

DEVELOPMENT OF AN ARGEO INSTRUMENT POOL IN THE REGION

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ABSTRACT

The East African Rift is endowed with vast indigenous geothermal energy resource and despite presence of substantial number of qualified personnel trained in geothermal technology in the region, its development has been slow. This is mainly due to technological constraints in the initial stages of development, which require purchase various types of equipment, the cost and maintenance of which is a major hurdle to developing countries. These equipments include geological, geochemical, geophysical, GIS, reservoir engineering and environmental monitoring devices that are used in geothermal resource assessment and volcano monitoring. Cost effective exploration for geothermal resources with these methods needs initial investments in field, laboratory, and office hardware. The creation of an African Rift Geothermal Energy Development Facility (ARGeo) Instrument Pool for this region is therefore necessary to address this shortcoming. The facility will be for pooling of scientific and engineering instruments, expertise, training opportunity and data archiving for use by Eastern African countries to significantly increase the exploitation of this environmentally benign, vast source of economic and renewable energy. It is therefore proposed that the facility be hosted at Olkaria where there will be a Geothermal Training Centre (GTC) for the African region and also due to availability of laboratories and workshops that would provide for equipment storage, servicing and maintenance.

1. INTRODUCTION

The East African countries have vast amounts of untapped geothermal resources within the African Rift. Geothermal development has been slow in part because of the region's inability to obtain special equipment, expertise, and experience to carry out exploration and development of this resource. The East African Rift is also an area of potential volcanic hazards e.g. the eruption in January 2002 of Mt. Nyiragongo in the Virunga volcanic province of the Democratic Republic of Congo where lava flows reached the city of Goma, killing many people and causing many more to flee. Mitigation of the risk due to such volcanic hazards involves obtaining information similar to that gathered in geothermal exploration. Therefore the availability of geological and geophysical monitoring and profiling equipment is very necessary.

In East Africa, however, the purchase cost and maintenance of these types of equipment has been a major obstacle. A number of individuals and agencies, including East African geothermal scientists, energy policy makers, and the United Nations Environmental Program (UNEP) in Nairobi, are keen on the establishment of an instrument pool in the region.

The aim of the proposed equipment pool is to see that the methods, facilities, and results of individual projects are available for both technology transfer and further work by others in this region. In this context, it is proposed that the technical aspects, equipment, and practical experience needed to mount new geothermal projects will be supplied by a stable, regional institution in the form of an ARGeo Instrument Pool for East Africa.

Similar obstacles have been overcome elsewhere through the founding of resource centres where such equipment and technical expertise have been pooled. The organization and operation of the ARGeo Instrument Pool will be adapted for East African conditions from facilities such as the IRIS PASSCAL Instrument Center, Potsdam, and PACES-NASA (UTEP) (Malin, 2001).

2. OBJECTIVES

The main objectives of the ARGeo Instrument Pool will be:

- To pool special equipment and expertise to carry out geothermal exploration and development and volcano monitoring in the East African region.
- To undertake exploration and research activities in the field of geothermal energy within the East African countries.
- To contribute to East Africa's effort in making geothermal energy development especially viable and faster than at present.
- To facilitate the integration of knowledge and staff from other East African countries.

3. THE EQUIPMENTS

The ARGeo Instrument Pool will include a central facility for geological, seismographic, potential field and geochemical equipment, a small support staff, and a documentation library for fundamental and case history studies. It is recommended that the ARGeo Instrument Pool host state-of-the-art fixed and movable scientific equipment for use by all the countries of the region. The instrument pool should preferably house equipment that would not be easily available to the countries in the region due to cost.

The status of the equipment and instruments in the region is still uncertain and questionnaires need to be sent out to member countries to give the type and status of equipment present in their countries. A recommendation as to which basic equipment and instruments that should exist in each ARGeo country and the ones to be pooled together should be made. Some of the equipment and instruments present in various member countries might not be suitable for geothermal exploration and development. Thus, critical instruments will still need to be purchased and the following equipment are recommended to be a part of the pooled resources:

Geology and Geochemistry:

- ICP-MS for the analysis of geothermal fluids, petrochemistry, stable isotope analysis and analysis of elements of environmental significance.
- Gas Chromatograph for gas analysis (GC)
- X-Ray Diffractometer (XRD) for analysis of geological samples.
- GIS system.

Geophysics and reservoir engineering:

- Gravity meter 2.
- Magnetometer 2.
- Reflection seismic system 2.

- TEM 3.
- MT 6.
- Seismology Systems 30.
- Geophysical well logging tools 1.
- Field truck 1.
- Quartz crystal type pressure monitoring assembly

Environment:

- H₂S logging equipment
- Weather Monitoring Instruments

Information Center:

- Reference materials
- Integrated Library system
- Desktop Publishing Unit (Software, computers, printers, scanners)
- Other library facilities

A summary of the equipment and estimated costs of procuring and maintenance is tabulated below in Table 1.

It is envisaged that some of the equipment already available at KenGen could be used as part of the instrument Centre so long as the Centre undertakes maintenance and running costs of the same. The various types of equipment could be purchased as funding is secured in a step-prioritized approach.

4. SUSTAINABILITY OF THE ARGEO INSTRUMENT POOL

1. Donor funding and UN support. The UNEP, KfW, national and bilateral partners have indicated willingness to setup such a facility in the East African Rift region.
2. Information selling: Data shall be sold to those that require them.
3. Consultancy and contracting: The Center shall strive to source for consultancy services from geothermal utilities in the region. The possible areas include volcanic risk assessment, well testing and geothermal exploration surface studies.
4. Support from agencies like the International Atomic Energy Agency (IAEA).
5. Equipment hire: The equipment shall be rented at rates approved by the management board of the Training Centre.

5. LOCATION OF THE INSTRUMENT POOL

It is proposed that the equipments be hosted at Olkaria (KenGen's offices) where there will be a Geothermal Training Centre for the African region. Secure storage facilities (laboratories and workshops) are available and would also provide for easy equipment servicing and maintenance. Some of the instruments will be stationed at satellite Centres within the East African Region to facilitate easy access.

TABLE 1: Proposed equipment pool and estimated costs

Equipment type	No. of Units	Cost Estimate (US \$)
Well Logging tool - geophysical	1	266,700
Well Logging tool – reservoir	1	224,000
Field truck - geophysical	1	134,350
Reservoir logging truck	1	616,000
Quartz type pressure monitoring assembly	1	133,333
Multi-gas logging equipment	3	15,500
X-ray Diffractometer	1	276,800
ICP-MS	1	180,000
Gas Chromatograph	1	125,000
GIS system	1	200,000
Gravity Meter	2	220,000
Magnetometers	2	24,000
Reflection seismic system – shallow type	2	100,000
TEM equipment	3	195,000
MT units	6	510,000
Seismographs	30	495,000
Weather monitoring system	3	15,000
Geothermal reference materials	Journals, books, magazines etc	40,000
Integrated library system	Furniture, Pcs etc	67,700
Desktop publishing unit with Pcs, Scanners, printers, software	Pcs, Printers, Scanners, Software, Plotters	98,000
Other library facilities		106,700
Technicians Cost/year (240 working days/year) @ 19 US \$/hr/technician	4	146,920
Cost of housing @ 4 US \$ /sq ft/month	300 sq ft	14,400/year
Equipment Maintenance Tools		10,000
Transport	1 vehicle	50,000
TOTAL COST		4,249,483

6. DISCUSSION AND CONCLUSIONS

The technical aspects of geothermal projects in East Africa have relied on separate equipment and expertise source, which have then been removed from play at the end of each project. Moreover, with continued relaxation of public control of East Africa's geothermal resource development, proprietary practices have limited some of the value-added aspects of exploration, including assessments of volcanic hazards and ground water distribution, which are by-products of standard geothermal exploration.

The ARGeo Instrument Pool's advantage in geothermal resource exploration and development in the region will allow not only for both continuity of instrumentation and expertise, but also for value-added research. With one pool of instruments, technicians, and other experts, the hard-won lessons of learning how specific instruments work and can be best applied to a given type of study area will not

be lost when individual projects are completed. The Instrument Pool will also allow for value-added information such as volcano hazards and ground water distribution to be collected, stored, and made available to the public. It is therefore recommended that an ARGeo Instrument Pool be set up at Olkaria.

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