produce paper using this method followed by geothermal energy. Timber seasoning by natural heat appears to be common (Burrows, 1970; Lindal, 1964). Geothermal energy can be used for veneer fabrication, and a number of other seasoning operations of timber beneficially (Burrows, 1970).

Cold Storage

Cold storage of fresh vegetables, fruits, meat and beverages can be achieved by the use of absorption chillers which utilize hot water as energy source. The most appropriate absorption chilling machine for this operation uses a mixture of water and ammonia as the working fluid. Geothermal energy can be supported to operate the cooling pump. Use of this technique can facilitate the storage of fresh agricultural products manufactured in the areas of thermal springs.

Recreational and health applications

Hot springs and warm mineral springs have been used for recreational and health purposes for many centuries, even in Sri Lanka. There are records of many geothermally heated swimming pools, mineral baths, mud baths, steam baths and specially organized recreational centers from several countries. Although thermal springs have been used for above purposes in Sri Lanka from ancient times they have to be developed according to the modern requirements. In recent years tourism impressively increased in thermal spring areas and such places have become more accessible to people. Therefore additional infrastructures such as hotels, recreational facilities have to be developed for better tourist attractions on such places.

Summary

Convective heat loss from all outflow zones associated with Sri Lankan thermal springs can be utilized in drying of agricultural products (cereal), fish and sea food processing, sugar processing, paper mill operation, cold storage and recreational facilities. Geothermal energy can therefore be used to improve the livelihood of the local communities in Sri Lanka. Most of these applications are related to agricultural, industrial and tourism activities. Use of geothermal energy in such sectors will replace the need for utilization of expensive and environmentally unfriendly fossil fuels. Such applications will be effective sources of employment which will lead to poverty elevation.

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