Geothermal investment in Democratic Republic of Congo

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ABSTRACT

The Democratic Republic of Congo on some of major structures that constitute part of East African Rift System (EARS). The heat energy from subsurface manifest in the form of volcanic eruptions, earthquakes and the upward transport of heat by hot springs and natural vapor emissions. Understanding the advantages of geothermal energy if developed in the country or in a region many opportunities arise. For example industry in the transformation of several agronomic produces can help to struggle against job less, poverty, etc., answering to the climate changing by the using of renewable energy.

Whereas the geothermal energy resource potential in EARS is estimated to more be than 20,000 MWe, DRC has not gone beyond the inventory work of resource potential. The Eastern part of DRC has geothermal potential but not exploited until now besides its benefits in medicine and in ore deposits; geochemical characterization … exhaled gases can be HS, CO₂, HCO₃, etc., and main components can be MgCl₂, CaSO₄, K₂SO₄, SiO₂ the emission of those gases are attached to the volcanic activities and the intern composition of the earth by their passage around rocks. Known temperatures ranges between 40°c and approximately 100°c flow rates vary widely from a spring to another. The exploration of those gases reaching to their quantification can be used in gasification of water etc. power plants to follow up on its comprehensive DRC geothermal by developing a country program which will guide future interventions; this is a successful model implemented. In fact the key natural resource sectors mining, forestry; oil and gas have been experiencing rapid growth over the past decade. The key question is how to promote and maximize broad based benefits from the development of DRC where geothermal notions are less known here there’s a need of many operations of exploration that can be taken even if
geolocazation have been done local and international scientist so the phase of evaluation and drilling could be more interesting to attract investors. Various initiatives to promote socially and environmentally responsible investments in the natural resource sector, including through due diligence, transparency and certification schemes, are a welcome to development in the country according the Resources identified. Even so, these novel technical mechanisms to improve accountability are unlikely to have the desired on development as they do not address the central question of generating employment on the necessary scale.

1. Introduction

The DRC’s geothermal power plant Projects present significant challenges. The country is perceived as being a high-risk market in which to operate, the business environment is difficult, and local banks are ill-equipped to support the sector. There is, however, a real opportunity, as it will be shown by the investments that can be made. The development community can play a role in realizing the full potential of the market of renewable energy with all the wider benefits that it will bring.

2. Status of electricity production (from all sources of energy)

2.1. Current total installed and effective capacity

The Democratic Republic of Congo has abundant and diverse energy resources:

- Renewable (biomass, hydraulic, solar, wind, geothermal, biofuel, biogas...)
- Non-renewable (oil, natural gas, mineral coal, uranium, oil shale, tar sands,...)

Despite enormous hydropower potential estimated at 100,000 MW, the access of the population to electricity rate is 9%. This access rate is unevenly distributed between urban areas (8.5%) and rural (0.5%) as well as between the provinces. Wood energy still represents 93% of the domestic consumption of energy, usually in the form of charcoal in the cities and firewood in rural areas. The population uses usually (more than 90% of households) wood fuels for its domestic needs for cooking meals and heating, causing deforestation and degradation of the forest with all the negative impacts on the environment, health, forest, biodiversity and socio-economic conditions. One of the ways to achieve a sustainable energy development of our communities both urban and rural as the use of renewable energy sources available to the country in general and each rural areas in particular, to facilitate energy supply and thus help curb rural-urban migration.

2.2. Status of electricity production (from all sources of Energy) and modes of generations

- Hydraulic resources
Hydropower potential is important and is rated at 100,000 MW of which 44% are concentrated in the only site of Inga. Today, the total installed capacity is 2589 MW with an exploitation rate of the order of 50%. It should be noted that the generation, transmission and distribution accuses many difficulties (overload, obsolescence of certain equipment, vandalism, low efficiency, low purchasing power of consumers,...). Two hundred eighteen (218) hydroelectric sites have been identified across the country for the following power ranges) Sites for from 10 kW to 500 kW

- Solar Resource
  The DRC, located in a high Sunshine Band which different values included between 3.500 and 6,750 Wh/m2/day, is therefore naturally favoured to exploit this form of energy that is currently underutilized.

- Wind Resource
  There is in the Democratic Republic of the Congo a limited wind potential. Several completed or ongoing studies designed to determine the wind direction of the targeted sites. These studies indicated by low annual average wind speeds ranging from 2.5 m/s to 5.5 m/s.

- Biomass Resource
  The country is highly dependent on wood fuel that currently meets the bulk of wondered energy (95%) 45 million m3 per year and is responsible for the annual destruction of 400000 hectares of natural forest. Wood energy is mainly used for cooking food in households.

- Biogas Resource
  The population of Kinshasa, alone produces per day more than 6000 m3 of solid waste containing at least 65% of the organic matter which half is only likely to be evacuated by a classic collective system. These wastes can favour the construction of digesters with a capacity of 20 million m3 capable of producing not less than one billion m3 of biogas per year. Lake Kivu which stores 50 billion Nm3 of methane is an important potential source of gas for household use in wood energy substitution.

- Biofuel Resource
  The potential in bio fuel in DR Congo are huge and varied. Depending on the technology used, it is possible to produce, among other things:
  - Pure vegetable oil from seeds or fruits of crops such as rapeseed, palm oil, Jatropha curcas, etc. to replace conventional fuels;
  - Biodiesel, obtained from oils processed by a chemical process used without any damage to the motor;
Bioethanol by the fermentation of sugar or starch
- The biofuel in the second generation based on the waste, residues, cellulose and non food ligno-cellulosic. In this regard, it has noted that the DRC has vast areas of unexploited savannas that could be used to produce these fuels.

The opportunities offered by biofuels in RD Congo include:

- Access to modern energy services, especially in rural areas;
- The decrease in the petroleum import bills;
- Increased productivity of agriculture and the income from the use of residues and waste in production processes;
- The growth of opportunities for jobs in associated industries;
- The reduction of polluting emissions, including greenhouse gas, etc.

- Geothermal Resource

DRC has not yet evaluated geothermal potential. However, several geothermal sites have been identified in the part East of the country especially in the Western branch of the rift is African. The exploitation of this resource can be used in the production of heat or electricity from riparian communities.

In conclusion, the hydroelectric potential appears predominant in the majority of provinces. Solar energy can play an important role in several of them with the implementation of individual solar systems or the erection of photovoltaic solar power plants. Biomass is probably essential to the Province of Ecuador, but can also complement the two energies above mentioned in the other provinces.

DRC's total final energy consumption of different sources 77% of the country's total final energy consumption goes only for the residential sector, making it the major consuming sector. The industrial sector counts for 20.5% of the final total energy consumption, and 2.4% for agriculture, transport and public services all together.

3. Contribution from geothermal

A geothermal power plant produces energy at a constant rate. In addition to geothermal, nuclear and coal-fired plants are also benefic. Because the energy is constant, its power output can remain consistent nearly 24 hours a day, giving geothermal energy a higher capacity factor than solar or wind power, which must wait for the sun to shine or the wind to blow, respectively. This means a geothermal plant with a smaller capacity than a solar or wind plant, A geothermal plant can also be engineered to be firm, flexible, or load following, and otherwise support the needs of the grid. Most geothermal plants being built now have adjustable dispatching capabilities. In addition to geothermal, natural gas is dispatchable. This means a geothermal plant can meet fluctuating needs, such as those caused by the intermittency of solar and wind power. In DRC 0.2 MWe Binary plant was installed in 1952 at Kiabukwa hot springs to support mining operations.
3.1. **Medium team power development plan and the role to be played by geothermal in the achievement of the plans**

After careful exploration and analysis, wells are drilled to bring geothermal energy to the surface, where it is converted into electricity. The USGS has defined moderate temperature resources as those between 90°C and 150°C (194 to 302°F), and high-temperature geothermal systems as those greater than 150°C depict the three commercial types of conventional geothermal power plants: flash, dry steam, and binary. In a geothermal flash power plant, high pressure separates steam from water in a “steam separator” as the water rises and as pressure drops. The steam is delivered to the turbine, and the turbine then powers a generator. The liquid is reinjected into the reservoir. Under one-third of the installed geothermal capacity is comprised of flash power plants. In a geothermal dry steam power plant, steam alone is produced directly from the geothermal reservoir and is used to run the turbines that power the generator:

➢ Completion of the reinforcement and modernization of the Inga - Kolwezi line;

➢ Commissioning of Karavia substation static voltage compensator for the improvement wing of 220 kV lines Goma - Rutshuru - Butembo - Beni and Nkenda Commissioning of the hydroelectric plants of Busanga (240 MW) and Nzilo II (120 MW);

➢ Commissioning of the Grand Katende hydroelectric power station (64 MW)

➢ Commissioning of the Mambilima (124 MW) and Mambilima II (201 MW) hydroelectric plants + Construction of the Mombutula CX (300 MW) hydroelectric plant shared with Zambia;

➢ Commissioning of the Inga III hydroelectric power station (4,800 MW including 1,300 MW for Katanga and 2,500 for RSA);

➢ Construction of the Ruzizi III hydroelectric plant (147 MW) shared with Burundi and Rwanda, the Tshopo II (15 MW) and the Goma methane gas (20 MW).

4. **Geological setting and map showing potentialities sites for geothermal development**

4.1. **Geological setting and map showing potentialities sites of geothermal development**

Most of Congolese springs are lined in the eastern provinces on a distance of more than 700 Km from Albert Lake in the North to the Tanganyika one in the South,
including Edward and Kivu lakes. This belt of lakes is highly attesting the rift of kivu in border Uganda and Rwanda in the northern and Burundi in the South.

This regional area is dominated by Preterozoic metasedimentary rocks intruded by granitoids. These rocks are found on both sides of the rift, with gradiented elevations from Grabens to Horsts here and there. Higher average elevation relative to the western rift side in eastern DRC as a result of the East African mantle plume and associated tectonism that began impacting the region during the Tertiary. This higher elevation is attributed to crustal uplift over the thermal mantle anomaly. This uplift was followed by intense normal faulting at the early stage of rifting as observed from the numerous faults of NNW-SSE to N-S affecting the western side of the Butare Horst to the east of the project area. This resulted in the formation of hanging blocks along the foot of the escarpment in the down wrap area. Although less evident for geological observation than in the Eastern Rift where the basement is covered by sedimentary of volcanic strata, this major feature explains the present asymmetry of the Kivu rift, dominated in its presently active part by normal faulting with eastern dips, as observed on the DRC side. The formation of basement rocks commenced with the deposition of sediments and the emplacement of plutons between cratonic crust that had been evolving separately during the Archean (>2.5 Ga) through the accretion of granite-bearing rocks and greenstone belts resulting in the formation of mobile belts. Between 2.2 and 1.86 Ga this area was part of a supercontinent assembly during the Eburnean orogenic cycle. The supercontinent broke up during the post-orogenic Kibarian phase of crustal extension between 1.60 and 1.2 Ga. This resulted in a supercontinent assembly by the collision of continental blocks, culminating in the formation of the Panafrican orogenic belts straddling the margins of the Tanzania Craton. The Kivu region is dominated by the “Zaire-Nile Crest” of the crystalline basement belonging to the Kibarian Orogen and comprises metasediments, metavolcanics, and granitic intrusions with younger granitic pegmatites and abundant basic intrusions. All of these units have been heavily fractured by later orogenic and extensional processes. This fracturation allowed for the development of permeable formations, particularly in the pegmatites, providing potentially suitable conditions for geothermal reservoirs.

4.2. Structural control of the volcanic and thermal activity

The occurrence of volcanic centers, thermal springs, and associated normal faults in the Lake Kivu rift result from the effects of the extensive mantle anomaly underlying the East African dome region, at the place where the rift virgates from N-S (Kivu) to NE-SW (Albertine). The ages of the oldest Cenozoic volcanic and sedimentary suggest a south-westward propagation of rifting from the Albertine Rift (Fig. 3) at the Uganda-South Sudan border region toward Lake Kivu between about 16-12 Ma and 7 Ma (Mc Connel, 1972; Ebinger, 1989). The area is characterized by a complex set of Cenozoic structural features that include a N-S to NE-SW oriented graben system that host lakes Albert and Kivu. Two other systems intersect the prospect area and
determined the NE-SW trending volcanic axis Virunga Kamatembe and the NW-SE-trending Bufumbira Bay Karisimbi axis, both extending in the volcanically and seismically active volcanic districts of DRC. These fault-bounded areas are the site of geothermal manifestations, in the southern extremity of the Virunga volcanic province. The map of the figure N°1 illustrates.

Figure 1. Kivucian springs and its Geological settings of the study region

4.3. Results of surface exploration done

Although an estimate of temperature from the geochemistry of a hot spring or fumarole is not available in a blink system, a range of likely reservoir temperatures can be estimated while a plausible conceptual model is assembled. A reliable starting assumption is that, where the sediments are particularly low in resistivity, they have a high clay content and are impermeable. The high resistivity zones have the potential to be permeable but, where it is not fractured, the schist is like to be high resistivity and impermeable. However, it has the appearance of a graphitic body characteristic of Paleozoic schist. In this case, it is more reasonable to assume that it is not relevant to the geothermal resource conceptual model, except to the extent that it can illustrate structure. Since no thermal manifestations are observed at the surface trace of the imaged fault, if there is a viable reservoir, it is reasonably likely that the up flow extends along subsidiary structures to the right of the fault. The base of the sediments is likely to have particularly low resistivity where hot water is rising. That geometry is suggestive. Although the sinter is not active, it implies that temperatures were, at
some time, about 180°C very close by. The flat-lying resistive is about 200 m below the water table, suitable for hosting a 180°C aquifer without boiling (and creating gas that is not observed). The inactivity of the sinter might be attributed to a minor drop in the water table. Because temperature is still the highest risk, a cost-effective test of this model could be a 250 m slim hole sited just to the right of the final “s” in the label.

Table 1. Shows some geothermal sites in DRC and its geolocalization

<table>
<thead>
<tr>
<th>NAME OF SITE</th>
<th>TERRITORY</th>
<th>LOCATION</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mazeka</td>
<td>Kabare/ South Kivu</td>
<td>S02°14.279’</td>
<td>E28°48.432’</td>
<td>1721 m</td>
<td></td>
</tr>
<tr>
<td>Kaskale</td>
<td>Kabare/ South Kivu</td>
<td>S02°14.544’</td>
<td>E28°50.123’</td>
<td>1595 m</td>
<td></td>
</tr>
<tr>
<td>Mahaya</td>
<td>Kabare/ South Kivu</td>
<td>S02°14.615’</td>
<td>E28°50.448’</td>
<td>1582 m</td>
<td></td>
</tr>
<tr>
<td>UVIRA</td>
<td>Uvira/ South Kivu</td>
<td>S3°24.333’</td>
<td>E29°57.715’</td>
<td>855 m</td>
<td></td>
</tr>
<tr>
<td>NYANGEZI</td>
<td>Wahangulu/ South Kivu</td>
<td>A visitor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KISUMA</td>
<td>Masindi/ North Kivu</td>
<td>S01°28.263’</td>
<td>E28°51.570’</td>
<td>1796 m</td>
<td></td>
</tr>
<tr>
<td>Wailale/ North Kivu</td>
<td>S01°19.092’</td>
<td>E29°59.780’</td>
<td>724 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayi ya Moto</td>
<td>Rutshuru/ North Kivu</td>
<td>S00°53.906’</td>
<td>E29°21.115’</td>
<td>953 m</td>
<td></td>
</tr>
<tr>
<td>KAMBO/KASINDI</td>
<td>Beni/ North Kivu</td>
<td>N00°03.708’</td>
<td>E29°40.107’</td>
<td>1014 m</td>
<td></td>
</tr>
<tr>
<td>MUTSORA</td>
<td>Beni/ North Kivu</td>
<td>N00°18.354’</td>
<td>E29°44.480’</td>
<td>1094 m</td>
<td></td>
</tr>
<tr>
<td>MASAMBO</td>
<td>Beni/ North Kivu</td>
<td>N00°10.852’</td>
<td>E29°41.748’</td>
<td>1006 m</td>
<td></td>
</tr>
</tbody>
</table>

4.4. Results exploration appraisal production drilling and results of well discharge tests and well out pout

The first wells are drilled into the target reservoir during this phase, with well design, location, and depth based on the outcomes of the preliminary survey and exploration phases. These wells are sometimes termed exploratory or appraisal wells since they are often the first opportunity to obtain direct information about the reservoir and resource characteristics. The term delineation wells may also be used when subsequent wells are drilled to assist in defining the margins of a productive geothermal field. Drilling the first wells into the predicted reservoir zone represents the period of highest financial risk in any project because geological uncertainty remains high.

In DRC the geothermal potential has not been estimated by the drilling’s phase about my research there's no forage made because of missing of materials, finances and a non-interesting of geoscientists of the country but according to the first phase of exploration as shown at table N° 1 we conclude that there is a great geothermal potential which concentrated in Eastern part.
5. Utilization (power production and direct use)

The completion of the steam gathering system is coordinated with any necessary civil works and infrastructure to allow the power plant to be constructed along with further testing of the wells. Power plants are often designed and constructed under a single engineering, procurement, and construction (EPC) contract awarded following a tender process.

The Commissioning Phase should be planned and costed as a separate exercise prior to operation. This includes the testing of all power plant components and associated equipment to ensure their operability meets the respective design conditions. This also includes fine tuning the power plant’s efficiency, pressures from the wells, and other parameters, which can take several months to complete and could require resolving technical and contractual issues with the supplier of the plant.

The power plant begins operations once the power plant construction and commissioning phases are complete. Since the fuel supply for the life of the plant has effectively been fully provided during the Field Development Phase, the main focus is to optimize the production and injection scheme to enable the most efficient and sustainable energy recovery and utilization. This helps to minimize operational costs, maximize investment returns, and ensure the reliable delivery of geothermal power. New production and reinjection wells may be needed over the lifetime of the plant to make up for any decline in productivity or adjustment of the reinjection strategy as the reservoir responds to exploitation. Currently, there is no operational geothermal power plant in DRC. However, it should be pointed out that the first ever geothermal power plant in Africa was installed in DRC in 1952 in mining activities. The current research can help revive this activity.

5.1 Direct use of power plants

With direct use applications, land use issues usually only arise during exploration and development when geothermal reservoirs are located in or near heavily urbanized areas, critical habitat areas, or intensive agricultural areas. Typically, these issues can be resolved through proper land use and environmental planning. Most direct-use geothermal wells are drilled using conventional water-well technology and equipment, which have even less impact than even the drilling technologies used for geothermal power plants. And buildings designed for direct-use space heating systems may actually require less land because there’s no need to construct space for conventional heating equipment (e.g., boilers and gas vents). Like geothermal power plants, injection can be used for direct-use applications not only to maintain the reservoir, but also to prevent land subsidence. However, few, if any, direct-use applications require the removal of enough fluid that could result in subsidence. Also, because direct-use applications withdraw and inject small amounts of fluid compared to geothermal power plants, induced seismicity really isn’t much of an issue either. Geothermal heat is used directly, without a power plant or a heat pump, for
applications such as space heating and cooling, food preparation, hot spring bathing and spas (balneology), agriculture, aquaculture, greenhouses, snow melting, and industrial processes. Geothermal direct uses are applied at aquifer temperatures between 90°F.

6. Investment opportunities

6.1. Investment of opportunities for potential investors

When the discussion turns to job creation, elected officials, political leaders, decision makers and policy makers tend to listen. The type of jobs created can also be an important consideration. Here’s a sampling of specific jobs related to geothermal development: welders; mechanics; pipefitters; plumbers; machinists; electricians; carpenters; construction and drilling equipment operators and excavators; surveyors, architects and designers; geologists and hydrologists; electrical, mechanical, and structural engineers; food processing specialists; aquaculture and horticulture
specialists; resort managers; and developers. Economic activity and job creation within the geothermal industry impact the following areas:

- Mechanical equipment and primary metal suppliers make casings for geothermal well shafts, drilling equipment, power plant equipment and controls, pumps, and transport or light-construction equipment (e.g., loaders, tractors, and trucks).
- General consultants and contractors search for geothermal resources and prepare simulations of resource availability and economic analysis so that developers can obtain financing.
- Drilling and well services firms use resource management, geoscience, and stabilization technology and expertise similar to that of the petroleum industry.
- Environmental services firms manage paperwork, permitting, well testing, water testing, air sampling and other tasks required for regulatory approvals.
- Geothermal developers under contract to a utility, government, or other entity to develop a project often act as general contractors and hire other firms to do the work. This can include all facets of development, from construction site security and safety, to turnkey requirements.
- Power plant ownership and operations firms may be electric utilities or independent power producers, which require trained and certified power plant operators.

6.2. Incentives offered to Developers

Geothermal energy has many attractive qualities as a non fossil fuel based renewable energy, with the ability to provide stable and reliable basic energy at relatively low costs. Once operational, the geothermal power plant will provide constant 24 hours production, typically over several decades, at competitive costs compared to other base load generation options, such as coal. Technological risks are relatively low. The production of geothermal energy from hydrothermal resources underground sources of extractable hot vapors or fluids is a mature technology. For medium sized plants (around 50 MW), leveled unit costs are generally between 0.04 and 0.10 USD per kWh, potentially offering economically attractive energy production. The development of domestic and renewable energy resources provides the opportunity to diversify sources of electricity supply and reduce the risk of future price increases due to increases in fuel prices.

From a global environmental point of view, the advantages of developing geothermal energy are undeniable. Carbon dioxide (CO2) emissions from geothermal energy production, although not always zero, are much lower than those produced by energy production by burning fossil fuels. The local environmental impacts of replacing
fossil fuels with geothermal energy tend to be positive, mainly due to the prevention of the impacts of the use of fossil fuels on air quality and the risks of transport and handling of these fuels. Of course, like any infrastructure development, geothermal energy has its own social and environmental impacts and risks that need to be managed, and the groups concerned must be consulted throughout the project preparation and development process. The impacts of a geothermal energy development project are generally very localized; few, if any, are irreversible, and in most cases, mitigation measures can be easily implemented.

Given the advantages of geothermal energy, one may wonder why its current level of use is not more important; one answer may be that, geographically, hydrothermal resources usable for producing energy are not very widespread. It is estimated that hydrothermal resources in the form of hot vapors or liquids are only available on a quarter to a third of the planet's surface. Technologies and operating techniques likely to increase this availability are not yet fully available. Another answer is that, from the investor's point of view, geothermal projects are risky the risk linked to geological exploration (or risk linked to resources) being often considered as the main stake and require significant capital investments, estimated on average at around USD 4 million per MW, which increases the risk, since the project's returns become more sensitive to financing costs.

A more detailed study of the advantages and disadvantages of geothermal development reveals that many advantages of geothermal energy also have their limits. For example, if the size and extent of the land are less restrictive for geothermal energy, in obtaining the required capacity, than for most other energy production technologies, the maximum capacity of the power plant is ultimately limited by the heat production capacity of the tank.

Furthermore, even the renewable nature of geothermal energy is not unconditional, since the capacity of a reservoir to replenish itself can be compromised by high and unsustainable extraction rates or by the absence of reinjection of fluids.

The completion of a complete geothermal development project generally requires 5 to 10 years. Due to the length of the project development cycle, geothermal energy is not a quick solution to electricity production problems for a country, but rather an element of a long-term production strategy. Many of the risks of geothermal development are essentially the same as in any energy production project connected to the network: risk associated with execution or delay, risk linked to purchase agreements, risk linked to price or demand from the market, operational risk and regulatory risk. The high level of financing risks due to high initial costs is common most other renewable energy technologies.
During drilling, temporary noise shields can be constructed around portions of drilling rigs. Geothermal developers use standard construction equipment noise controls and mufflers, shield impact tools, and exhaust muffling equipment. Once the plant is built, noise from normal operation of power plants comes from cooling tower fans and is very low. Turbine-generator buildings, designed to accommodate cold temperatures, are typically well-insulated acoustically and thermally and are equipped with noise absorptive interior walls. When noise issues arise, they can be dealt with effectively in ways that do not impact plant performance.

A 2006 GEA estimate showed that for every dollar invested in geothermal energy, the resulting growth of output to the U.S. economy is $2.50, or, a geothermal investment of $400 million would result in a growth of output of $1 billion for the entire U.S. economy.66 Renewable energy technology projects worldwide saw $70.9 billion of new investments in 2006, and $117.2 billion in 2007, according to a DOE assessment. “This is no longer just an interesting alternative, but a large scale transformation in global energy markets”

7. Conclusion and Outlook

Depending on the country, there are in DRC massive intellectual resources available for geothermal project in forms of research systems with a massive customer database. In DRC the geothermal knowledge is very less in scholar system, both to design and to build, at this domain is massively available and represents a valuable human resource. In order to optimize and improve the use of geothermal energy. In order to increase the attractiveness of the knowledge of other local Renewable Energy Source availability (as well as geothermal).
Hot water from geothermal resources can be used to provide heat for industrial processes, greenhouses, crop drying, heating buildings, or even melting snow on sidewalks and bridges. This is called “direct use.” A well is drilled into a geothermal reservoir to provide a steady stream of hot water. The water is brought up through the well, and a mechanical system—piping and pumps, a heat exchanger, and controls—delivers the heat directly for its intended use.

This study need to establish the DRC geothermal database capable to attract the investments from some financing banks in order to boost the dark situation raging the eastern part. This one needs the recent field trip to all geothermal resources inventoried in order to update with the new field information. All the data in our possession concerning the geothermal sources are limited and have been studied in geological context especially without the current geothermal energy vision in economic aspect and need to be reworked.

In spite of the use energy the thermal Walter can be used in other ways such as: Medicine, tourism, ore deposit. Support geothermal energy is still required in the following areas:

Human capital development, Technical Assistance, Increased grant support for the exploration phase.

REFERENCES


Riccardo Basosi et al. Life Cycle Analysis of a Geothermal Power Plant: Comparison of the Environmental Performance with Other Renewable Energy Systems


Parada Lageo et Fernando.A, Geothermal binary cycle power plant principles, operation and maintenance, Colonia.

Adam Zoet et al., 2011, geothermal 101: The basics and applications of geothermal energy.


DRC Ministry of Hydraulic Resources and Electricity, expression of interest to participate in srep The Last Frontier for Energy Access, Report