

ARGeo Geothermal database: progress report

A case of Rwanda

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ABSTRACT

The African Rift Geothermal (ARGeo) Geothermal database was initiated by ARGeo project and presented to ARGeo member countries at Nairobi - Kenya, in November 2012 during the ARGeo conference C4. The aim of the database is to build a web based regional hub for geothermal energy, where useful information will be easily accessible to the various geothermal actors. Since then, each ARGeo member country is contributing to the database by sharing information related to geothermal development of their respective countries.

This paper presents the progress that has been made so far in terms of building a geothermal database in Rwanda as part of the African Rift Geothermal project. It includes the inventory of the geothermal data existing in the country, the identification of the geothermal data users and their needs. The present paper highlights also the progress of Rwanda in the exercise of filling data into the web based ARGeo geothermal database inventory. Furthermore, it discusses the challenges arising from the development of the ARGeo geothermal database in Rwanda and gives recommendations.

1. BACKGROUND

The African Rift Geothermal Development Facility (ARGeo) Project is funded by Global Environment Fund (GEF) and being implemented by United Nations Environment Programme (UNEP).

UNEP-ARGeo project aims at supporting the development of the large untapped geothermal resource potential in the Eastern Africa region with the main objective of reducing the risks associated with the resource's exploration. One of the ways to achieve that aim is to encourage both public and private developers to accelerate development of geothermal resource in the East African Region. The project provides fast targeted and demand driven technical and financial support to East African Countries.

The ARGeo Geothermal database inventory (AGID) was designed under the ARGeo's components which are regional networking and information systems, other components being capacity building, policy advice and Technical Assistance for Surface exploration studies. The expected output for this database is the establishment of geothermal regional networking hubs. AGID is a data warehousing interoperable networked system of distributed data stores accessed through authorized focal member country nodes. The Inventory database system is built upon an open architecture using open source software practices. It provides access to geothermal data from providers across the 6 ARGeo member countries, including the other 7 ARGeo target countries' centers. Basically the ARGeo Geothermal Inventory Database system is a set of software programs that controls the organization, storage, management, and retrieval of data in the database. It therefore allows users and other software to store and retrieve data in a structured way (ARGeo, 2010). In line with AGID, Rwanda is developing a geothermal database management system designed to store actual geothermal research or production data.

Geothermal development in Rwanda has started in 1980s with geo-volcanological survey which has encouraged more studies in the vicinity of Virunga massif and in Bugarama graben. The development of geothermal has taken momentum in the last ten years, where several campaigns were carried out on various geothermal disciplines to map out the resource. All those studies coupled with the Rwandan government effort to develop geothermal have produced a big number of data that worth to be inventoried, stored and shared with all geothermal actors across the world especially those ones of African Rift. Alrene A., et al, (2013) has reminded that "a variety of data is required to ascertain whether a potential geothermal energy site should be developed for production: composition and hydrologic proper-ties of materials hosting the thermal energy, proximity to existing power grids, and quantity of thermal energy flowing from the interior of the earth are all primary considerations".

Considering that "Data analysis for geothermal resource development presents a highly complex challenge where: —The rate-limiting step for all geothermal development is proving the resource – i.e., having sufficient geo-scientific and exploration drilling data to be certain of a certain level of output (Bloomberg New Energy Finance, 2012)", the development of African Rift geothermal database is taken as tool that will help much to prove the existence of the geothermal resource at the same time accelerating its development.

2. CURRENT STATUS OF ARGEO GEOTHERMAL DATABASE IN RWANDA

The ARGeo geothermal database in Rwanda has started by inventorying the existing geothermal data in Rwanda at the same time filling in the data into the web based ARGeo geothermal database inventory. Furthermore, geothermal data users in Rwanda were identified as well as their needs defined. Currently, efforts are multiplied to outline the way forward to meet those needs.

2.1. Inventory of Existing Geothermal Data in Rwanda

While several geothermal datasets on Rwanda exist, there has never been an inventory of what is available. It is still a challenge to know what datasets exist, where they are and how to access them. It is to ease the discovery of geothermal data that the ARGeo geothermal database – Rwanda is being developed.

The data inventory of the existing geothermal data in Rwanda has started in 2013 and is still going on. Data have been grouped into data types depending on their usefulness and are presented as follows:

- *Publications*: this type of data includes all kinds of published documents (reports, papers, proposals and presentations) on geothermal in Rwanda or related to East African Rift – Western branch where Rwanda is located.
- *Raw data*: this includes MT/TEM files, geochemical data, seismic data, geological cuttings & thin sections plates, pressure and temperature logs.
- *Geographical Information System (GIS) & Remote sensing data*: “GIS are tools that allows for the processing of spatial data into information, generally information tied explicitly to, and used to make decisions about, some portion of the earth” (Demers, 1999). It is preferable to make a separate group for GIS data independently from other data to ease the data management using geo-information based software such as ArcGIS. GIS data comprises a set of maps presented as secondary maps (hard and scanned copies) and primary maps (soft and hard copies), geo-referenced aerial photo dated of 2009 and satellite images.
- *Institutional capacity*: This group comprises all data on personnel, laboratories, equipment and partnerships related to geothermal development in Rwanda.
- *Regulatory Framework*: This set of data is made of legal and regulatory guidelines documents governing the development of geothermal in Rwanda. The inventoried documents including policies, strategies, laws, acts and memoranda.

The summary of the data inventory is presented in the below chart.

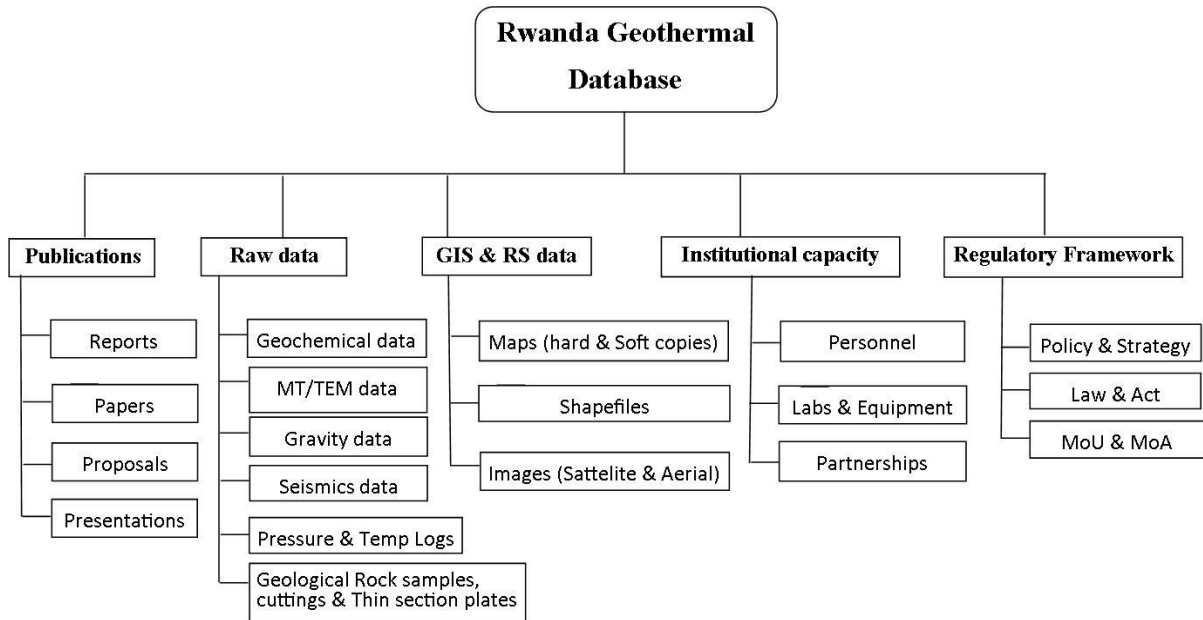


Figure 1: Rwanda Geothermal Database Inventory Chart

As the inventory goes on, the above chart may be reviewed to meet the most proper representation on the inventory.

2.2. Progress of the ARGeo web based geothermal database inventory – Rwanda

The AGID (ARGeo Geothermal Inventory Database) provides an overview of geothermal development in the African Rift region by storing information on geothermal projects, their progress and funding, as well as related information on human resources capacity and equipment available or required in the countries concerned (ARGeo, 2012).

AGID web, which is still accessible only for ARGeo database focal points, contains the input from Rwandan side. The package is made of information on sites or geothermal prospects, projects, laboratories, power plants, Maps, equipment, man power and trainings. It shows also references where by you can get information on the existing publication related to geothermal in Rwanda. The website does not contain the actual data. The figures below are a snap shot showing the sample of the AGID website.

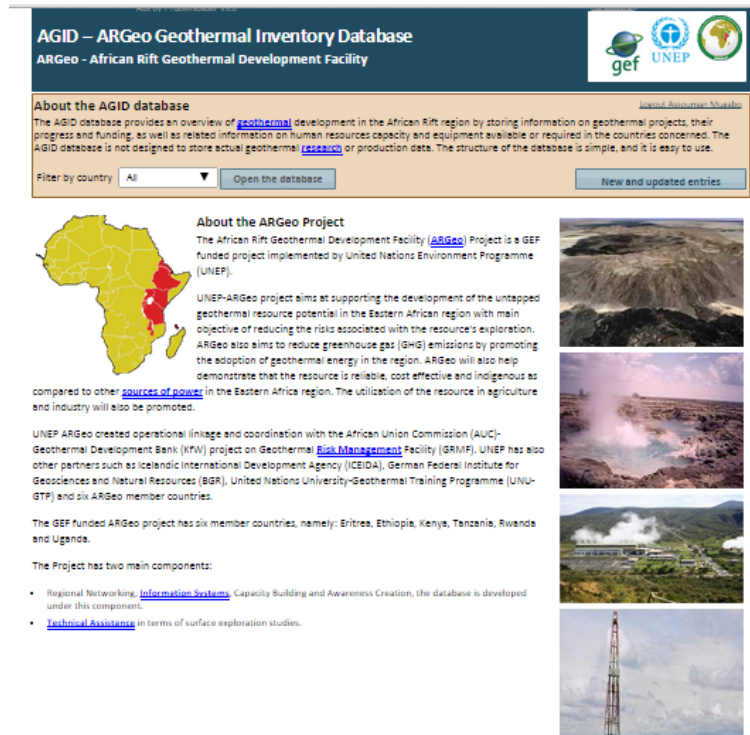


Figure 2: snap shot of the AGID website home page

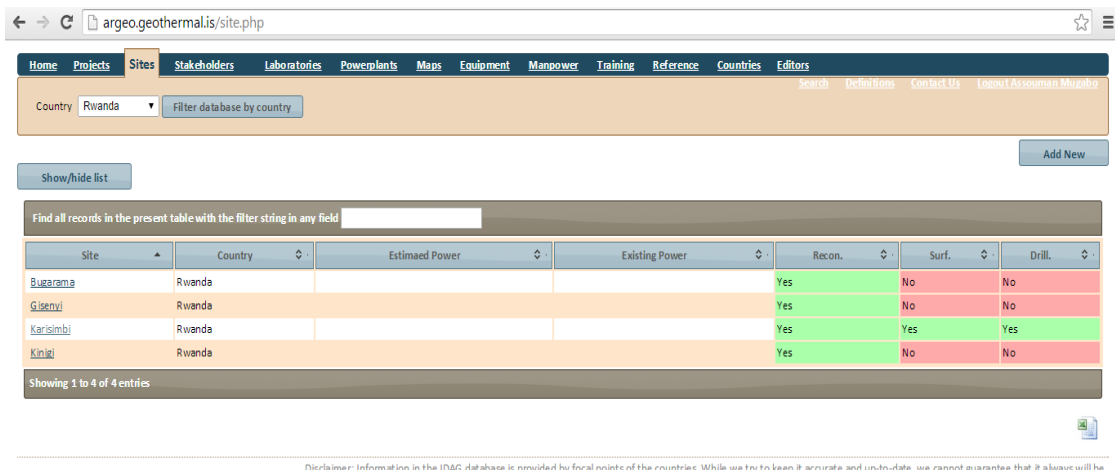


Figure 3: Snap shot of the AGID website, page of Rwandan sites

2.3. Geothermal data users' identification in Rwanda

Geothermal data users in Rwanda are increasing in terms of numbers and variety of category of people. We have identified several sorts of geothermal data users in Rwanda and we grouped them as follows:

- *Geothermal scientists and engineers*: This group is the fundamental of the geothermal business. Considering that geothermal energy in Rwanda is at the exploration stage, geothermal scientists and engineers are working very hard to prove the existence of this resource. To achieve their goals, they regularly deal with geothermal data either by collecting them, manipulating, sharing and/or providing them to other groups. In fact they lead most of the geothermal activities in the country.
- *Energy decision makers*: an effective decision has to be based on reliable information. Energy decision makers are one of the key groups of people that use geothermal data in order to extract the useful information that they need.
- *Private energy developers*: Clean and cost effective. Geothermal development attracts a big number of private developers in Rwanda. Private developers use geothermal data to decide how they can invest in geothermal.
- *Academicians and researchers*: With its multidisciplinary aspect, geothermal energy is attracting many academicians and researchers especially in the Earth sciences and natural resources studies. The same as elsewhere in the world where geothermal occurs; the Rwandan research and academic community is showing high interest in geothermal.
- *Natural resources related institutions*: As geothermal resources involve crosscutting disciplines of geosciences, geothermal data becomes very useful to other resources development. Geothermal data are useful in oil, gas and mineral exploration as well as in the ground water studies.

All the above mentioned categories of the geothermal data users will benefit from the establishment of the database which will help them to know what kind of data exists and how to access them.

3. CHALLENGES

The development of the ARGeo geothermal database is facing some challenges most of them related to the fact that such initiative is the first of its kind in African Rift. In the Rwandan case, we have tried to outline some challenges as well as brainstorming on the solutions. Those challenges are:

- *Database policy*: There is no database policy either for AGID or for Rwandan Geothermal database. The establishment of the rules and guidelines to govern the geothermal database is one of the main challenges that need to be taken as important in this exercise. That policy is intended to provide solutions for some of the questions that are asked by data communities such as: what are the available data? who owns data? What are the requirements to get the data? What are the standards /format of those data? All those questions have their responses in the database policy. As a solution it is proposed that ARGeo should initiate the drafting of the policy.
- *Database updating and sharing*: Ideally, agencies should spend their time on adding value to existing data, instead of wasting resources in cleaning up and producing yet more agency specific versions of the same base datasets (Wilson et al. 2009). Dale and McLaughlin (1999) noted that data ought to be produced once and used by all users, given that no single agency can satisfy its data needs on its own. So far, the AGID website is not shared with all data users in need and editing the existing data set needs to be done by only website administrator. This needs to be solved by the AGID management.
- *GIS database*: Knowing which data resources are available and allowing the larger geospatial community access to them can result in cost savings to the data producer as well as the user community. Access to geospatial data can allow for effective and coordinated response to incidents such as natural and human induced disasters as well as new emerging diseases. These events often extend beyond physical or political boundaries. The need to effectively and efficiently access and share data requires proper documentation and the means to access the documentation and the spatial data itself (Moellering et al. 2006).

With the increasing volume of geoscience data in geothermal business, we need to prioritize the application GIS and Remote Sensing technology in collecting, organizing, storing and disseminating information in a modern way. That would help to organize the geological, hydrogeological, geochemical, mineral resource exploration, geophysical, and to monitor any geo-hazard caused by geothermal.

- *Metadata for GIS & RS data*: The term metadata is defined as structured information that describes, explains, locates or otherwise makes it easier to retrieve, use or manage an information resource (NISO 2004). In its most elemental form, geospatial metadata is information about geospatial data, usually housed within the database. As such it has been realized that in order to efficiently use and manage all kinds of spatial databases, sets of metadata pertaining to the data in question are needed (Ezizbalike, 2004).

It has been realized that GIS data sometimes are not compatible to each other due to the differences of the projection definitions. To be able to use GIS data you need to have information on those data. Through ARGeo, GIS operators should be reminded to produce metadata for every GIS data they have; that ease the data inspection and sharing in the future.

4. CONCLUSION

Prior to developing the ARGeo Geothermal database Inventory, there was no record of existing geothermal data in African Rift. The AGID was developed to ease geothermal data discovery. In its development, a systematic inventory of existing geothermal data in African Rift has started and still underway. It comprises information from ARGeo country members on geothermal projects, their progress and funding, as well as related information on human resources capacity and equipment available or required for each country.

From the ARGeo's good initiative, Rwanda has taken the opportunity and is trying to go beyond the database inventory. Rwanda Geothermal Database is being created to store and manage not only the information about the data but also the actual data and the catalogue of the existing data will be shared online. The database will include all kind of data that can be useful to develop geothermal in Rwanda. Data acquisition procedures will also be drafted and published to attract many geothermal actors.

The development of ARGeo geothermal database requires a collaborative effort of the ARGeo members. Much has been done but there is still a long way to go. It is recommended that ARGeo should fast-track this exercise by completing the AGID website and make it accessible to all, initiating the drafting of database policy in the region and think on establishment of the geothermal database that would store the actual data. Database awareness campaign can also be organised in the region to accelerate the process.

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