

Conducive Legal and Administrative Settings for Geothermal Energy Development in the East African Rift Region

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Why address the subject?

Geothermal resources exist in nature because of long term earth processes.

In contrast to other renewable energy resources, they are near-perpetual and stable.

On the time scale of human civilization they are:

- Non-depleting
- Non-fluctuating

Human life is centered on energy consumption

- The quest to satisfy energy needs modulates geothermal resource development
- Its successful development arises from need, is governed by **laws** and fulfilled by **institutions**

We can do what we need to do, given enabling legal and institutional conditions

Geothermal energy has diverse uses

Here, we consider geothermal use in electricity generation because:

- electricity is portable between source and market;
- there is urgent need to increase access to electricity in the region;
- there is a limited and uneven distribution of indigenous renewable energy resources suited to low cost & clean power generation:
 - Djibouti and Eritrea have no other known indigenous energy resources except potential for geothermal energy:
 - they rely 100% on petroleum fuels for commercial energy supply,
 - Kenya and Tanzania are exhausting their hydro-potentials,
 - Uganda's remaining hydro-potential appears to be less than 1,000MW,
 - Ethiopia's relatively large hydro-potential is subject to climatic fluctuations. Hydropower supply needs to be stabilized by suitable energy mix, mainly using geothermal power generation.

There is an abundance of high enthalpy geothermal resources suited to low cost and clean electricity generation using established technology

- More than 4 dozen sites of high enthalpy geothermal potential associated with Quaternary magmatism have potential for medium to large scale development between Eritrea (North) and Tanzania (South).
- Numerous non-magmatic systems also show potential
- Past resource development had been slow. The more advanced projects progressed sporadically:

	1 st geothermal well drilled	1 st power plant built	Current generation capacity
Kenya	1956	1982	129
Djibouti	1975	-	-
Ethiopia	1982	1999	7

The roots of the challenge had been:

Policy, legislation and the institutional setups:

- Electricity supply systems have dominantly been state monopolies: “The electricity supply system is a basic infrastructure, electricity should be available at low cost”
 - The monopolies are unable to generate surplus for accumulation of investment capital and technical know-how.
- Nature of geothermal resources
 - Need for high initial expenditures to allow such definition,
 - The risks (actual and sometimes perceived) are high,
 - Very few resource areas are adequately delineated and characterized to allow inclusion in the “Long Term Power Development Master Plan”
- Resource knowledge generator institutions not well developed or adequately funded.
 - Resource identification and characterization by drilling competed unfavorably for allocation of scarce resources.

The legal and institutional arrangements needed reviewing

Geothermal electricity development needs to access investment resources that are available to the private sector.

The private sector can:

- raise the economic and technical resources required in electricity development,
- contribute to progressing electric power development along the least cost sequence.

Governments

- Can retain ownership of power transmission systems until they achieve their infrastructure building/ extension objectives,
- assume regulatory responsibility over public and private operators,
- Should create the information base on energy sources:
 - to reduce the risks associated with operations and the resource,
 - to take into consideration factors in economic externality.

It is a question of marrying two complementary interests

Governments need to expand the electricity supply systems to achieve **universal** access

- at lowest possible cost to consumers, and,
- in a reliable and environmentally sound manner
 - to Increase per capita consumption: human welfare,
 - to promote use in economic production: increase income,
 - to energize social service facilities: ensure social welfare,
 - to decrease heavy reliance on biomass use & to deter environmental degradation.

Concerns are primarily economic and social

The **private sector** is able to allocate investment resources to the most **secure** and **profitable** economic activities

- To ensure continued economic viability: dividends;
- To continue participating in sustainable socio-economic development: further investments;
- To contribute to social welfare and stability through social and environmental roles: solution of societal problem by provision of key commodity (energy), job creation, increased household income, taxes

Concerns are primarily financial, with social off-shoots: aspect which overlap the socio-economic agenda.

Governments create the conditions under which the two interests come together

Investors are encouraged where:

1. Resource availability and quality is demonstrated:

It is in the nature of underground resources that we know them increasingly more confidently as we extract them.

- ***You know your geothermal resource increasingly well by monitoring its behavior under production conditions.***

Thus the definition of the “full geothermal field potential” is not an essential precondition for investment in its development:

- ***In addition, the most economically rewarding way to develop a new field is to do it in stages, the stages involving the partial development of the progressively better defined field potential.***

This avoids the possibility of

- over-estimating field potential and over-investing in it
- its unsustainable over-exploitation
- undue delay of resource development

It also allows revenue from earlier stages of development to be ploughed back into further resource development.

Adequate resource characterization can be achieved by drilling a few wells which give information on fluid quality, well performance, reservoir behavior in a part of the field.

In its purpose, this information from drilling is broadly analogous to other energy information: e.g. basin analysis information for use in promoting petroleum exploration, or hydraulic and engineering geologic information gathered to promote hydroelectric dam construction. **But it involves drilling**

Such information also has elements of economic externality, where its availability also benefits other economic activities

Such information is not provided by the private sector. It should be expected to remain so in the region at least in the near term.

Society commonly recognizes the need for such **knowledge infrastructure** and governments commonly create and provide it.

- Human, institutional and infrastructure capacities need to be developed
 - to carry out these tasks, and,
 - to acquire sufficient technical and sector business expertise to enable reliable sector regulation.

The necessary expenditures can be sourced by

- ***increasing domestic budgetary allocations,***
- ***accessing bi- and multilateral technical and economic collaboration,***
- ***acquiring any of several drilling risk mitigation guarantees/ funds***
- If adequate risk mitigation mechanisms are setup, the task of resource proving and characterization can even be transferred to the private sector

2. There should be sound bases for expecting:

– sufficient revenue for:

- paying for the costs of field and plant operation, including purchase of resource and plant risk insurance;
- recovery of investment,
- returns on investment for dividend distribution,

– Long term stability of conditions: for ensuring that revenues continue to accrue over project life

These can be addressed by suitable legislation and fair and reliable regulation.

2.1 Governments tend to wish to retain ownership of the power to help them achieve their objective of progressing toward universal access to electricity by citizens.

- Most geothermal prospects are in regions which can be reached by the national grids in the short to medium term.
- Geothermal electricity would thus be generated largely for feeding into the national power grids.

A first legislated guarantee to an investor in geothermal power generation, the IPP, should thus be a **“take or pay”** arrangement: Grid operator should have the responsibility of accepting the amount of electricity that he would have agreed to buy under the PPA, failing which he should pay for it.

Needless to say, this cuts both ways: IPP failure to deliver electricity as per agreement would entail penalty.

2.2 IPP revenue from power sales would be more attractive than other investment opportunities.

An equitable “**feed-in tariff**” system should be set by legislation (to serve as basis for agreement with the grid operator) according to any one of a number of formulas:

- Government may decide to directly negotiate with a single developer;
- It may elect to have a bidding process to select the most advantageous tariff structure;
- It may legislate a flat rate applicable to electricity produced from all sources for specified capacities;
- It may legislate different rates by electricity source and by generating capacity tranches;
- It may elect to provide for guaranteed rates of return.

Each may have its advantages and disadvantages and specific situations may favor any one over the others.

2.3 Clear and coherent legislation and regulation governing:

- Geothermal resources
- Electricity standards
 - Building codes
- Environmental protection
 - Water resources
 - Leasehold of land
- Compensation of prior right holders
 - Right of way

2.4 Investment sourcing and ensuring its safety are preferred when simple and of low cost

High cost will be reflected in

- Need for unduly high tariff,
- low IPP income and also low tax revenue,
- Non-optimal resource development,

Remedies are regulatory schemes which ensure most favorable financing, provide guarantees, support risk insurance

2.5 Fiscal impositions promote optimal resources development when they are low and simple to administer

- Match the most attractive provisions available to other investment
- Adopt the principle of taxation as an investment management tool

The Evolving Situation in the Region

Kenya leads the way: Experiences to applaud and learn from

- Years of effort has created strong capacities and sense of confidence to want to take the initiative to guide the way geothermal resource development advances rapidly for the benefit of the citizens.
- Outcomes:
 - Good legislative package allows resource development, even in wild-life areas;
 - Un-bundled structures (generation, transmission and distribution) anticipate increasing system complexity with advancing electrification and growing sector size;
 - A useful feature: dissociation of Rural Electrification (with its strong social objectives) from the main system (greater economic objective), but kept under same oversight umbrella.
 - While still largely state owned, geothermal power development has adopted a commercial identity: better suited to the economic objectives of geothermal resource development.
 - These have encouraged entry of IPPs which now account for 24% of the power generation capacity; with more to come.

Rest of EARS Region

- Institutions are still to be strengthened or revitalized: These require long-drawn, well planned and pursued effort, imbued with sense of purpose and diligence.

- However the opportunities are now better than ever before when the Kenyans did it: the world is now more together; it is more interactive than before
- It is even more so at the African level in geothermal work: Thanks to the concepts behind the ARGeo idea.

Overarching objectives such as the African Union bear fruits which emanate from collaboration between national institutions in the solution of problems.

National and collective capacities can be built or rebuilt if we decide so and act.

Legal Settings

- As Ms. Sanders pointed out yesterday, legislative development elsewhere is at various stages from early to fairly comprehensive.

The gaps should be identified and filled.

It is not necessary to re-invent the wheel: Each country can borrow from its neighbor what has worked, adapt it to its needs and adopt it as its own.

A number of countries are working on the “Feed-in Tariff” which is encouraging. Perhaps there is opportunity for exchange of experiences.

The bases for determining the tariff structures is the key determining factor for effectively achieving intentions and avoiding distorting influences.

The Big Picture: The EAPP

- It plans to achieve high voltage interconnection of the national grids of all countries between Egypt in the north, Tanzania in the south and Eastern DRC in the west by the mid-2010s
 - Some interconnections are underway
 - A number of feasibility studies have been completed
 - Others are at advanced stages of study
 - Many of the institutional elements are in place to plan and achieve these tasks; organs for coordination and regulation are impending
 - An eventual integration of the five regional power pools is also sought
- Most of the power to be wheeled through this regional grid is to come from hydro-power and it should be expected to be subject to the vagaries of fluctuating climatic conditions
- There is need to develop the large geothermal resource potential in the region to improve the energy mix:
 - To lend stability to the regional power pool, and,
 - To provide reliable base load power at the national level.
- It is time for the region to adopt an integrated approach toward geothermal development, for its institutions to work together in support of the regional and eventual continental objectives.

Thank you for your attention