DEVELOPMENT OF A METHODOLOGY TO ASSESS THE GEOTHERMAL ENERGY POTENTIAL IN SRI LANKA

G.D .Nanayakkara

(098099)

Master of Philosophy

Department of Earth Resources Engineering

University of Moratuwa

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This thesis submitted in partial fulfillment of the requirements for the degree Master of Philosophy

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DECLARATION

" I hereby certify that this thesis does not incorporate any material previously submitted for a degree or diploma in any university and to the best of my knowledge and belief, it does not contain any material previously published, written or orally communicated by another person except where due reference is made in the text"

…………………………………

(Signature of the applicant)

G.D.Nanayakkara

"The above given particulars are true and correct to the best of our knowledge"

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(Main Supervisor)

Dr.H.M.R.Premasiri
Senior Lecturer
of the Department of
Earth Resources Engineering
University of Moratuwa
Sri Lanka

(Co – Supervisor)

R.A.Attalage
Senior Professor,
of the Department of
Mechanical Engineering
University of Moratuwa
Sri Lanka

ABSTRACT

Assessing geothermal potential is a difficult task. It is a time and money consuming process. There are many methodologies, such as deep drilling bore holes and measure temperature by using thermal sensors, silicon solubility measurement, magneto telluric, etc.

The used equipment for these methods, especially for drilling of deep bore holes are much expensive. If geothermal gradient is very low, the area cannot be effectively used to establish a geothermal power plant. Another method based on contents of amorphous silica in hot spring water is also used to determine the geothermal gradient. Main task of this study is to find a suitable cost effective method to assess the geothermal potential in Sri Lanka and to develop a lab scale plant. As a cheaply available geophysical technique, ground resistivity measurement was also used to measure the temperature. Increasing temperature again increases their resistance. This natural phenomenon has been used to develop a methodology to assess the geothermal potential in various countries.

Resistivity surveys have been carried out in various places in Sri Lanka. Gathered resistivity data has been analyzed. Geothermal gradient calculation was done in Bogala Graphite Mines to study about the temperature gradient in Sri Lanka. Also this selected place was far away from hot spring areas and hence those hot springs had no influence to the collected data. This method is suitable to find temperature gradient of Sri Lanka. The average values of temperatures in those levels were computed and then geothermal gradient was calculated which is 28.046^{0}C/km. This method gave some reliable information as to how the temperature gradient varies at crustal level of rocks in Sri Lanka.

To calculate power generation, a laboratory model was developed with the possibility of applying varying parameters. Collected the annual average temperature data and predicted the temperature gradient of various districts. According to the calculations done, geothermal gradient in Sri Lanka is varying between 23 ^{0}C and 30 ^{0}C per km. This information has been used to develop the geothermal map of Sri Lanka.

Laboratory plant was developed and its performances were studied for varying hot spring temperatures and all data gathered and analyzed. According to that the geothermal temperature gradient in Sri Lanka is suitable to generate electricity. But the water flow rate is not sufficient to produce more power.

The research team who studied about the Mahapelessa hot springs has observed that during the period of one minute, 10 liters of geothermal hot water have been released. Another research team exposed that underground reservoir temperatures are higher in some areas by applying geochemical method. Considered all possible geothermal gradient assessment methods and the best system suitable for Sri Lankan territory is the borehole drilling, out of all of them. The reason for this is borehole can be drilled at any selected location, without facing difficulties out of all of them.

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G.D.Nanayakkara,
Institute of Technology,
University of Moratuwa

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List of abbreviations, terms and symbols

kW	Kilo Watt
kWh	Kilo Watt Hour
MW	Mega Watts
GW	Giga Watt
VOC	Volatile Organic Compound
EGS	Enhance Geothermal Systems
MT	Magneto Telluric
GENI	Global Energy Network Institute
GSI	Geological Survey of India
IOE	Institute of Engineers
DEDE	Department of Energy Development and Efficiency
AfDB	African Development Bank
TEC	Theoretical Cycle Efficiency
CO_2	Carbon dioxide
CO	Carbon monoxide
H_2S	Hydrogen Sulfide
SO_2	Sulfur dioxide