PUBLICISING GEOTHERMAL ENERGY

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SUMMARY - Each year the Geothermal Institute at the University of Auckland holds a workshop on geothermal energy. This appears to be the only time and the only forum where this form of energy, in which New Zealand is well endowed, is brought to the notice of the General Public. On the other occasions the publicity is usually negative and frequently relates to how Developers of this energy form are destroying New Zealand's natural tourist attractions such as Geysers and other forms of natural activity, and a Maori Heritage. In recent months there has been a chronic shortage of power in New Zealand. This could well have been prevented by incremental development of New Zealand geothermal reserves. Electricity produced from this resource is ideally suited to base load generation and can be produced at a competitive price.

This paper reviews the likely knowledge that New Zealanders have about this sort of energy and how the probable lack of knowledge is likely to influence decisions made by government and energy planners. It compares the New Zealand scenario with the image of the resource and how it is publicised in other countries particularly the USA.

1.0 INTRODUCTION

Although geothermal energy and electricity generated from this energy form have been available since the mid 1930's the presently installed capacity of geothermal electricity in the world, as of 1992, was only 6000MW. Since 1950 the world's annual growth rate of geothermal electrical capacity has been approximately 7% although since around the 1980's this rate appears to have increased to approximately 16%, Figure 1. In a period of some 25 years when at least two worldwide energy crises have occurred, including the oil crisis of 1973, and alternative and sustainable forms of energy have been promoted the lack of interest and progress with developing this energy form is puzzling.

In the Introduction to the book Geothermal Energy (1977), one of the first texts written on this energy form, the author Christopher Armstead comments "Reluctance to take financial risk has, moreover, been reinforced by a certain conservatism and unwillingness on the part of electricity supply undertakings to take geothermal energy seriously; there has been a tendency to regard it as 'new fangled', and to cling to more conventional sources of energy that have for longer stood the test of time. Prejudicial though this attitude may have been, it has undoubtedly been an adverse psychological factor that has retarded the rate of geothermal development, and one which even now has not been fully eliminated". One wonders whether after fifteen years these same comments and sentiments directed towards the technology and industry, can be said to be even more relevant and true.

In the same book the sentiments expressed in the Dedication, although emotional, are more than appropriate to the beliefs and findings of the recent World Environmental Congress held in Brazil. Armstead stated "To all of those who feel profound unease at the profligate squandering of the earth's dwindling resources and at the wanton fouling of our once beautiful planet this book is dedicated, in the hope that it may at least contribute to the solution of one of the grave crises confronting Mankind - that of finding abundant energy and of simultaneously reducing the terrifying degree of pollution associated with the combination of huge quantities of fossil fuels on which we are now so dependent for our social needs. Obviously the contents and background of New Zealand's recently enacted Natural Resources Act is modelled along these same sentiments and regards.

One wonders therefore what has gone wrong with the promotion of this energy form and why it has not taken off, certainly during the periods of energy crises. During New Zealand's recent energy crisis various articles on the power shortage appeared in reputable journals, for example the NZ Business Review, copy published on 3 July 1992, which talked about alternative forms of energy to Hydro, but failed to even mention the geothermal alternative. Eventually one article appeared in the NZ Herald written by Jim Lawless, a true and trusted supporter of the technology, drawing attention to this possibility. One can only believe from this type of behaviour and publicity that the New Zealand public and possibly the rest of the world seem to know little about this energy form and its true potential. Recent technical publications arising out of the United States draw attention to the same behaviour and attitudes. It is the intention of this paper to review the publicity that has been directed and occurred in NZ and other parts of the world to this form of energy and to determine where it has gone wrong for the developments to be as dormant as they are today.

2.0 INTERNATIONAL PUBLICITY

Natural hot waters discharged from springs and steam derived from fumaroles have been used for bathing, cooking and balneological purposes since the beginning of time. These natural fluids form the surface discharges of most geothermal systems including active volcanoes. The first use of these fluids for electricity generation occurred in Larderello, Italy, in the mid 1930's and later in the 1950's at Wairakei NZ and The Geysers USA. During the 1960's and there after many developments occurred through out the world.

Publicity in the early stages revolved around the unique usage of the resource for bathing and possible medical applications and was related, although perhaps indirectly, to tourism.

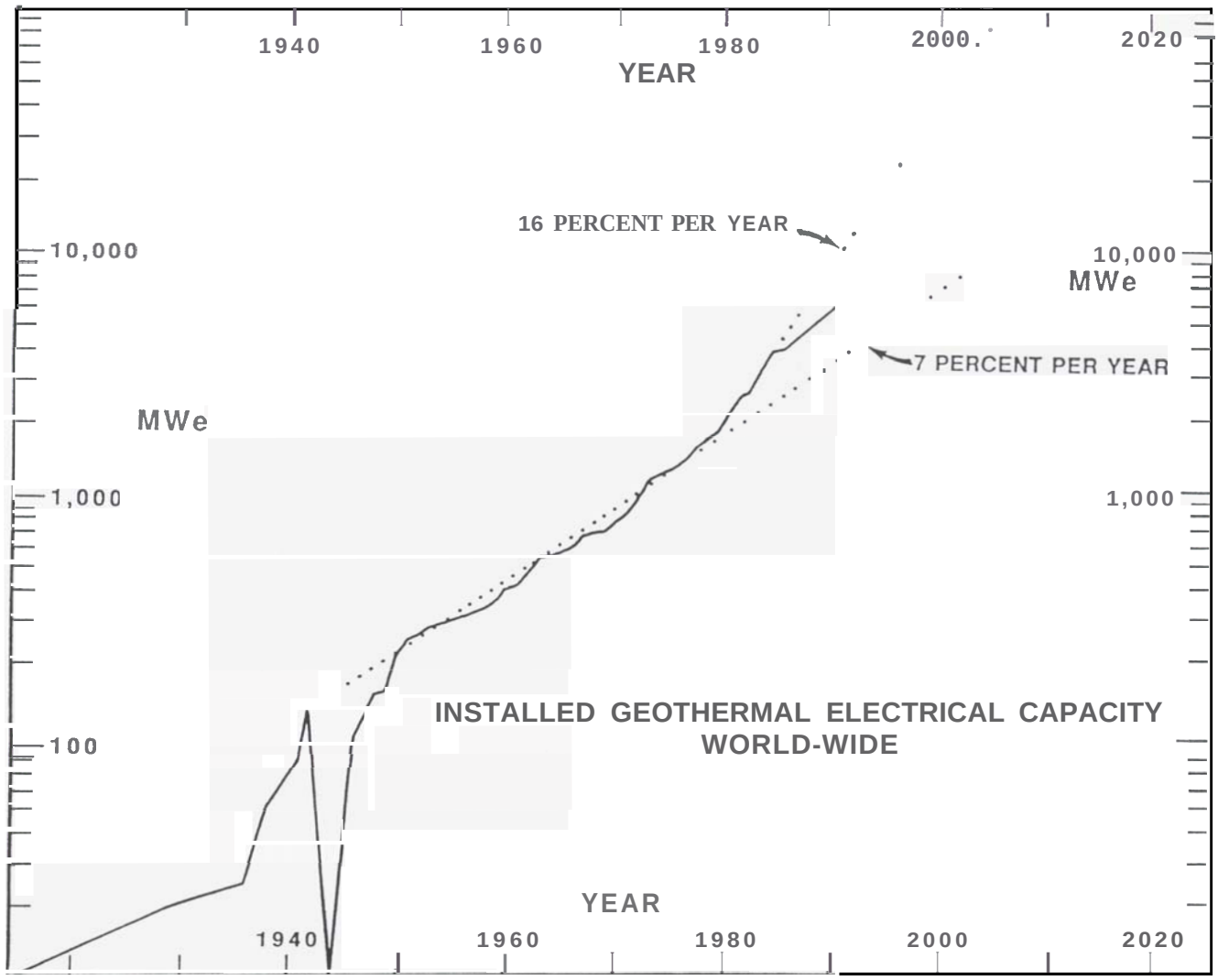

Figure 1

The first international occasion that took place in which the significance of the world's geothermal energy resources was discussed was in Rome, Italy, in 1960 at a conference convened by the United Nations on New Sources of Energy. Apart from geothermal the centre stage at the conference was shared with wind and solar energy. This was followed in 1970 and 1975 by further international UN conferences which were devoted entirely to geothermal energy and in 1985 and 1990 by international conferences run by the Geothermal Resources Council of the United States and associated sponsors. This Council which was set up in 1972 has been the most important single agency in The United States and for a considerable time in the world, promoting the geothermal technology.

These conferences made a significant impact within the world energy scene and created considerable interest, particulary in periods of energy shortage such as in 1975. However the impact was always diluted by the apparently small amounts of energy in terms of electrical capacity that were available from this resource. When compared against the historic methods of generating electricity, such as hydro and oil fired thermal, geothermal seemed insignificant and of little importance for the larger producers and consumers of electricity. Similarly a large scale geothermal development could perhaps reach a capacity of 250MW which was considered very small compared with some of the nuclear and coal fired plants that were being installed around the world. What went unnoticed was the fact that some countries, as for example El Salvador, were generating up to 50% of their electrical capacity using geothermal energy.

3.0 UNITED STATES

In the United States the local industry had realised for some time that the publicity given to geothermal energy was of a low profile compared with that in other energy fields and that this could be having a major influence on the utilisation of this form of energy. During the lead up to the last international geothermal conference in Hawaii efforts were made to publicise the technology by the publication of a number of booklets on the industry and by the submission to the conference of a number of papers on the subject. In particular a brochure was produced by the University of Utah Research Institute entitled Geothermal Energy.

This brochure drew attention to the nature of the resource in its simplist form describing what the energy was, showed that it was sustainable and that it was kind to the environment. As indicated earlier a number of very good papers on publicity were subsequently presented at the conference. More latterly the 20th anniversary of the Resources Council took place at their annual conference in San Diego and the Bulletin published by the council listed in its Anniversary issue in June 1992 the significant events in the development of geothermal energy in the United States. This added publicity and more aggressive advertising has taken the technology into the 1990s in the **USA** and appears to be having a marked influence on the positive sides of the technology.

The technology and industry in the United States has been

difficult to promote due to the large differential between the total electricity generated in the country, the contribution made by geothermal energy and the growth rate required. However as the above pamphlet pointed out "the production of geothermal energy in the US currently ranks third in alternative energy sources following hydro electric power and biomass energy. However as a result of geothermal production , consumption of exhaustible fossil fuels is offset, along with the release of acid rain and greenhouse gases that are caused by fossil fuels use. Todays geothermal energy use in the United States is equivalent to the burning of about 60 million barrels of oil each year, while world wide geothermal use is equivalent to the burning of about 150 million barrels of oil".

The resource base in the United States for the renewable energies, geothermal, solar, biomass and wind is quoted as being much larger than the total resource base in coal, oil ,gas and uranium (nuclear power). Similarly geothermal energy has a net positive environmental impact compared with development of conventional energy sources. Quoting from the same pamphlet as above. In the United States electric utilities now account for 70 percent of the US sulphur dioxide emissions (the major cause of acid precipitation), 33 percent of our nitrogen-oxide emissions (that combine photochemically with vaporised hydrocarbons to form ground level ozone), 20 percent of the releases of gases linked to the atmospheric greenhouse effect and 50 percent of all nuclear waste.

Geothermal power plants have sulphur emission rates that average only a few percent of those from fossil fuel alternatives. Geothermal energy use reduces emissions of greenhouse gases. The newest generation of geothermal power plants emit only 0.3 lb of carbon per megawatt-hour of electricity generated. This figure compares with 282 lb/MW-hr of carbon for a plant operating on natural gas, 418 lb/MW-hr of carbon from a plant operating on fuel oil and 497 lb/MW-hr of carbon for a plant using bituminous coal.

Of similar importance in the United States is the small usage of land by geothermal plants. Geothermal power plants require very little land , taking up only a fraction of that needed for other energy sources . Other land uses can mingle with geothermal plants with little interference or fear of accidents. These two considerations are respectively shown graphically and tabularly in Figure 2 and Table 1. The figure and table are taken from the above publication.

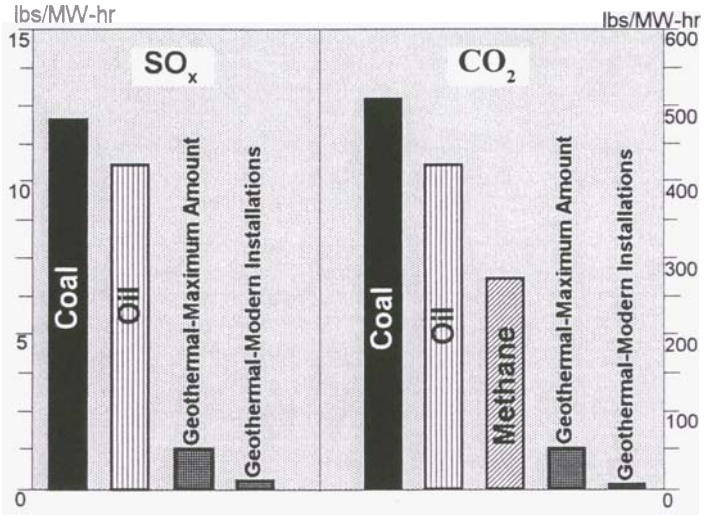

Figure 2 - Table I

Technology	Land Occupied (Square meters per gigawatt-hour, over 30 years)
Coal	3642
Solar Thermal	3561
Photovoltaics	3237
Wind	1335
Geothermal	404

In the conclusion drawn in this publication it states "Geothermal energy and the other sustainable energies have compelling advantages compared to conventional energy sources. These advantages include (1) much less environmental damage, (2) reduced total energy demand with geothermal heat pumps, and (3) increased energy security for our country with less requirement for expensive imported energy. The actual cost of geothermal energy today is much less than that or our present energy sources if hidden costs are included.

4.0 NEW ZEALAND

There have been numerous papers and publications on the history of geothermal developments in New Zealand but perhaps the one which summarises the early developments most accurately is entitled Wairakei Geothermal Power Project by Love and Bolton published in 1980. The Ohaaki development was summarised in a number of very good papers in the proceedings of the 1989 geothermal workshop which had as its main theme the commissioning of the Ohaaki plant. Between these two major developments a considerable amount of information was published in scientific papers and books. The various environmental Groups such as the Nature Conservation Council were very active during this period particularly in respect to The Rotorua and Waimangu geothermal systems.

The very slow rate of development of this resource in New Zealand can be gauged by comparing the dates of commissioning of the first electricity generation at Wairakei in November 1958 to the final commissioning of the Ohaaki plant of 114MW in 1989. In other words it took nearly thirty years to install 294MW of geothermal electricity. What was even more unfortunate was the prolonged length of time between the drilling of wells at Ohaaki and the commissioning of the plant, an investors' nightmare. Only a project financed out of the taxpayers pocket could have supported such an economic policy.

Of particular interest in the 1989 Proceedings of the above workshop was the summary statement in the keynote address given by John Malcolmson of the Electricity Corporation of New Zealand Ltd. In this he stated "I have briefly outlined the history of the development of the Ohaaki Power Station. The Corporation is both pleased and satisfied with its construction. However I believe that it is the last of its type in New Zealand. The economic and environmental changes that are currently occurring are such that any developer of a geothermal field will have to pay as much attention to the external issues associated with the development as to the technical plant issues". One wonders whether with the passing of the Resource Management Act in the last period, the ability of private developers to generate electricity in New Zealand and the absence of any National Energy policy or plan whether these sentiments are still valid.

During the period since 1950 when the first scientific and engineering studies were being carried out to determine the

viability of geothermal energy for generating electricity the national understanding of the resource has been limited. The greatest publicity that has occurred has been at the plants themselves where the impressive sight of the natural draft cooling tower at Ohaaki, the view from the lookout overlooking the Wairakei bore field and the information bureaus in both areas has impressed many tourists amongst whom have been a considerable number of New Zealanders. However, compared with the discovery of natural gas in Taranaki and its subsequent development and the think big energy projects of the **1970's** and **80's** geothermal has gained little positive public press.

Whereas the geothermal developments in New Zealand did not hit the local headlines very often in the **1960's** and **70's**, New Zealand scientists out of the DSIR and engineers from the Ministry of Works and New Zealand Electricity Department, working in the technology gained international recognition for their pioneering work in the Industry. The accolades gained from this excellence of input was rewarded by the United Nations requesting the New Zealand Government to supply geothermal expertise, working through the UN, for the development of geothermal resources world wide. In the period starting around **1968** at least forty New Zealand technologists were employed in around thirty countries of the world carrying out this work. Internationally this was recognised in newspaper articles, in television shows, particularly in Japan and other forms of publicity and finally by the awarding of the covenanted Geothermal Resources Pioneer prize to New Zealand scientist and engineers at the **1985** Hawaiian International Geothermal Congress.

The international standing of New Zealand geothermal technologists led in to New Zealand government funded aid programmes in geothermal developments in the Philippines and Indonesia. These countries wished to develop their local resources, for somewhat different reasons, at a rate which had been unknown in the world for some time. Two New Zealand companies were instrumental in carrying out the aid work on behalf of the New Zealand government, KRTA in the Philippines and GENZL in Indonesia. The **80's** were golden years for development in these **two** countries and the word geothermal was well recognised and understood by power planners in both countries. However, apart from the fact that revenue was returned to New Zealand from the projects and that New Zealand received promotional benefits in both countries little publicising of these important events to the New Zealand public, other than the odd newspaper article, took place.

In contrast the negative publicity created by the concern in Rotorua over the exploitation of the local system and the possibility that major tourist attractions such as Pohutu Geyser and the hot springs at Whakawerawera would be lost has created problems in promoting the viability of the resource for electricity generation. The Government run Rotorua Monitoring programme that was initiated to study the situation at Rotorua produced both positive and negative publicity to the technology but since it was both political nationally as well as locally the overall effect was probably negative. Certainly the difficulties experienced by users of the energy in Rotorua both during and as a consequence of the programme would have made them have second thoughts about further investment or private development.

One of the very positive aspects of the technology and its publicity was the setting up of the Geothermal Institute at the University of Auckland. The history of the Institute has been published on a number of occasions and updates of this history have been published in a variety of journals and articles. Needless to say the forum for the technology in New Zealand and the International recognition of geothermal work and research carried out in this country has been at the annual workshop held by the Institute since **1979.** This workshop attracts geothermalists from many countries and most of the people working in the technology locally and the addition of a selection of papers from the students, who come from many different countries gives the whole procedure a truly international flavour.

Apart from various branches of already established professional bodies as well as the New Zealand Geochemical Group; there has been no professional body in New Zealand which has been entirely connected or associated with the technology. As a result there has been no body capable of offering independent advice to government or local organisations and answering questions and making decisions arising from the development of this energy form. Similarly the absence of such a body has reduced the ready availability of advertising material and publicity toward the energy form. Some three years ago, in **1989,** an international organisation called the International Geothermal Association Incorporated was set up. The Association was incorporated in New Zealand and included four New Zealanders in its initial Board of 30 Directors. This Association now has nearly 2000 members from all of the countries where the energy form occurs, making it a truly international group with considerable opportunity and ability for decision making. In the last year an application has been submitted to the New Zealand Justice Department for the Incorporation of the New Zealand Geothermal Association which has already made application to the International Geothermal Association for an Affiliation agreement.

The Laws of the New Zealand group indicate and express the role of the group and the possible significance that it may have on future policy and decision making. They state, "The New Zealand Geothermal Association is a scientific, educational and cultural organisation established to operate in New Zealand. It is a non political, non governmental, non profit making organisation. It has no political affiliation. Its aim is to encourage, facilitate and when appropriate, promote coordination of activities related to worldwide and national research, development and application of geothermal resources. The place of residence for the Secretariat of the NZGA will be the Geothermal Institute's and its annual conference will be the present institutes Workshop. The initial number of its members will be around sixty to seventy. It is considered that this group, with the support of the Institute will be able to bring to the attention of the New Zealand public and governments in the best way possible, the publicity required to favourably promote the uses of the energy form.

Now that the Resource Management Act has been passed it may be wise for the newly formed NZGA to seriously consider republicising the true facts about geothermal energy and the technology and remove all the myths and preconceived ideas that have been bandied about due to the lack of any coordinated group, to a wide area and representation of the New Zealand Public. Certainly the problems encountered this year with the lack of a viable supply of electricity makes the timing of such a review to look at the advantages and disadvantages of this energy form and for electricity generation as well as direct use, perfect.

Many reasons have been listed in the past as to why Geothermal Energy is not a viable energy form for electricity

generation in this country. Such comments as there is not enough of it to produce large increments of generation (>200MW) such as perhaps coal fired or gas fired power plants can, its too expensive and not economic, its environmentally unacceptable, problems of land ownership are complex and not readily solved in reasonable periods of time, its a non proven resource, seem rather out of line in the 1990's and with what has been learnt in the last decade. Perhaps these questions could be viewed and partially answered in terms of the confidence that New Zealand and New Zealanders put in to the development of the geothermal resources of Indonesia and the Philippines compared with their interest and confidence in developing the resources in their own country. Without the constraints of any national energy plan the promotion of this form of energy above other forms with thoughts such as small could be beautiful and economic are worth reviewing.

5.0 CONCLUSIONS

It is not necessarily valid to compare the geothermal development programme in the United States with that in New Zealand due to the availability of various and different resources in one country which are not present in the other. However, there are many similarities which are worth discussing as has been done in this paper. What is always surprising is the neglect that occurs to the development of any sustainable energy resource that is different and not in line with the simple options. The USA and Japan belong to the Oil syndrome, New Zealand belongs to the Hydro syndrome and Indonesia belongs to the Coal syndrome. These represent the simple options in the respective countries.

The two major sources of relatively non polluting energy that the world has are solar and natural thermal energy from the earth's interior. Until mankind understands this and takes the correct action to harness these energy forms the world will continue to suffer energy shortages and crises. Hopefully the proper promotion of these well known and obvious sustainable alternatives will aid in their development and usage in the longer term.

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