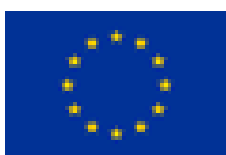




## Deliverable 2.4

### Kenya Market Visit

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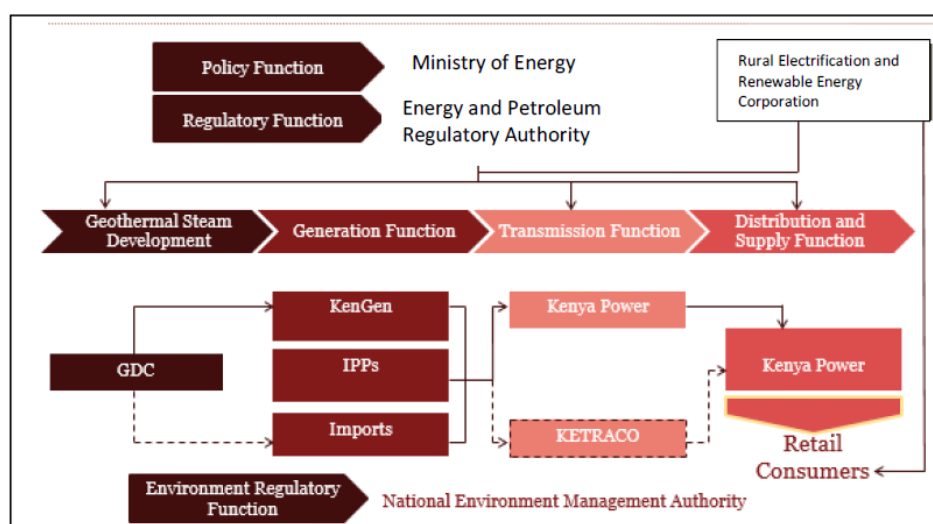
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# 1) Introduction

In 2019, a GeoEnergy Europe market outlook report country screening process identified Kenya as “a low-risk market with strong internal finance backing for geothermal development”. A trade mission was planned for Q4 of 2019. This target country was identified as one with a well-established knowledge of geothermal resources, a clear framework for investments in new geothermal projects including clear objectives for developments, well defined call for tenders and multiple existing ongoing projects. It also offered attractiveness for foreign investors and availability of return of experience from private companies involved in a target country. A robust legal framework allowing investments to be recouped allowing investors to have sufficient certainty that non-technical and non-market factors would not prevent recouping their investments in this a target country. To improve efficiency, open the energy sector to private participation and promote private-sector investments the Electricity Power Act of 1997 opened up for Independent Power Producers (IPPs) to enter electricity generation industry (Omenda et al., 2021). The Geothermal Development Company (GDC)<sup>1</sup>, a government-owned company, undertakes geothermal resource assessment, manages the proven steam fields and sells steam to geothermal power plant operators. This, along with its mandate to carry out geothermal exploration sales agreements with investors, minimizes the early-stage risk associated with geothermal projects (Energy & Petroleum Regulatory Authority, 2021). In addition, Kenya has a large number of well-trained human resources in all required expertise for geothermal development including geology, geochemistry, geophysics, reservoir engineering, drilling engineering, power plant engineering, and environmental and social sciences (Omenda et al., 2021).



**Figure 1. Kenya Energy sector Institutional setup (Omenda et al., 2021).**

<sup>1</sup> Website of the Geothermal Development Company: <https://www.gdc.co.ke/>

In East Africa as a whole, electricity demand is expected to quadruple by 2033, with geothermal, wind and hydropower seen as important means of meeting that demand. For Kenya, electricity access rate has grown from 20% to 67%, from 2010 to 2017 (over 75% in May 2021, according to Energy & Petroleum Regulatory Authority 2021), and the National Electrification Strategy (KNES) aims to achieve access to electricity for all in the country (IRENA, 2021). Geothermal is now officially favoured over hydropower because of the climatic changes that hydropower is susceptible to, and it has the potential to transform the nation into a rapidly industrialising, middle-income economy that offers its population a good standard of living in a safe and secure environment. The Energy and Petroleum Regulatory Authority (EPRA) projects significant increase in Geothermal Energy Development in Kenya, according to a recently released report on the energy statistics and market updates by Kenya's Energy and Petroleum Regulatory Authority. The Energy and Petroleum Statistics report 2021, provides key data on renewable energy and other energy sub-sectors.

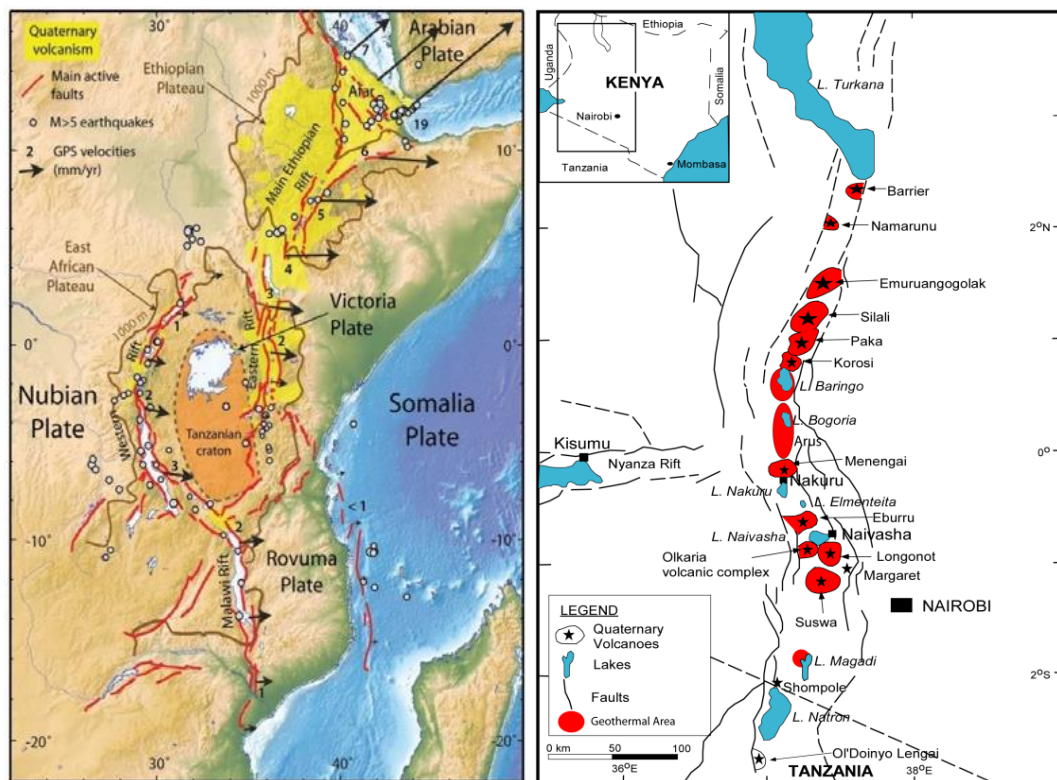
Kenya started developing geothermal resources in 1950, when first two exploratory wells were drilled, and has risen in the list of top 10 geothermal power producers, aiming to enter in 1 GW Country Club next years. It is Africa's largest producer of geothermal energy, with a total installed capacity of 865 MWe (+ 328 MWe planned or under construction) and 18.5 MWth regarding direct uses (Omenda et al. 2021 and Mutua, 2022), for green houses, Spas and other applications. This makes this renewable source to account for a significant portion of Kenya's total installed power capacity of about 2,990 MW, with the remainder taken up by hydropower, wind, solar and thermal power, as showed in Table 1. The benefits are not only for the national grid; other uses of geothermal energy include powering some Naivasha flower farms.

**Table 1. Installed capacity and production of electricity per energy source in Kenya <sup>a</sup>Mutua, 2022 and <sup>b</sup>Omenda et al., 2021)**

Source	Capacity Mwe <sup>a</sup>	Capacity %	Gross Prod. GWh/yr <sup>b</sup>	Share %
<b>Geothermal</b>	863	29%	7,199	42%
<b>Hydro</b>	838	28%	4,397	25%
<b>Wind</b>	437	15%	1,027	6%
<b>Solar</b>	173	6%	628	4%
<b>Biomass</b>	2	0,1%		
<b>Fossil Fuels</b>	677	23%	4,080	24%
<b>Total</b>	<b>2,990</b>	<b>100%</b>	<b>17,331</b>	<b>100%</b>

Geothermal power is flagged in Vision 2030, the Government of Kenya's vision for the future, as a central plank in the development of the country. Kenya aims to produce 50% of its energy from geothermal sources by 2025, and 100% by 2050. Thanks to its position into a bifurcation of the East African Rift System, which extends from the Afro Arabian rift in the Red Sea in the north to Mozambique in the southern Africa, Kenya has an estimated

potential of 10 GWe, with most of geothermal systems hosted by volcanoes and closely associated with Quaternary central volcanoes of the rift axis (Figure 2). Despite this, only the Olkaria area is extensively developed and has all Country's geothermal power plants, apart from a 2.52 MWe wellhead generating unit in Eburru. Minor drillings for exploration and exploitation, and prospects for detailed exploration, were carried out further north, while geothermal power plants are under development or planned in Menengai, Baringo Silali and Paka (Omenda et al., 2021).



**Figure 2. Map of the East African Rift System (left), from IRENA 2020, and Geological Map of Kenya showing geothermal areas (right), from Omenda et al. (2021).**

The main objectives of the market survey visit in Kenya were focused on the deep Kenyan Geothermal Sector, with significant attention to the overall objectives of the Geo-Energy Europe (GEE2) project. The events featured presentations by EU companies seeking partnerships with Kenya counterparts to develop deep geothermal energy. The visit addressed the key requirements of the clusters and SMEs as outlined in the objectives of the GEE2 project including:

- Presentation of tailored strengths of the member companies to target Kenya market.
- Enhancement of business development and capacity building activities through engagement.
- Supporting transition to the green economy, utilising existing skillsets in subsurface geoscience.
- Developing new sustainable services, using traditional subsurface activities experiences.

- Supporting the expansion of employment in niche scientific and engineering related disciplines.
- Sustainable application of subsurface knowledge, promoting geothermal exploration.

In addition, the visit allowed GEE2 partners and members to thoroughly understand the policy framework relating the geothermal sector, including development and investment drivers and risks.

The market visit took place to coincide with the Kenya Geothermal Congress 2022<sup>2</sup> (KGC 2022), organised in Nairobi between the 12<sup>th</sup> and 17<sup>th</sup> of July 2022 by the Geothermal Association of Kenya (GAK)<sup>3</sup>.

## 2) Preparatory Work

In February 2020, the Geothermal Association of Kenya and Pole Avenia, on behalf of the GEO-ENERGY EUROPE metacluster, signed a MoU to begin a formal cooperation to establish and deepen the working relations between the two entities in areas of mutual interests related to technology, know-how transfer and capacity building applied to geothermal energy development in Kenya and East Africa. Arising from the MoU, GGE2 undertook to progress the discussions with GAK regarding participation at the KGC 2022. A number of preparatory meetings and email exchange between GEE2 partners and GAK took place in the first semester of 2022, to agree on the modalities of participation by the metacluster, which was among the partners of the event. At the end of the negotiations, it was agreed that Geo-Energy Europe would have a booth during the congress, as well as space in the agenda to make a presentation of the metacluster and its objectives.

Other contacts and agreements, before the market visit, were undertaken with GDC and KenGen.

At the end of July 2021, the Embassy of Kenya in Ireland<sup>4</sup>, had an online meeting to discuss support to the development of natural resources in Kenya. It was learned that the Kenya Energy sector were especially interested in exploring opportunities for technology transfer; geothermal and mining were among the main activities discussed. The Embassy agreed to assist GEE2 consortium with contacts in the Geological Survey of Kenya and with geothermal industry in Kenya including KenGen and the Geothermal Development Company.

A virtual Geo Energy Europe (GEE) Market Study Visit for Kenya took place on the 30 August 2021. Present were the Director of Geological Survey Ireland, KenGen Asst. Manager Resource Development and project partners from EGEC, CAPES, CoSviG-DTE<sup>2</sup>V, Jesder, Pole

<sup>2</sup> Website of the KGC 2022: <https://gak.co.ke/kgc-2022/>

<sup>3</sup> Website of the GAK: <https://gak.co.ke/>

<sup>4</sup> Embassy Website: <http://www.kenyaembassyireland.net/>

AVENIA, GeoDeep and Geoscience Ireland who presented on “Integrated Workflows for Geothermal Exploration”.

Since that time, in line with existing commitments in Geo-Energy Europe and support of Kenya Embassy, meetings were requested with the main stakeholders in Kenya.

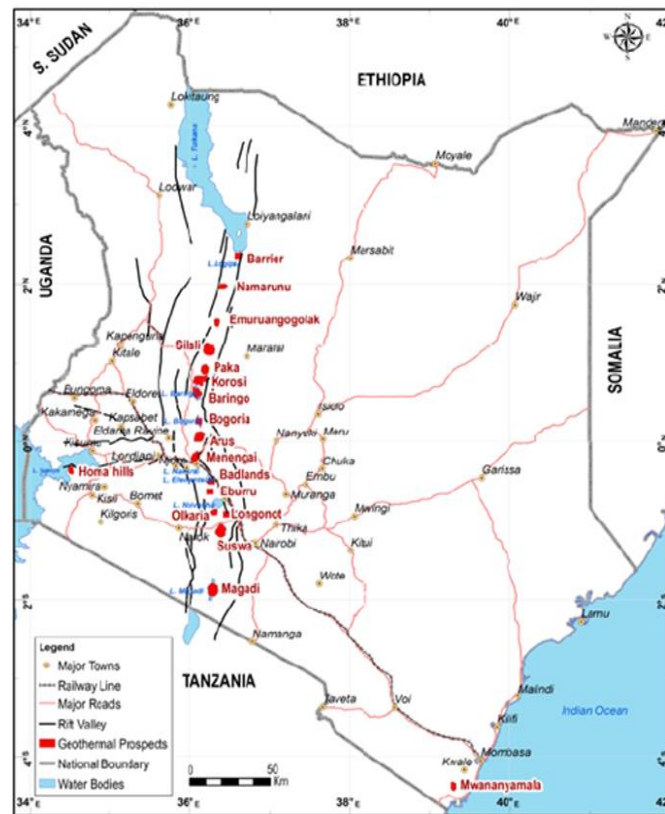
With support from GEE2 consortium and the Embassy of Kenya in Dublin, meetings were held with KenGen, at the end of August, followed by a meeting with GDC on the 18<sup>th</sup> November, 2021.

Both entities agreed to set up MoUs and one is already in place with KenGen. The Cooperation Agreement aligns with the objective of establishing and deepening the working relations between KenGen/GDC and GEE in areas of mutual interests related to technology, knowledge transfer and capacity building, applied to geothermal energy development in Kenya and Eastern Africa. We have pitched our offering to meet the requirements as identified through a Geoscience Ireland market survey, conducted on behalf of GEE in 2019. This includes other countries in East Africa, but primarily in Kenya, as an agreed target market for GEE.

### 3) Training Session

The training session was held on the 24<sup>th</sup> June 2022, commencing with an overview of the Geo-Energy Europe project by the Geological Survey of Ireland and presentation of capacity building activities and Kenya country fiche by GEODEEP. This included an overview of the global structure of the energy market and geothermal market with reference to recent International Energy Agency (IEA Kenya) statistics, including the regulation and risk mitigation scheme with a summary of the market barriers, structure of the competition and key stakeholders. The review highlighted most of the geothermal plants were in the Olkaria area with output of 862 MW and only one Independent Power Producer supplying electricity to the grid so far, despite several IPPs have been granted licenses by the Ministry of Energy (MoE). This area also includes the 3.6 MWe installed by Oserian flower farm for private use. Kenya ranks highly in terms of global output but outside of the Olkaria area, few wells had been drilled elsewhere long the main rift trend to the north. The geothermal prospects that correspond to volcanic centres in Kenya are: Suswa, Longonot, Olkaria, Eburru, Menengai, Korosi, Paka, Silali, Emurungogolak, Barrier, and Homa Hills. Other geothermal prospects, which are not associated with central volcanoes, were reviewed, and include Namarunu, Lake Baringo, Lake Bogoria, Lake Magadi, and the Elementaita and Akiira geothermal areas. Some geothermal prospects, such as Mwananyamala and Homa Hills, lie outside of the Kenya Rift valley (Figure 3).





**Figure 3. Geothermal perspectivity trends in Kenya**

There were 24 attendees at the training session and a case was clearly presented for attractive opportunities for both prospectors and technology providers alike. The training session also looked at emerging opportunities for direct use

CAPES presented the GEO-CoLab tool with demonstration of the web features including information of GEE2 activities. The search menu was demonstrated with descriptions of companies and product services. It was noted that there were more than 800 projects in the database, however, only 4 of which were relevant to the Kenya market survey visit. A search of fields, cluster statistics and activities were presented, which confirm that the tool is being adapted by members.

The best practices for export activities in Kenya was presented by STEAM Srl. The presentation covered key aspects in relation to working with Kenyan geothermal companies and expectation of the SME companies from Europe. The session concluded with a GEODEEP presentation of the market visit, which was scheduled to coincide with the KGC 2022, commencing on the 12<sup>th</sup> July.

The agenda of the training session distributed to GEE2 members and published on ThinkGeoEnergy.com<sup>5</sup> is reported in Annex I.

<sup>5</sup> Weblink to the news: <https://www.thinkgeoenergy.com/gee-2-project-kenya-market-tour-and-other-webinars-in-june-registration-open/>



## 4) Market Visit

The market visit in Kenya took place from 12<sup>th</sup> to 17<sup>th</sup> of July, during the Kenya Geothermal Congress (KGC) 2022, as reported earlier. The congress hosted over 250 delegates from more than 20 countries and was aimed at leverage on opportunities in Kenya's geothermal sector, through:

- A showcase of the country's successes in using renewable geothermal energy,
- Promotion of cooperation between companies and institutions in the geothermal sector,
- The engagement of communities in the resource areas,
- Inclusivity and diversification in geothermal development,
- Presentations for and from national policy makers,
- Scientific presentations and plenary sessions,
- Field excursions to various geothermal projects in the country,
- An exhibition showcasing geothermal successes and lessons,
- Networking and social events.

The congress activities took place during the conference days, from 12<sup>th</sup> to 14<sup>th</sup> July, and the field trip Olkaria Geothermal Field, Oserian Development Company, Menengai Geothermal Field and Baringo-Silali Geothermal Project, on the 15<sup>th</sup>-17<sup>th</sup> July. The agenda of the Congress is in Annex II.

The Geo-Energy Europe Strand 2 project had a booth during the whole congress duration to increase its visibility within the event. This was a reference space for member SMEs that attended the event, where they could share their promotional materials and meet potential partners from Kenya and other countries. The booth was also visited by Kenya's government representatives, namely, the Principal Secretary, the Ministry of Petroleum and Mining and the Principal Secretary, the Ministry of Energy.

Cluster partners that participated to the market visit in Kenya were:

- Geoscience Ireland
- COSVIG-DTE<sup>2</sup>V
- CAPES
- GEODEEP

The participation was mainly focused to gain a better understanding of sector advancements, the role of policies and regulatory instruments supporting the geothermal development in Kenya, as well as the role of the private sector and industry in geothermal energy utilization was debated. In addition, the cluster partners had the chance to promote services of their companies and the entire European geothermal sector. Contacts were made with companies and associations for future collaborations. In addition, COSVIG-DTE<sup>2</sup>V presented the project, its objectives and the metacluster partners during the general session on the second congress day.

All the member companies that attended the market visit (see the list in Table 2) presented an overview of their activities in general, or specific topics related to their business, during the general session or the technical ones. Some of these companies already have collaborations in Kenya, whereas other are new in this market, but they have a high level know how that would favour the development of collaborations with local actors.

**Table 2. Topic of interest of GEE2 consortium partners and member SMEs that attended the KGC 2022.**

Company/cluster	Country	Presentation/speech - Topic of Interest
<b>General session</b>		
<a href="#">CoSviG-DTE<sup>2</sup>V</a> cluster	Italy	Presentation of Geo-Energy Europe Project
<a href="#">GEOCHEM</a>	Hungary	Presentation of Geochem services
<a href="#">IdroGeo Service</a>	Italy	Presentation of IdroGeo services
<a href="#">Steam</a>	Italy	Opportunities for Oil and Gas in the Geothermal – Sector-panellist (the speaker was on behalf of both Steam and Unione Geotermica Italiana)
<b>Technical session</b>		
<a href="#">Enertime</a>	France	Two-stage acid dosing concept for enhanced scaling control in geothermal bottoming binary cycles
<a href="#">Geoscience Ireland</a> cluster	Ireland	Geothermal resource evaluation in East African Rift basins using hydrocarbon workflows

In addition to increasing their knowledge on the state of the art of Kenya geothermal sector, both concerning technical and non-technical issues, as reported above, member SMEs met other attendees with the aim of developing new collaborations on topics concerning geological services, technology providing, plant design and optimization, engineering, project management. Main actors and exhibitors at the KGC 2022 were:

- [Kenya Electricity Generating Company \(KenGen\)](#)
- [Geothermal Development Company \(GDC\)](#)
- [EXERGY](#)
- [Turboden](#)
- [Welltec](#)
- [Geothermal Resource Group \(GRG\)](#)
- [Stryde](#)
- [Kurita](#) and [Davis & Shirlilff](#)
- [Baker Hughes](#)
- [Bentworth Energy](#)
- [NDT Africa](#)
- [Australia Africa Energy and Minerals Institute](#)

The KGC 2022 field trip (15<sup>th</sup>-17<sup>th</sup> July) was organized to showcase some of the developed and ongoing projects by both Public and Private Sector in the Rift Valley and contextualize the opportunities and good practices of geothermal development attained through time. Visits were carried out to Olkaria (including Olkaria geothermal Spa and the 165.4 MWe Olkaria V flash powerplant) and geothermal areas and Oserian geothermal greenhouses the first day. Menengai geothermal field the second day, including a 35 MWe binary plant construction site and the GDC (Geothermal Development Company) direct use pilot demonstrators to showcase potential investors, local communities, learning institutions and other relevant organizations. On the third, participants went further north in the rift, to visit the Korosi and Paka geothermal fields. The field trip as a whole was a good opportunity to gain insights for investments in the geothermal development in Kenya.

A summary of main outcomes from KGC 2022 is reported ahead and slides of all presentations are available online, in Congress proceedings<sup>6</sup>.

#### 4.1) Overview of Kenya's main public geothermal stakeholders.

About 83% of Kenya's installed capacity is provided by **KenGen**, with the remaining 150 MWe coming from IPPs. In the Menengai and Baringo-Silali, geothermal capacity drilling exploration and production are ongoing. In early 2022, KenGen completed the commissioning of the Olkaria I Unit 6 geothermal power plant, increasing Kenya's installed geothermal power capacity to 944 MW and just short of the global 1 GW club. This last additional capacity is not yet included in statistics and figures above, on country's geothermal capacity and referred to 2021.

KenGen is among the top electric power generating companies in Africa and was incorporated in 1954 under the Kenyan Companies Act as Kenya Power Company (KPC) with the mandate to generate electricity through the development, management, and operation of power plants. In January 1998, the KPC was renamed KenGen and in 2006 the Government sold 30% of its stake in the company following a successful Initial Public Offer. Subsequently, KenGen was listed on the Nairobi Securities Exchange (NSE). Over the years, the Company has continued to increase shareholder's value through profitability and maintaining a sustainable growth path. In line with the organization's strategic objectives, shareholders were given opportunity to exercise their rights in a successful rights issue in 2016. With installed capacity of 1,904 MW and market share of 63%, KenGen is Kenya's largest energy producer. KenGen's strategy is to deliver affordable clean energy by creating value for shareholders and while expanding energy sources and revenue streams. The company's installed generation capacity mix includes Hydro (825.69MW), Geothermal (799 MW), Thermal (253.5MW), Wind (25.5MW).

Leveraging on the experience and expertise in successfully operating geothermal power plants for many years, KenGen can offer a wide range of services, both concerning the

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<sup>6</sup> KGC 2022 presentations are available to the following link: <https://gak.co.ke/kgc-2022-presentations/>

geoscience, drilling and engineering. The company is also aiming to extract raw materials from geothermal brines, like lithium, nitrogen to produce urea, H<sub>2</sub>S to be used as pesticide and water. In addition, it offers opportunities to develop partnerships for innovative solutions (e.g., to increase the efficiency and amount of the energy extracted from wells and direct heat uses) and to develop new geothermal plants.

The **Geothermal Development Company** was incorporated in 2008 by the Government of Kenya to accelerate development of geothermal resources in Kenya and lowering the cost of power in Kenya. GDC is therefore mandated to carry out geothermal exploration (including surface studies and exploration drilling) to minimise the early-stage risk associated with geothermal projects, drill appraisal and production wells, manage the steam fields in its licensed areas and enter into steam sales agreements with investors. These agreements mandate GDC to provide steam and manage the reservoir during generation while the IPPs to finance, design, construct, install, operate and maintain the plants on a Build-Own-Operate basis. GDC also builds capacity for geothermal development through training of its staff and acquisition of various equipment necessary for geothermal development and promotes the development of direct uses of geothermal heat. Its mission is to develop 1,065 MWe of geothermal resources by 2030, through projects in different geothermal areas. The GDC Menengai Geothermal project has an estimated potential of 1,600 MWe and will be developed in three phases. The Baringo – Silali Geothermal Project has a resource estimate of 3,000 MWe. The first 300 MWe will be developed from Paka, Korosi and Silali prospects with each prospect contributing 100 MWe each. The Suswa Geothermal Project has a further estimated potential is 750 MWe and is planned to be developed in phases of 100 MWe each. In 2021 GDC drilled the first appraisal well in the Paka Field. This follows a 17-MW well, one of the most powerful in the area. Three exploratory wells were drilled to define the boundaries of the geothermal area and all delivered positive results. Further drilling took place at Korosi.

The company also aims to promote investments to extract and use CO<sub>2</sub> and H<sub>2</sub>S and is seeking partners to collaborate in setting up industrial parks in the project areas. To this end, the GDC has five demonstrative prototypes in Menengai to showcase the technical and financial viability of direct uses. These consist of a geothermal Green House, aqua-ponds, milk pasteurizer, grain dryer and a laundry.

#### 4.2) Legal framework and business Incentives

Geothermal exploration, development and utilisation in Kenya is anticipated to be implemented in collaboration and joint development between Private Sector and Semi-Autonomous Government Agencies (SAGAs). The geothermal prospects are all under different stages of development which general follow a development cycle. This cycle offers opportunity for investors, developers and SAGAs which have experienced staff and equipment to work together.

In August 2022, the Ministry of Energy of Kenya has lifted a ban on negotiations for new power purchase agreements (PPAs), also providing clarifications to existing processes and approval mechanisms. This development is expected to spur investments into the renewable energy sector, including geothermal. The ban was previously put in place by the MoE to prevent increase in power bills due to idle capacity charges charged by IPPs. Indeed, the electricity supply grown at a higher rate than demand and the country's electricity grid installed capacity was 2,732 MWe against a peak demand of 1,870 Mwe in July 2019 (Kamau, 2019). Accordingly, all ongoing PPA negotiations under the off-taker Kenya Power and Lighting Company (KPLC) were cancelled following the recommendation of a taskforce on power sector reforms. Future PPA negotiations will be in line with the Least Cost Power Development Plan (LCPD). This system is designed to leverage the country's renewable energy sources, thus providing more incentive to invest on the renewable energy sector. In line with this, the MoE has issued guiding principles to LCPD for the integration of renewable energy and emerging technologies.

Subsurface studies can be financed through equity grants like the Geothermal Risk Mitigation Facility (GRMF)<sup>7</sup> which provides up to 80% of grants for surface studies and 20% of infrastructure development. The developers and investors can provide the balance of phased payments. SAGAs can provide equipment at a fee. Other consulting firms and companies can provide complimentary services. Countries can work together with both private and public sectors on infrastructure development and creating decent work and economic opportunities for local communities.

The Japanese International Cooperation Agency (JICA)<sup>8</sup> supports the geothermal projects of GDC in Kenya through capacity building programs through expert training and this assistance greatly improved the business of GDC. JICA provided financial, technical and grant aid for 400 MW of the 880 MW installed. JICA provides loans at 0.01 % over 30 years and has an elaborate technical assistance scheme for resource uncertainty and risk mitigation.

The current programme is through the JICA Phase II Capacity Strengthening for Geothermal Steam Supply and Management project, to enhance resource evaluation and management of geothermal projects. JICA plans to conduct interference and tracer tests in Menengai to help in optimizing steam supply and re-evaluating the existing geothermal resource. The development plans in Menengai West, Paka, Korosi, Suswa, and other geothermal fields are also in the plan for review and updates.

The Kenyan Government's plan to increase geothermal energy production to over 5,000 MW by 2030 is part of Kenya Vision 2030, which highlights the country's ambition to become a middle-income country by 2030. As part of its commitment to reduce greenhouse gas

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<sup>7</sup> The GRMF is a facility established by the African Union Commission (AUC) on the one side and the German Federal Ministry for Economic Cooperation and Development (BMZ) and the EU-Africa Infrastructure Trust Fund (EU ITF) via KfW Entwicklungsbank (KfW) on the other side, to fund geothermal development in Eastern Africa. The UK Department for International Development (DFID) also contributes to the GRMF. More information is available at the GRMF's website: <https://grmf-eastafrika.org/>

<sup>8</sup> JICA website: <https://www.jica.go.jp/english/index.html>

emissions in Eastern Africa, the European Investment Bank (EIB) has agreed to invest \$95 million in geothermal power projects across the region.

#### 4.3) Financing risks.

Associated services can be provided by both SAGAs and private sector. Joint development would accelerate development and lower costs. There is an opportunity to work on business models for joint development and exit strategies for investment partners.

Production drilling & power plant financed through debt from major banks and financing institutions, EPC contractors will play a critical role in the power plant construction.

Private sector, SAGAs and county governments can work together in developing direct use of the geothermal resources. The development cycle will require appropriate and cost effective legal and financing services.

#### 4.4) Private Sector Business / Collaboration Opportunities

Sosian Energy trading as Sosian Menengai Geothermal Power Limited (SMGPL), is currently developing and constructing a 35 MWe-net binary geothermal power plant at Menengai Geothermal Field<sup>9</sup> on a 25-year Build-Own-Operate (BOO) basis, through a PPA with KPLC and Project Implementation and Steam Supply Agreement (PISSA) with GDC. SMGPL has been issued with Government of Kenya Support Letter and Partial Risk Guarantee from the African Development Bank (ADF). This project involves design, supply, installation, testing, commissioning, and management of defects during warranty period of the 35 MWe Project. SMGPL has signed an Engineering, Procurement and Construction (EPC) contract and a 14-year Operations and Maintenance (O&M) Contract with Kaishan Group<sup>10,11</sup>. The commissioning of the plant is expected to begin in 2023. The Sosian Energy's company is one of the private developers of the three 35 MW geothermal power plants to be built utilising wells drilled by GDC in Menengai. The other two IPPs are Quantum Power and Ormat.

Geothermal Exploration and Development areas in Kenya have been assigned to both Public Sector (PS) and Primary Processing Centres (PPC) connected with an IPP. Figure 4 shows the Geothermal Exploration and Development sectors assigned to IPPs and PS.

The sectors are summarized below:

- 1) The northern sector of the rift is under varying stages of development by IPPs for a planned generation of 560 MWe. This area can be developed through Joint

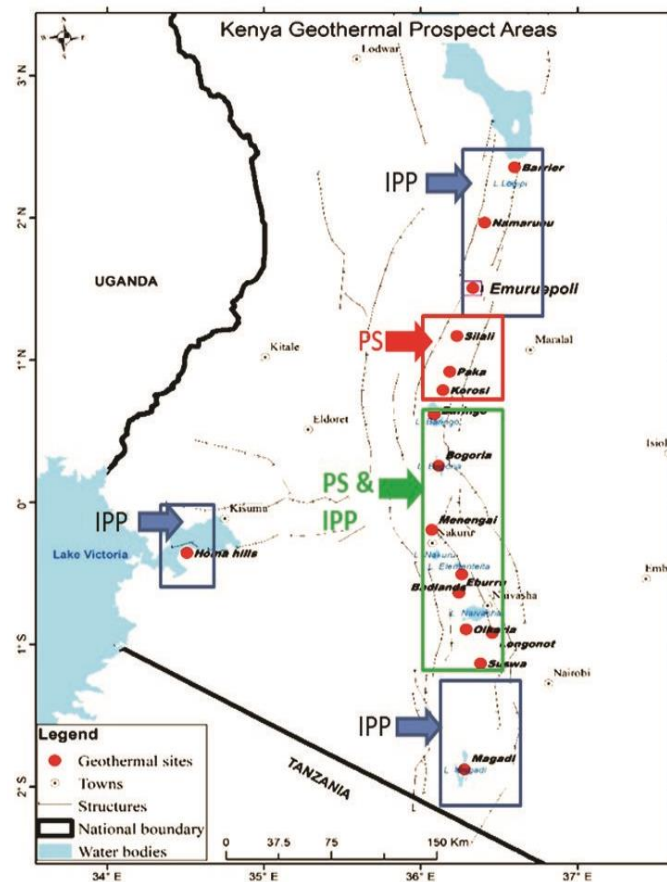
<sup>9</sup> The plant construction site was visited during second day of KGC 2022 field trip.

<sup>10</sup> Kaishan Group website: <http://en.kaishangroup.com/>

<sup>11</sup> More details on this operation are reported in a ThinkGeoEnergy news: <https://www.thinkgeoenergy.com/kaishan-to-supply-plant-technology-to-one-of-the-menengai-geothermal-projects/>

Development with counties playing significant roles in direct use. A master plan for power transmission is required.

- 2) The Korosi, Paka and Silali area is under exploration drilling to develop over 3,000 MWe.
- 3) The Suswa-Olkaria-Bogoria Area is under exploration and development for over 5,000 MWe by IPPs and Public Sector Companies. Some areas like Olkaria and Eburru have power plants, or plants under construction, like in Menengai.
- 4) The Suswa – Magadi area is earmarked for over 140 MWe.
- 5) The Homa Hills potential in the western part of Kenya is under exploration by an IPP for initial 70 MWe.



**Figure 4: Geothermal Exploration and Development sectors assigned to Independent Private Partnerships (IPP) and Public Sector (PS).**

#### 4.5) Geothermal Capacity building - Expertise and Capability

**KenGen** boasts of having knowledge, experience hence being the ultimate geothermal expert in all fields of geothermal, ranging from exportation to power plant management. The teams have also provided consulting services in geothermal exploration in several African countries including Rwanda, Djibouti, Zambia, Comoros, Sudan and most recently Ethiopia.



It has developed a wealth of experience and expertise in geothermal resource exploration and development through hands-on experience, training, and career development of staff. As an example of its aims to build capacities in geothermal, KenGen has recently published a tender for the construction of Geothermal Training Centre Facilities at the Olkaria Ward<sup>12</sup>. The Company also promotes research, technology, and innovation in geothermal energy.

The Company's geological services include a well-equipped Geology and Geochemistry Laboratories with highly experienced and skilled teams, for petrographic and fluid inclusion studies, well logging and analysis of rock, liquid and gas samples. The company has also a geophysics team with expertise in geothermal exploration surveys using state-of-the-art techniques. The KenGen's reservoir and steam field team is responsible for carrying out scientific assessment and simulation, with well measurements and tests for evaluating geothermal reservoir characteristics.

The company has also qualified and experienced staff on Environmental and Social Impact Assessment (ESIA) studies for geothermal related projects, Resettlement Action Plan (RAP) implementation, ISO quality audits, Strategic Environmental Assessments (SEA), and Environmental and Social Management Plans (ESMP) implementation and stakeholder and community engagement.

KenGen owns and operates two electric land rigs with capacity to drill up to a depth of 7,000m and a national drilling rig that can drill wells up to 2,200m, using innovative drilling techniques and tools that minimize costs and it offers a number of qualified drilling services.

**GDC** owns seven high powered geothermal drilling rigs, also offering specialized drilling services such as Coiled Tubing services for well logging, well testing and well stimulation through air lifting, thanks to highly trained technical staff. The company also has expertise to offer geoscience services (Geology, Geochemistry, Geophysics, GIS and Remote sensing), reservoir engineering, Project Management and Strategic & Financial Planning, manage direct uses, Environmental Management, Occupational Health and Safety Management Drilling Technology.

GDC is the sole Company in East Africa region that owns a geothermal drilling simulator to train GDC drilling crew as well as offering consultancy training to other interested staff, also coming from other countries. The company has a Geothermal Centre of Excellence that offers training and consultancy services for geothermal experts. The centre has trained over 600 personnel in the Eastern Africa region & carried out over 40 external consultancies.

#### 4.6) Socio – Economic Impact of the Geothermal Projects

In addition to create direct and indirect jobs in facilities, geothermal projects are promoting the development of geothermal areas in Kenya.

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<sup>12</sup> Tender details are available on the KenGen website at the following link: <https://tenders.kengen.co.ke/index.php?art=tenders&tid=Njg4>

GDC has developed a robust infrastructure network comprising Steam Gathering System (SGS), road networks, drill pads and Water Reticulation System. Over 300km of road network in both Menengai and Baringo-Silali Geothermal projects has been developed. In Baringo-Silali Project, GDC has constructed over 100km of water line to serve its three prospect areas of Paka, Korosi and Silali and 150km community water line system for livestock and domestic use. GDC has constructed forty animal watering points, as well as twenty water treatment points for treating the water meant for domestic use. These developments have improved education uptake and reduced community water related conflicts.

A group of Nakuru farmers has also signed a deal with GDC to use geothermal energy in agriculture.

#### 4.7) Geothermal Direct Use of Heat

The world's biggest geothermal greenhouses complex is installed in Oserian, close to Olkaria plants and Naivasha lake and it has an installed capacity of 18.5 MWth to heat 120 acres of land, employing almost 5,000 people and producing 350 million stems every year. These green houses are also air-fertilized with geothermal CO<sub>2</sub> and use electricity generated with a PV plant, a 1.8 MWe binary system and 2 MWe flash plant.

In 2014, GDC, in collaboration with USAID, carried out a detailed study on Direct Use applications and produced a guide titled "Geothermal Direct Use Guidebook". It built five direct use demonstration facilities in Menengai, to attract investments for the establishment of an industrial park with greenhouse farming, fish farming, milk pasteurization, laundries and grain dryer, close to each other.

Pass Africa Ltd is in the process of developing an innovative "Model Agri-Food Parks", like those in India and China, under a Public Private Partnership (PPP) model. The concept revolves around a Central Processing Centre (CPC) fed through number of collection centres operated by the farmers.

## 5) Lessons learnt

The market visit findings confirmed that good opportunities exist in Kenya for European SMEs through the continued provision of technology transfer. Many of the GEE presentations and discussions centred around addressing this requirement. From a GEE2 perspective, certain aspects of the private business sector were of particular interest. GDC conducted drilling in the Menengai geothermal field before offering the development and management of its fields to private partners. Although, it was generally accepted that capital exists for the right projects, it was acknowledged that independent standalone projects were often viewed as too expensive to get over the line. Hence, the risks associated with the economics of the project took longer than anticipated to understand to the extent that the project could process.

The Nairobi congress conclude with a panel discussion on “Financing and Insuring Geothermal Projects”. At this, it was acknowledged that although the Menengai project was bankable in 2013, it took almost 10 years to get to a point that the plant could be up and running. Parallels were drawn with the established Oil and Gas consents process and the desire for letters of support, which may not be forthcoming for future projects to the extent that they were in the past.

The position of the lending institution representative was largely sympathetic due to the complex nature of the projects and the associated timing and pricing which required borrowings in dollars for long term debt and the requirement of a moratorium of 5-7 years for a 15-year debt period. It was debated that the role of the banks has changed significantly, and the private sector may not have the industrial technology to provide the necessary comfort and hence, the ongoing requirement for capacity building and technology transfer. In such projects equity is the most complex as there is no payback if the venture underperforms or fails. It was also noted that the traditional equity players for OECD (Organization for Economic Co-operation and Development) financial markets were concentrating on European or US markets in recent years. In Kenya, access to alternative funding such as that from the Japan International Cooperation Agency (JICA) is a far more attractive option for those with such access. For early-stage exploration the Global Risk Mitigation Fund (GRMF) is backed by the European Union and is reimbursable.

The market visit included a field visit to SMGPL facility in Menegai. In this case, the award was made in 2013, with a PPA in place by 2014. Letters of support were issued in 2017 with JICA insurance and in 2018. Here, STEAM Srl is providing the project management, factory acceptance testing attendance, supervision of construction and commissioning, including capacity building through transfer of knowledge. The market visit included a detailed tour of the facility under construction by the STEAM Srl project manager. Attendees learned about the complex supply chain issues, including those relating to impacts project delivery during the Covid-19 restrictions.

## 6) Final Considerations

Kenya is currently utilizing renewable energy sources with over 85% of electricity generation from renewable sources. Additionally, 90% of electricity consumed was generated within the country.

Geothermal leads energy mix, followed by hydro, wind, thermal and imports (2%), and solar. This is attributed to fair regulation and conducive energy policies which boosted private investments in electricity generation.

The country has successfully adopted more renewable energy than many in the region, with 24% of its electricity mix derived from fossil fuels. This is in line with the Government's priority in the use of green energy sources to promote environmental sustainability, as well as to adapt to and mitigate against the effects of climate change.

There are opportunities for SMEs to support the Geothermal industry in Kenya through capacity building activities and technology transfer. Advanced technologies are required for risk reduction, particularly when it comes to securing finance for projects in the independent private sector but the need for enhanced risk reduction is in evidence for all projects. Technology transfer from the oil and gas sector was seen to be a considerable enabler for the accelerated growth of geothermal point forward. The Contribution from the GEE2 attendees, was acknowledged in this regard. There are various sources of financing available to both the public and private sectors although generally most favourable terms apply to the former. Kenya is already approaching 1 GW capacity, and this represents only 10% of the total estimated potential. This presents significant upside opportunity for investors in support of the accelerated growth required to achieve ambitions 2030 targets. Knowledge and technology transfer are key enablers and necessary inputs from GeoEnergy Europe to assist Kenya in achieving such goals.

In terms of preparation for the market visit, the matchmaking process normally adapted for such market visits was impacted by COVID-19 social and travel restrictions for much of the GEE2 duration. Consequently, the training session for Kenya took place three weeks before the market visits, despite the market training session should ideally take place two months ahead of the market survey visit to allow sufficient time to engage in the matchmaking process. The programme for the congress was also under continuous update as it too had been impacted by Covid-19 restrictions.

Attendance at the Geothermal Association of KGC 2022 proved to be an effective way to network with local companies and better understand the opportunities for future collaboration between Kenya's SMEs and their European counterparts from Geo-Energy Europe. This facilitated a successful market visit despite the compressed schedule imposed by Covid-19 restrictions. Finally, Geo-Energy Europe wishes to acknowledge the help and support from the Geothermal Association of Kenya in assisting to deliver this market visit

through its various accommodation in the congress programme of events which included an exhibition booth and speaking slots for GEE2 cluster leaders and SME delegates.

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# ANNEX I – Agenda of the training session



## GEO-ENERGY EUROPE WEBINARS AND KENYA TRAINING SESSION



### Kenya Training session

**24/06/2022**  
**14:00 - 15:30 CET**

#### Introduction :

**14:00 CET** - Overview of Geoenergy Europe project (Ana Luisa LAVADO – Geological Survey Ireland)  
Presentation of capacity building activities (Virginie BLOCH - GEODEEP)

**14:15 CET** - Presentation of GEE Collaborative tool (Gabor GERDEI - CAPES)

**14:30 CET** - Presentation of KENYA Country Fiche (Christian BOISSAVY - GEODEEP)

Global structure of the energy market  
Geothermal market (regulation and risk mitigation scheme if existing, market barriers, structure of the competition, key stakeholders)

**15:00 CET** - Best practises for export activities in Kenya – Mateo QUAIA (STEAM)

Key aspects when working with Kenyan geothermal companies

Roundtable with participants - Q&A session

Share experience

SME's expectations in coherence with training contents

**15:20 CET** - Presentation of Kenya Market visit - 13rd of July (Virginie BLOCH - GEODEEP)

**REGISTER!**

Contact: Thomas Garabetian, Senior Policy Advisor EGEC  
([t.garabetian@egec.org](mailto:t.garabetian@egec.org))



The GEO-ENERGY EUROPE project was funded by the European Union's COSME Programme under Grant Agreement N° 951195



## ANNEX II – Agenda of the KGC 2022

### Day One: Tuesday, 12.07.2022

TIME	ACTIVITY & SPEAKERS
07.00 – 09.00	<ul style="list-style-type: none"> <li>Arrival and Registration</li> <li>Breakfast is served</li> <li>Entertainment</li> </ul>
09.00 – 10.00	High level tour of the Exhibition Booths
10.00 – 11.30	<p><b>Opening Session</b></p> <ul style="list-style-type: none"> <li>Kenya National Anthem &amp; East African Community Anthem</li> <li>Opening Prayer – Mrs. Beatrice Kandie and Dr. Altaf Abdalla</li> <li>Security, Safety, and Housekeeping Briefs: Emara Ole-Sereni Hotel – Mr. Hesbon Ombongi</li> </ul> <p>Welcome Address – Chairperson, Kenya Geothermal Congress 2022 – Dr. Gathuru Mburu</p> <p>Opening Remarks – Chairman, Geothermal Association of Kenya – Mr. Paul Ngugi</p> <p>Opening Remarks – Executive Director, International Geothermal Association – Dr. Marit Brommer</p> <p>Opening Remarks – Director, UNEP ARGeo Program and Head of UNEP South Africa – Dr. Meseret Teklemariam</p> <p>High Level Remarks – MD &amp; CEO, Geothermal Development Company – Eng. Jared Othieno</p> <p>High Level Remarks – MD &amp; CEO, Kenya Electricity Generating Company PLC – Mrs. Rebecca Miano</p> <p>High Level Remarks – Chairperson, Board of Directors, Geothermal Development Company – Mr. John Njiraini, CBS</p> <p>High Level Remarks – Principal Secretary, Ministry of Industrialization, Trade and Enterprise Development, State Department for Industrialization, Amb. Peter Kaberia, CBS</p> <p>Key Note Address, Scene Setting and Official Opening – Principal Secretary, Ministry of Energy, Maj. Gen (Rtd) Dr. Gordon O. Kihlangwa, CBS</p>
11.30 – 12.00	Tea Break, Tour of the Exhibition Booths and Field Trip Registration
12.00 – 13.00	<p><b>Panel Discussion: Role of policies and regulatory instruments in spurring geothermal development in Kenya</b></p> <p><b>Moderator:</b> General Manager, Geothermal Development, Kenya Electricity Generating Company – Mr. Peketsa Mangi</p> <ul style="list-style-type: none"> <li>Chairman, Mineral Rights Board – Mr. Stephen Kuria</li> <li>Director General, Energy and Petroleum Regulatory Authority – Mr. Daniel Kiptoo</li> <li>Managing Director, Olsuswa Energy Limited – Mr. Mugwe Manga</li> <li>General Manager, Renewable Energy, Research and Development, Rural Electrification and Renewable Energy Corporation (REREC) – Mr. Fred Ishugah</li> <li>Ag. General Manager, Legal Services, GDC – Ms. Agnes Muthengi</li> <li>Executive Director, International Geothermal Association – Dr. Marit Brommer</li> <li>Director of Policy and Strategy, Africa Utility Forum – Mr. Daniel Thuo</li> </ul>
13.00 – 14.00	Lunch Break, Tour of the Exhibition Booths & Field Trip Registration
14.00 – 14.10	Presentation by Lanyard Sponsor: Vice President, Operations, Geothermal Resource Group Inc. (GRG) – Mr. Samuel Abraham
14.10 – 14.20	Presentation by Sponsor: Managing Director, Australia Africa Energy and Minerals Institute – Mr. Stephen Kuria
14.20 – 15.20	<p><b>Panel Discussion: Role of Private Sector and Industry in Geothermal Energy Utilization</b></p> <p><b>Moderator:</b> Dr. Stephen Onacha, Director in charge of Resource Development – Akiira Geothermal Limited</p>





	<ul style="list-style-type: none"> <li>• Director General, Public Private Partnerships Directorate – Mr. Christopher Kirigua, OGW</li> <li>• Chief Executive Officer, Kurrent Technologies &amp; Director, Kenya Private Sector Alliance – Eng. James Mwangi</li> <li>• Chairperson, Kenya Private Sector Alliance (KEPSA), Energy Sector Board – Mr. George Aluru</li> <li>• General Manager, Geothermal Development, Kenya Electricity Generating Company – Mr. Peketsa Mangi</li> <li>• General Manager, Geothermal Resource Development, Geothermal Development Company – Eng. Cornel Ofwona</li> <li>• Associate Programme Officer Geothermal Energy IRENA &amp; Global Geothermal Alliance (GGA) – Mr. Jack Kiruja</li> <li>• Global Market Manager, International Geothermal Association – Mr. Martin van der Hout</li> <li>• Project Manager, Fortescue Future Industries, Kenya – Mr. Ruskin Onyambu</li> </ul>
15.20 – 16.20	<b>Panel Discussion: Accelerating the Role of Geothermal Energy in the Energy Mix</b> <b>Moderator: Dr. Peter Omenda, President, International Geothermal Association – Africa Regional Branch</b> <ul style="list-style-type: none"> <li>• Chief Executive Officer, Tulu Moyo Geothermal – Mr. Maxence Mirabeau</li> <li>• Director, UNEP ARGeo Program and Head of UNEP South Africa – Dr. Meseret Teklemariam</li> <li>• Director, Electricity &amp; Renewable Energy, Energy &amp; Petroleum Regulatory Authority – Eng. Joseph Oketch</li> <li>• Director Economic Regulation, Uganda Energy Regulatory Authority – Dr. Geoffrey Okoboi</li> <li>• Director, Climate Change, Ministry of Environment and Forestry – Dr. Pacifica Ogola</li> <li>• Ministry of Energy and Mineral Development, Uganda – Mr. Vincent Kato</li> </ul>
16.20 – 17.00	<b>Tea Break, Tour of the Exhibition Booths &amp; Field Trip Registration</b>
17.00 – 18.30	<b>Networking Cocktail – Sponsored by Kenya Electricity Generating Company, KenGen</b>



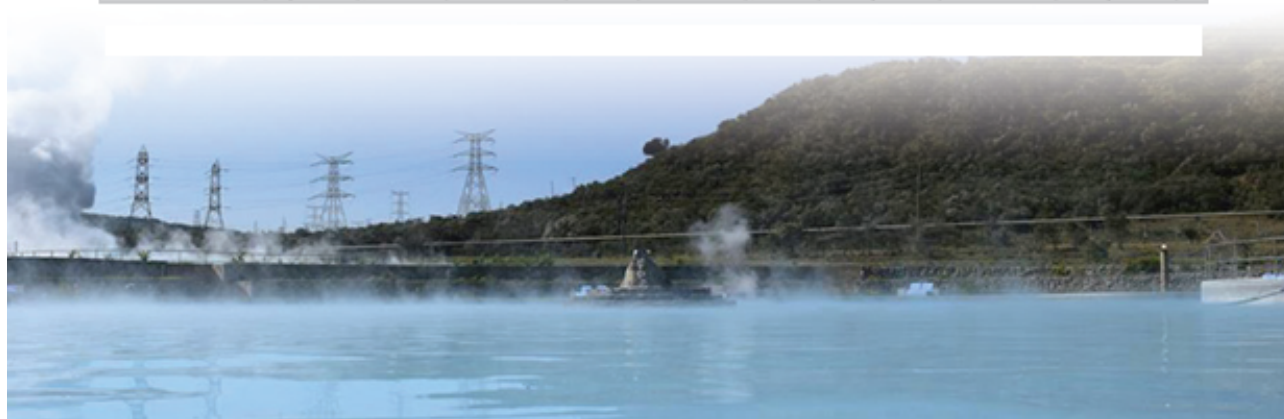
## Day Two: Wednesday, 13.07.2022

TIME	ACTIVITY & SPEAKER	
08.00 - 09.00	Morning Tea and Tour of the Exhibition Booths	
09.00 - 09.20	Key Note: Principal Secretary, Ministry of Petroleum and Mining - Mr. Andrew N. Kamau, CBS	
09.20 - 10.20	Panel Discussion: Opportunities for Oil and Gas in the Geothermal Sector	
	<ul style="list-style-type: none"> <li>• Moderator: Chief Executive Officer, Tsavo Oilfield Services - Eng. Elizabeth Rogo</li> <li>• Executive Director, International Geothermal Association - Dr. Marit Brommer</li> <li>• Managing Director, Oil and Energy Services - Mr. Mwendia Nyaga</li> <li>• Sales &amp; Commercial Leader, Baker Hughes, Sub Saharan Africa - Mr. Toks Azeez</li> <li>• Project Manager Steam Group Srl and representative, Unione Geotermica Italiana - Mr. Paolo Basile</li> <li>• Director in charge of Resource Development, Akiira Geothermal Limited - Dr. Stephen Onacha</li> </ul>	
10.20 - 10.40	Tea Break, Tour of the Exhibition Booths & Field Trip Registration	
10.40 - 11.15	Opportunities in the Geothermal Sector in Kenya	Moderator: Geol. Mike Karanja, CEO, Geothermal Association of Kenya
10.40 - 11.00	Opportunities in the Geothermal Sector in Kenya - Independent Power Producers	Dr. Stephen Onacha, Director in charge of Resource Development - Akiira Geothermal Limited
11.00 - 11.20	Opportunities in the Geothermal Sector in Kenya - Geothermal Development Company	Paul Ngugi, General Manager, Drilling and Infrastructure - Geothermal Development Company
11.20 - 11.40	Opportunities in the Geothermal Sector in Kenya - Kenya Electricity Generating Company	Peketsa Mangi, General Manager, Geothermal Development - Kenya Electricity Generating Company
11.40 - 11.50	Public Private Development Partnerships (PPDP)	Isaac Mwema, National Programme Coordinator, Public Private Development Partnerships(PPDP), International Labour Organization
11.50 - 12.05	Harnessing Geothermal Potential with EXERGY's Highly Efficient & Reliable ORC Systems	Erdogan Arpacı, Sales Manager, Turkey & Middle East and Africa - Exergy
12.05 - 12.20	Well Integrity and Zonal Isolation in Geothermal Wells	Maximilien Hallaire, Area Vice President Africa - Welltec
12.20 - 12.35	ORC technology optimized for geothermal resources	Joseph Bonafin, Sales and Business Development Manager - Geothermal, Turboden
12.35 - 12.45	Presentation of Geo-Energy Europe Project	Dario Bonciani - CoSviG & Cluster DTE²V
12.45 - 12.55	The STRYDE portfolio - Applications for the geothermal sector	Nick Tranter, Business Development Manager, New Energy - STRYDE
12.55 - 13.05	The Bentworth Energy and Baker Hughes portfolio - Applications for the geothermal sector	Toks Azeez, Sales & Commercial Leader, Sub Saharan Africa - Baker Hughes
13.05 - 13.15	The Davis & Shirtliff / Kurita Geothermal portfolio - Applications for the geothermal sector	Hande Şile, Product Manager - Geothermal - Kurita Geothermal
13.15 - 14.00	Lunch Break and Tour of the Exhibition Booths	



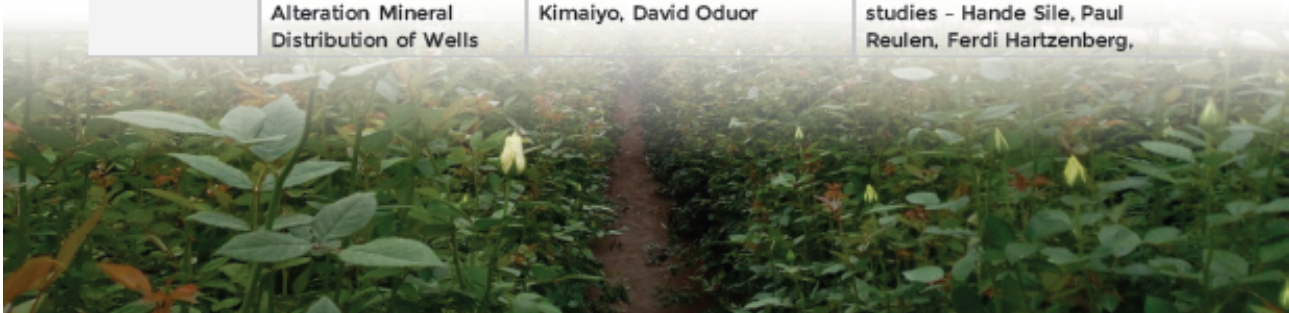


BREAKOUT SESSIONS			
14.00 – 16.30	Room 1: Geothermal Resource Development Moderator: Mr. Cyrus Karingithi, KenGen	Room 2: Utilization of Geothermal Resources Moderator: Eng. Martha Mburu, GDC	Room 3: Geothermal Resource Development Moderator: Dr. Stephen Onacha, Akiira
14.00 – 14.25	Geothermal resource evaluation in East African Rift basins using hydrocarbon workflows - Joe Mongan	Geothermal Direct Utilization and Opportunities for Industrial Parks, GDC Case Study - Eng. Martha Mburu	Application Of Public Private Partnerships In The Extraction Of Geothermal Mineral Resources In Kenya - Daniel Mutegi
14.25 – 14.50	Thermal breakthrough and maximization of reinjection in geothermal fields: a geological perspective - Hawuory, John Paul	Utilization Of Low-Pressure Geothermal Wells In Olkaria For Food Drying: A Case Study Of Macadamia Nuts - George Maingi	Applications of Coil Tubing in Geothermal Exploitation - Reuben Ngosi & Stephen Onacha
14.50 – 15.15	Well siting strategies in geothermal resource development - Geoffrey Mibei, Tito Lopeyok and Joseph Mutua	Geothermal greenhouse heating - economics and opportunities for expansion - Mr. Alasdair Keith, Oserian Development Company	De-Risking Upstream Geothermal Exploration to Fast-Track Renewable Energy Deployment - Rosemary Njenga
15.15 – 15.40	Supporting renewables by making HD seismic simple and affordable - Nick Tranter and Amine Ourabah	Accelerating Direct Use of Geothermal Energy in the Agriculture Sector in Malawi - Mumba Ruth	Applying Surface CO <sub>2</sub> Flux Mapping to Identify Structural Controls on Caldera Hosted Geothermal Resources: A Case Study of Menengai, Kenya - Robinson, Helen; Koehn, Daniel; Rochelle, Christopher
15.40 – 16.05	Added-Value Of Geoscientific Information In Geothermal Energy Development: A Conceptual Approach - Bosire Paul	Geothermal Tourism Potential of Uganda - A review- Vincent Kato	Implementation of the PPA Taskforce Report, Function of the Public Private Partnerships Unit (PPPU) in geothermal resource development
16.05 – 16.30	Petrogenesis and Geothermal Potential Assessment of the Corbetti Volcanic Complex in the Main Ethiopian Rift (MER) - TesfayeDemissie (PhD) and TakeleChekol (PhD)		The Kenya Energy Sector - Least Cost Power Development Plan (LCPDP) and the Medium Term Plan - Unbundling the Medium Term Development Strategy for the Energy Sector
16.30 – 17.30	Tea Break and Tour of the Exhibition Booths		
17.30 – 20.00	Women in Geothermal Cocktail -The International Geothermal Association (main sponsor), WING (Global Host), GAK (Local Host), GGA (Co-Sponsor) and GRG (Co-Sponsor)		



## Day Three: Thursday, 14.07.2022

TIME	ACTIVITY & SPEAKER		
08.00 - 09.00	Morning Tea and Tour of the Exhibition Booths		
	BREAKOUT SESSIONS		
09.00 - 10.40	Room 1: Geothermal Resource Development Moderator: Mr. Shammah Sambili, Arus Energy	Room 2: Training, Stakeholder Management and HSE Moderator: Mr. Paolo Basile, UGI	Room 3: Geothermal Drilling & History of Geothermal Moderator: Ms. Yvonne Wanambisi, GDC
09.00 - 09.25	Geothermal Reservoir Evaluation Using Current Modelling Technique & Drawdown test data from Olkaria Domes Geothermal Field - Stephen Ouma and Daniel Wandera	Capacity Building For Geothermal Development: Successes, Opportunities And Challenges - Prof. Nicholas Mariita	Success Of World's First Hybrid PDC And "Particle Drilling" Bit For Geothermal Applications - Pink Anthony, Paul Schiller, John Jennings Matthew
09.25 - 09.50	Buranga geothermal exploration strategy - Vincent Kato	Training for Careers in the Geothermal Sector- Migere Borniface	Improvement in Rate of Penetration in FORGE Drilling Through Real Time MSE Analysis and Improved PDC Technology - Samuel, Abraham, Rickard, William M., Rivas, Ernesto, Atalay, Sami, Moore, Joseph, Self, Jordan Self, Stevenson, Matt
09.50 - 10.15	Reservoir rocks and hydrothermal mineralogy occurrence in Paka Geothermal Field, Kenya - Michael Lokirima	Involuntary resettlement of project affected persons: key outcomes and lessons from Olkaria geothermal power project in Kenya - Elizabeth Mwangi	Effectiveness of an Integrated Supply Chain Management System in Geothermal Drilling. A Case of Geothermal Drilling Company in Kenya - Evans Nyamweya
10.15 - 10.40	Review of Rift and Magmatic Systems at Cratonic Margins, Case Study of Homa Hills- Renju Melvinne	DRM/BCP- Exploiting the Bow tie method to prepare for Pandemic - Patrick Gikunju	KenGen's geothermal development history and achievements - Rose Mathenge
10.40 - 11.00	Tea Break and Tour of the Exhibition Booths		
11.00 - 11.05	Room 1: Geothermal Resource Development Moderator: Nick Tranter, STRYDE	Room 1: Opportunities & Resource Development Moderator: Martin van der Hout, IGA	Room 2: Power Plants Moderator: Dr. Benson Ongarora, DeKUT
11.00 - 11.25	Structural and fissure dynamics in geothermal fields and its implications on reservoir management - Kenneth Kinyua	A new mode of geothermal development for Africa: the geothermal village project - Omenda Peter and Varet Jacques	Maximizing the Potential of Geothermal Resources in Steam Power Plants with Retrofitted Binary Technology: Exergy's Case Study in the Philippines, Mindanao 3 Power Plant - Erdogan Arpac and Marco Frassinetti
11.25 - 11.50	Petrology and Hydrothermal Alteration Mineral Distribution of Wells	Opportunities In The Geothermal Sector - Evans Kimaiyo, David Oduor	Anti-scaling applications in geothermal: Worldwide case studies - Hande Sile, Paul Reulen, Ferdi Hartzenberg,



	LA-9D and LA-10D in Aluto Geothermal Field, Ethiopia - Dereje Moges		Duygu Disci
11.50 - 12.15	Locating seismic events in the Menengai volcanic field of the Kenyan Rift Valley - Kamau Esther, Wamalwa Antony, Nderitu Francis	Geothermal Power Resource in Ethiopia - Markos Ture, Yasin Hanfere, Berhanu Lemma, Zewde Gebregziabher	The 29 MW binary brine recovery project in Bacman geothermal plant - Joseph Bonafin
12.15 - 12.40	Depth Estimation of Geothermal Heat Structures by Euler Deconvolution of Potential Field Data. A Case OF Ground Gravity Data at Eburru Area, Kenya - Nyakundi Erick Rayora, Githiri John, K'Orowe Maurice	Mapping and Prospecting of Geothermal Resources of Jharkhand, India - a Case Study of North Jharkhand - Srivastava Raj Ranjan and Singh Bijay	An analysis of Turboden's binary ORC technology for the geothermal power plant situated in Berlin, El Salvador - Joseph Bonafin
12.40 - 13.05	Application of infrared spectroscopy in identification and analysis of hydrothermal alteration minerals - Mathew Kamau	Gas Chemistry of Paka Geothermal Field, Kenya, and Its Implication on the Development of the Field - Jeremiah Kipngok, Leakey Ochieng and Nicholas Muli	Two-stage acid dosing concept for enhanced scaling control in geothermal bottoming binary cycles - Hartmann Andre, Toulankine Evgueni, Lovelock Brian, Purdie Don, Ziegler Caspar
13.05 - 14.00	Lunch Break and Tour of the Exhibition Booths		
14.00 - 15.00	<p>Exhibitor Presentation: Director, NDT Africa - Mr. Amos Githinji</p> <p>Panel Discussion: Financing and Insuring Geothermal Projects</p> <p>Moderator: Mr. Paul Ngugi, General Manager, Drilling and Infrastructure - Geothermal Development Company</p>		
	<ul style="list-style-type: none"> <li>Chairman, Board of Directors, Sosian Energy Limited - Mr. Shaun Zambuni</li> <li>Senior Energy Advisor, JICA Kenya Office - Mr. Evanson Njenga</li> <li>Head Client Coverage, Corporate, Commercial &amp; Institutional Banking Kenya and East Africa, Standard Chartered Bank Kenya - Mr. Birju Sanghrajka</li> <li>Global Head of Geothermal, Parhelion - Mr. Darrell Boyd</li> <li>Partner, Oraro and Company Advocates - Ms. Cindy Oraro</li> <li>Managing Director, Geothermal Exploration Limited - Mr. Ajay Shah</li> <li>Representative, Cooperative Bank of Kenya</li> </ul>		
15.10 - 17.00	Closing Session		
15.10 - 16.10	<p>Remarks: Vision for Accelerating Geothermal Energy Development</p> <ul style="list-style-type: none"> <li>Director, Capacity Building &amp; Technical Assistance, Ministry of Devolution - Mr. Kennedy Nyambati</li> <li>General Manager, Drilling and Infrastructure, Geothermal Development Company - Mr. Paul Ngugi</li> <li>General Manager, Geothermal Development, Kenya Electricity Generating Company - Mr. Peketsa Mangi</li> <li>Regional Coordinator, International Labour Organization, Public Private Development Partnerships (PPDP) Project - Mr. Isaac Muema</li> </ul>		





	<ul style="list-style-type: none"> <li>• Director, Vocational Training, Nakuru County Government – Mr. David Mwangi</li> <li>• Director, Youth Affairs, Nakuru County Government – Mr. Josephat Kimemia</li> <li>• Asst. Director, Vocational Training, Narok County Government – Mr. Paul Rutto</li> <li>• Chief Officer, Gender And Youth Affairs, Narok County Government – Mr. Koinet Ole Lemein</li> </ul>
	Outcome and Action Points from the Kenya Geothermal Congress 2022
16.10 – 16.40	High Level Closing Remarks: Principal Secretary, Ministry of Energy, Maj. Gen (Rtd) Dr. Gordon O. Kihlangwa, CBS
16.40 – 16.50	Vote of Thanks
16.50 – 16.55	Closing Prayer
16.55 – 18.00	Tea Break
18.00 – 20.00	Closing Dinner - Sponsored by the Geothermal Development Company and the Co-operative Bank of Kenya

\*Please remember to adhere to COVID-19 regulations. Please take care of your personal belongings.

### Field Trips: Friday, 15.07.2022 to Sunday, 17.07.2022

- ❖ Field Registration open until 10.40am on Wednesday, 13.07.2022. More information at the Registration Desk.

Options	Duration	Field Tour To
Option 1	One Day – 15/07/2022	Olkaria Geothermal Field & Oserian Development Company
Option 2	Two Days – 15/07/2022 to 16/07/2022	Olkaria Geothermal Field, Oserian Development Company, and Menengai Geothermal Field
Option 3	Three Days – 15/07/2022 to 17/07/2022	Olkaria Geothermal Field, Oserian Development Company, Menengai Geothermal Field and Baringo – Silali Geothermal Project

