Steam

Issue No. 3

A Publication of the Geothermal Development Company

February 2011

In search of a nation's fuel

400MW geothermal investment up for grabs

Management for growth: The need to delegate

Harnessing Kenya's Geothermal Resources for a bright future.

GDC Geothermal Development Company

Powering the Vision

Editorial Committee

The steam is an authoritative platform that reports on geothermal development activities in Kenya. It gives readers an understanding of the great potential that exists in Kenya and how GDC is providing an enabling environment for investors to play a key role in providing Kenya with green, reliable and affordable energy.

The steam is published quarterly by the Geothermal Development Company Limited (GDC). Views expressed in this publication do not necessarily reflect the position of GDC.

Geothermal Development Company Limited
Taj Tower, Upper Hill 9th Floor
P.O. Box 100746-00101
Nairobi
Tel:+254 20 2427516/19
email: steam@gdc.co.ke
www.gdc.co.ke

Editorial

A new year brings a sense of optimism and renewed vigour. For GDC, 2011 is a significant year that will see us commence geothermal drilling in the Menengai Geothermal Project situated about 200 km from Nairobi. Two rigs are on site, fully assembled and ready for work. In this issue I invite you to read the captivating story of GDC's search for a reliable, affordable, and eco-friendly source of energy, and get to learn some of the milestones we have achieved.

And, Menengai is just the starting point. GDC is already exploring other geothermal sites such as Homa Hills in Nyanza, Barrier, Paka, Korosi and Silali in Northern Kenya, and Mwananyamala at the Coast, to mention but a few.

One of the emerging and promising new investment frontiers is in geothermal development. GDC, realizing the critical role that investors will play in harnessing Kenya's huge geothermal potential, has invited bids for the development of 400MW of geothermal. This is a great opportunity and in this issue, we encourage all investors to consider this window of investment opportunity.

Talking of New Year resolutions, I suggest you add one more item to your 2011 resolutions list- the resolve to delegate. It is a generally established fact that most of us could delegate more than we are currently doing. The challenge, however, is that most people lack the requisite delegation skills. In this issue, Bruno Linyiru gives you tips on the why, what, when, and how of delegation. Turn to page 21 for details.

Giving back to the community is a buzz word in corporate circles. At GDC, we have started weaving closely knit ties with host communities for mutual benefit. We have listened to the community, understood their needs, interests and concerns, and we have come up with a methodology that has ensured mutual co-existence. More on community perspectives on page 24.

We have these and many more captivating articles awaiting you. I invite you to grab a mug of coffee, turn the pages and get the complete picture of how GDC is shaping events in the geothermal sector in Kenya and in the region.

Local communities harvest water from fumeroles in Eburru, Kenya

Contents

Your letters

Dear Editor,

Thank you very much for forwarding me your interesting September edition of your magazine Steam. Very interesting, well written and focused on an important and abundant energy available under the Kenyan soil.

-Gian Carlo Culazzo, Economic and

Commercial Affairs Attaché' at the Italian Embassy in Nairobi.

I want to take this opportunity to aptly congratulate the management and staff of GDC for a job well done. I have been following your progress keenly and can only marvel at the high speed with which GDC is meeting its target, for instance you started drilling way before the projected starting time! Your website is also very informative for young upcoming engineers like me. My bet is that GDC is going to be the biggest and most relevant Energy Sector parastatal within the next few years!

Barasa Mulati,
Kakamega County

Dear Editor,

I really enjoyed your first edition of the Steam. It was informative and interesting with a variety of topics.
Having grown up in Nakuru, and visited the Menengai Crater a number of times, I was especially tickled and intrigued by the accurate nostalgic description of the superstitions surrounding it. Years later, it is so exciting to hear the prospects of something good coming out of this extinct (or is it really?) volcano. Bravo to the GDC team, and best wishes in this exploration. Kenyans are counting on you to be the light at the end of the power tunnel.

I am anxiously looking forward to your next edition of the Steam.

Millicent Marutit
Nairobi.

Geofacts

1. Kenya was the first country in Sub-Saharan Africa to exploit geothermal based power on a significant scale

2. Kenya's Least Cost Power Development Plan (LCPDP) instituted in 2000 recognizes geothermal as the best low cost energy option for the future.

3. Geothermal fuel - like the sun and the wind - is always found where the power plant is. Therefore, economic benefits remain in the region and there are no fuel price shocks

4. Geothermal power plants are designed to run 24 hours a day, all year. A geothermal power plant sits right on top of its fuel source. It is resistant to interruptions of power generation due to weather, natural disasters or political rifts that can interrupt transportation of fuels

5. GDC is targeting to prove 5,000MWe by 2030

6. Since the first geothermal-generated electricity in the world was produced at Larderello, Italy in 1904, the use of geothermal energy for electricity has grown worldwide to about 7,000 megawatts in twenty-one countries around the world. The United States alone produces 2700 megawatts of electricity from geothermal energy, electricity comparable to burning sixty million barrels of oil each year.

GDC Managers and some members of Parliament join drilling engineers in Menengai Geothermal Project.

Keeping the national vision alive

One of the reliable springs of optimism for Kenya is the presence of large reserves of geothermal energy running to 10 000MWe. It even gets better and exciting. The state is keen on developing this resource for national economic prosperity.

Being the East Africa's economic power house, electricity appetite in Kenya has largely gone unsatisfied. It is the geothermal portfolio that will sate this crave.

We at GDC are privileged to undertake this critical assignment that will power our country. We are pretty aware that Kenya's economic takeoff is pegged on availability of affordable, reliable and clean electrical energy.

And we are on track. Already, two new GDC-owned drilling rigs are on site in Menengai. This is a major turning point in the geothermal landscape because by GDC owning the rigs it means we are going to heavily cut down on the drilling costs.

Furthermore, we have covered massive ground on scientific exploration and feasibility studies. And that is why we can confidently slot our odds on the geothermal roulette.

Since the odds favour us, we are ready to drill the Menengai Geothermal Project and consequently create a platform where 400MW of electricity will be generated by 2014. It doesn't end there. By 2016 we should have 800MW and 1000 MW by 2018 running in the national grid. This is a major boon for Kenya.

For the investor this is the time to smile. The sector is abuzz with investment opportunities. Already we are inviting bids for interested parties to put up power plants in Menengai. Indeed, we appreciate the premium role strong partnerships play in the growth of such a heavy-investment sector.

Ours is to turn this country into a reputable and vibrant geothermal epicenter. This is quite feasible considering the extent of the resource and the goodwill we are enjoying from the Government of Kenya, financiers, and the Kenyan public.

Geothermal energy has proved to be the most reliable base-load power which is available around the clock. This means that once it's harnessed, it will continue to power this country for long without the anxieties of an erratic weather pattern.

Additionally, worldwide, geothermal is a favorite. Being a renewable, it is clean and friendly to the environment. It is the most viable alternative to fossil fuels which are as expensive and big pollutants. Therefore with the coming of GDC, the energy sector will be scoring many economic and environmental points for Kenya.

To meet our obligations, GDC is scaling up the training of engineers and other experts who will run the show. Kenya is alive with young talent which we are nurturing and giving an opportunity to serve the country instead of enlisting expatriates to do the same job. This self-reliance stratagem will guarantee an independent and secure energy supply for Kenya's industrialization voyage.

Of course, as a nation, we deserve to enjoy the magnificence of flawless electricity offered by our indigenous resource. Kenya has what it takes to lead in geothermal energy and that is the path that GDC is treading. Ours is a commitment to build a company of excellence; a company with a difference. We know we are keeping the national vision alive.

Dr. Silas Simiyu,
Managing Director & CEO.

Ours is to turn this country into a reputable and vibrant geothermal epicenter.

Experts hail GDC's 'unique' model

GAB consultants from (left) Stefan Arnorson, Prof. Kevin Brown and Ann Robertson during a tour of GDC's geothermal projects.

GDC recently engaged international geothermal consultants – the Geothermal Advisory Board (GAB) -comprising of renowned geothermal experts who hailed the GDC's model on geothermal development as "refreshingly unique."

The body made the observation after touring our areas of operation and engaging with GDC's development plan.

The three leading consultants will provide technical assistance to GDC by reviewing GDC's business geothermal development plans.

The GAB board members came from New Zealand, United States and Iceland -leading countries in geothermal production. The GAB is chaired by Prof. Stefan Arnorson from Iceland. The other two members are Kevin Brown from New Zealand and Ms. Ann Robertson-Tait from the United States of America.

The GAB held its first meeting from in November 2010. ,

They appreciated the epic journey that GDC has begun and the milestones already covered since its inception a year ago.

GDC managers, led by Dr. Peter Omenda Chief Manager, Research and Development led the three in the tour of Menengai geothermal field. They later toured the Olkaria field. They described the work being undertaken by GDC simply as "spectacular and awesome."

"A year ago I did a review of GDC's business plan and thought it was too ambitious. I am humbled at the much progress GDC had made. You are indeed on the path to success", said Ms. Robertson-Tait, during the visit to the Menengai field.

The consultants later paid a courtesy call to Dr. Silas Simiyu and to the Minister for Energy. They have since given GDC's business plan a thumbs up. Their endorsement is a mark of approval for the work GDC is undertaking.

The GAB is a technical board unlike the Board of Directors which performs governance functions.

Geothermal Training: GDC's promise

GDC will continue to support the annual UNU-GDC-KenGen geothermal training, the MD/CEO, Dr. Silas Simiyu said.

Additionally, GDC is ready to share expertise on geothermal development with countries rich in the resource within the Eastern African Rift region.

Dr. Simiyu made the remarks during the opening of the short course in Naivasha.

Apart from the monetary support, GDC availed its geophysics equipment for field demonstration while offering 20 of its experts as instructors in the training.

The MD reiterated the need to develop geothermal resources in the region but explained that this can only be possible through a pool of qualified personnel.

Dr. Simiyu also announced that GDC is working towards establishing an ultra-modern geothermal training institute, which will be used in future for geothermal trainings.

"I'm happy to announce that in future, this programme will be more exciting and fulfilling. GDC is at an advanced stage to establish a state-of-the-art geothermal training facility in Nakuru which will be used for future in-depth training," the MD said.

This year's training attracted new participants from Mozambique, Malawi and Morocco who trained alongside other 12 countries from the region who totaled 55.

Meanwhile, Geoffrey Muchemi, the KenGen's Geothermal manager commended Dr. Simiyu and three others for their "great brains in conceptualizing the training model" now in its fifth year. This year's training started October 29 and will end November 19.

GDC's Convine Omondi holds aloft his certificate at the end of the training.

GDC scoops awards at the Nairobi fair

Levi Shako explains to pupils how geothermal energy is generated during the Nairobi Trade Fair.

GDC scooped two prestigious awards at the Nairobi International Trade Fair which took place in September, 2010.

"We emerged Second-Runners up in two different categories; The Best Energy Stand Sector Commercial/ Manufacturers category and The Best Medium Trade Stand," said Ruth Musembi, Manager, PR & Communication.

This means that GDC came third after competing against some of the best established and respected energy and manufacturing firms in the country.

It was the first time GDC was having its own stand at a major event, unlike previously where it was being hosted at the Kenya Power and Lighting Company stand.

"Well done! This is an excellent display, especially the first time you are managing your own stand. Keep it up!" These were the heartening comments from KPLC MD/CEO Eng. Joseph Njoroge, who visited GDC stand flanked by the GDC chairman, Mr. Paul Gondi.

While commenting, another show enthusiast, Mr. Joel Ayieko, said "the whole vision 2030 lies behind you," while Embu-based KARI director, Mr. Stephen Njoka, was very much impressed by the stand and the competent personnel who manned it.

GDC chairman, Mr. Paul Gondi was full of praise for the well laid out display stand.

Directors Sally Towett and Rhoda Loyor, also visited the stand.

The awards have come at a time when GDC is striving to accomplish its mission to produce at least 5,000MWe by 2030.

GDC has already carried out surface explorations in the Menengai and Silali prospects. Drilling has already begun in Menengai Geothermal Project.

GDC management honors Board Chairman

Mr. Paul E. Gondi, the GDC Board Chairman, has been honored by the management for his contribution to the welfare of the company. The chairman received his recognition certificate during the GDC Awards Ceremony held in Nairobi mid December 2010.

The Management Special Award is conferred to a member of the GDC community who has made great contribution to the welfare of the company. It is the highest honour in the stable of awards celebrated employees received.

"Today I'm honoured to be the recipient of this award," an ecstatic chairman said. "I'm wholly dedicated to the growth of the geothermal sector in this country."

Mr. Gondi noted with pride the phenomenal growth GDC has registered and attributed it to great leadership and a dedicated workforce.

Congratulations Mr. Chairman...*Paul E. Gondi, GDC Chairman displays his award. Director Rhoda Loyor and Chief Manager Dr. Peter Omenda cheer on.*

Board thrilled with progress

The GDC board of directors has been pleased with the progress the company has made so far in the development of geothermal resources, and has guaranteed unrelenting support to enable the company achieve its goals.

The board concluded this during a recent field tour of some geothermal sites in the Rift Valley. Three directors who sit in the Procurement Oversight Committee (POC) were happy with the progress the company has made since its inception.

The POC members, who toured Menengai, were Eng. Kariuki Muchemi, Mr. Joseph Kariuki and Ms. Rhoda Loyor. They were later joined by the GDC Chairman, Paul Gondi, directors Ms. Sally Towett, Mr. Martin Heya and Mr. David Ole Sankori, for a tour of Olkaria and Eburru.

"You have the support of the board and we will certainly brief the minister on the tremendous progress which you have made so far. Kenyan tax-payers are certainly getting value for their money" said Mr. Kariuki, who represents the PS Treasury, in the board.

According to Eng. Muchemi, the GDC board will make sure work progresses well "since at the end of the day, Kenyans will want to see reliable, affordable electricity which they need badly."

"As a board, we have to see this through. We know the investment is massive but we will pull through together as a team," said Muchemi, who also chairs the POC.

Michael Mbevi (left) GDC's Manager, Drilling Operations explains to a section of the Board how a rig operates.

GDC's going beyond borders

A team of scientists from GDC carried out geothermal consultancy work in Malawi in September 2010 paving way for GDC's influence in the region. At the same time, negotiations are at an advanced stage with Rwanda and Saudi Arabia where similar consultancies are in the making.

This follows a contract entered into between GDC and Geothermal Projects PTY Ltd of Malawi for the former to carry out a reconnaissance survey in Malawi.

Aa proposal for detailed Geo-scientific work to be done in Malawi had been done and sent to Geo-Projects. The contract has now been signed by both parties and work is scheduled to start in March 2011. James Wambugu, the Manager, Resource Development at GDC exuded confidence that the Malawi exercise will be a success.

"We are very happy with the new development. It is exciting that most

African countries are embracing the geothermal philosophy. This way, expertise development and exchange of ideas will be upped," he said.

The Malawi team was led by Wambugu; the other team members are John Lagat, Chief Geologist and Charles Muturia, Senior Geophysicist.

The advance team assessed the nature of the geothermal resource in Malawi and gave direction on the way forward.

The reconnaissance report recommended for further detailed geoscientific surveys.

"This is a major breakthrough in our consultancy pursuits," says Wambugu .

"GDC is now being recognized in the region as a source of geothermal expertise. More opportunities are exist. In Tanzania, a private firm has approached GDC to carry out surface exploration. The plans are still in the pipeline. We're optimistic that it will be a success too."

Meanwhile, Wambugu says negotiations are underway for work in Rwanda and Saudi Arabia.

GDC is establishing itself as a one-stop-shop for geothermal expertise providing top of the range consultancy services to governments and private companies alike.

Why GDC has stirred Wanyororo

Wanyororo village in Bahati, Nakuru is ecstatic. Residents are looking forward to shine exciting times as GDC develops the Menengai Geothermal Project.

When GDC bulldozers started rolling into the village paths, the torment that was bad roads are now turning to fortunes for the residents.

They can now sigh with relief as the youth get jobs at the construction site, thus guaranteeing bread at the end of the day. The transport system has also been greatly boosted with the new roads which GDC has graded.

"This is dry area, but now there is hope since we can see electricity nearby, our youth are getting jobs while we will transport milk to the markets easily," said Mzee Joseph Kimani, whose home is adjacent to the caldera says, when the Steam team visited the area recently.

Another villager, Mrs. Peninah Njeri, could not hide her joy as she exalted GDC's efforts in the area.

"Now we have a good road; there is electricity nearby and we are expecting water in the near future. It is also easier for us to rush a patient to hospital," she said. "Power is key to business operations and we will be happy once we are connected. We also thank GDC because our youth who used to be idle have some job to do."

The road to plenty... *Wanyororo villagers have started to enjoy the fortunes of a geothermal revolution.*

Workers off-loading pipes in Menengai

Piping Menengai

Clunks and drones, fleets of tracks packed at a storage yard, a wheezing folk lift hauling and packing and a lone crane pulling and twisting.

These are the sights and sounds of Menengai now as the long-awaited Victaulic pipes finally made their way to the caldera in some 60 long trucks. To many a resident of the caldera this is just but spectacular; to GDC it is a great milestone.

The pipes are intended for water supply from the pump station to the drilling sites.

"It is big milestone for GDC," said Johnson Mungania, the Manager Infrastructure & Logistics.

"These are high density pipes that are suitable for water supply. They can run for 50 kilometers."

In drilling operations water is key hence the excitement that has greeted the arrival of the pipes.

The Victaulic pipes are unique because they can easily be re-routed at short notice and be connected to any new well pad.

Now the pipe network is ready for the drilling operation.

GDC shines at Djibouti forum

GDC staff who presented papers at the ARGEO-C3 conference in Djibouti received a standing ovation for a job well done.

The MD, Dr. Silas Simiyu, was buoyant as he received congratulatory messages from Djibouti.

"I'm pleased that our team demonstrated a variety of expertise that went beyond the traditional geothermal subject. The diversity in the papers placed GDC on the global map," note a buoyant Dr. Silas Simiyu, GDC's Managing Director and CEO.

The 18 staff participated in the conference which aimed at creating an information exchange platform on the exploration, development and utilization of the geothermal resources in the region. It is organized under the auspices of Africa Rift Geothermal Project.

Kenya also successfully bid to host the ARGEO-C4 conference to be held in Nairobi in 2012.

ARGEO regional project is dedicated to the development of clean geothermal resources mainly for energy production in the East African Rift System. ARGEO-C3, is the third bi-annual conference organized after the Addis-Ababa 2006 and Entebbe 2008.

Key thematic areas covered during the conference included exploration methods in geology, tectonics, geophysics, geochemistry and isotopes, hydrology, GIS, CDM, and remote sensing.

The conference also explored economic and financial issues, involvement of the private sectors and environmental, CSR, legal and institutional aspects.

Footloose scientists smell coastal steam

Mwana Nyamala in Coast Province may not ring a bell, yet it may be the next bet in geothermal development.

When three GDC scientists attended the Mombasa Trade Fair, they detoured 100 kilometers south of Mombasa in Kwale where the hot springs of Mwana Nyamala bubble infinitely. The area lies between Jombo and Mrima Hills.

Here, they found three main hot springs and a few other small ones within the area which is also known as Maji Moto. The team measured the water temperature which ranged from 550c to 700c.

"We easily identified the hot springs, a great clue of geothermal activity," said an ecstatic Joseph Wambua, a reservoir scientist, who was among the group.

These hotsprings gave the team confidence that there is a geothermal activity in the area. Locals said that there is another hot spring further west, but it was inaccessible because of bad roads. The hot springs suggest the existence of a geothermal resource within the vicinity. More scientific detailed exploration has since been carried out in this prospect. Findings will determine the next step.

The smell of steam... *Joseph Wambua (left) and Levi Shako (right) take water temperature at Mwananyamala.*

GDC marks milestone as rigs land

The machines are here...*GDC rigs being assembled in Menengai.*

The two GDC rigs made their way to Menengai Caldera and stirred excitement in the geothermal world locally and internationally.

This historic development marked a turning point for GDC's efforts towards the envisioned 5,000MWe by 2030.

"This is a major milestone for GDC and Kenyans," noted a thrilled Michael Mbevi, the Manager Drilling Operations. "We are all excited as we prepare to venture into Menengai. We are privileged to be the people doing this."

"A rig is a bulky equipment with hundreds of parts. It took time to transport and assemble but we made it," Mbevi said. The rigs came in 320 trucks from Mombasa and it took the team up to seven weeks to complete the hauling and assembly process.

These dip drilling rigs are ultra modern. They are 2500 horse power with a capacity to drill up to 5000 meters under the ground. They are also complete with state of the art campsites where drilling staff will be accommodated.

The cubicles are self-contained, with key amenities including a shower unit, beds, and emergency lamp, lavatories, kitchen, dining hall and LCD TVs.

"This will afford for engineers a great working environment," explains Baraza Ali, a Drilling Superintendent.

Geothermal industry creates jobs for California

The geothermal sector is creating massive jobs for California USA. The Geothermal Energy Association (GEA) Executive Director Karl Gawell announced findings of new industry reports that demonstrate the geothermal industry will add thousands of jobs in California as dozens of new clean geothermal power plants come online or enter advanced stages of development.

GEA released reports on job creation in the geothermal industry and an industry update. The reports reveal how the industry is creating more jobs than conventional energy and is "creating jobs that are permanent, full-time, and often provide a higher wage -in some cases with pay that doubles county and state averages."

The GEA report—"Green Jobs through Geothermal Energy"—found that the federal stimulus, tax incentives, and strong state renewable standards continue to fuel the growth in geothermal power and job creation.

In US, every geothermal project that came online in 2009 took advantage of the tax reimbursement provisions of the stimulus bill, which helped maintain momentum for new projects and continue to create new jobs in America.

GEA predicts that 2011 will be a high-point of geothermal activity in the US under the stimulus legislation. There will be approximately 500 to 700 Megawatts of power projects in the final construction phase in 2011, and these projects will add approximately 3,000 construction jobs, primarily in Nevada and California.

Because of its location on the Pacific's "ring of fire" and because of tectonic plate conjunctions, California contains the largest amount of geothermal generating capacity in the United States, according to the California Energy Commission.

Global geothermal capacity set to jet up

The global geothermal capacity will register a 78-percent growth by 2015, a new report shows. In its recently released Sixth Edition of the Geothermal Report, ABS Energy Research concludes that although 2009 was a very difficult year for the geothermal industry, the market will continue to grow over the next five years.

According to ABS Energy's research, only 10 projects, totaling 405-megawatts, were commissioned in 2009. The geothermal power projects were located in the United States (181 MW), Indonesia (137 MW), Turkey (47 MW), and Italy (40 MW). The report states the requirement of high up-front investment along with high risk associated with developing geothermal projects as the chief catalysts for the tough year.

Nevertheless, the Geothermal Report says the overall outlook for the geothermal industry is positive. ABS Energy expects the global geothermal market to increase 78 percent between 2010 and 2015; this would bring global capacity to 19,016 MW.

The countries driving this growth will be the current world leaders in geothermal production: the U.S., the Philippines, and Indonesia. Geothermal energy is set to enter new markets, however. ABS Energy projects the number of countries producing geothermal energy to rise from 24 at the end of 2009 to 36 in 2015.

Steam jets of Lake Bogoria, Kenya

The Kenyan Case

Kenya, which has begun to aggressively pursue the development of her geothermal resources, will be one of the largest new markets. For instance, the Geothermal Development Company (GDC) is opening up a new field in Menengai, central rift. GDC is a state corporation formed in 2008 as a special purpose vehicle to specifically accelerate the development of geothermal resources in the country. GDC targets some 5000MW by the year 2030.

Kenya is the leading producer of geothermal energy in Africa and ranks among the highest in geothermal utilization globally.

The Geothermal Report also highlights South American countries such as Peru and Chile as other emerging geothermal markets.

Resource Development in geothermal energy

10 Questions for the Manager, Mr. James Wambugu

What does RD concern itself with?

Resource Development Department's responsibilities cut across in all phases of geothermal development that can be summarized as follows:

Exploration Phase: during this phase the department's key responsibility is to explore for steam in geothermal fields. Exploration involves acquisition and interpretation of scientific data and recommending best sites for geothermal wells.

Well drilling phase: The RD department carries out geological well-logging and advise the drilling team on well-casing depths and the mapping out of well feeder zones.

Resource Development Geophysicists commissioning equipment in Menengai.

Field development phase: During the Field development phase The RD team carries out well-discharge, geochemical sampling and fluid chemical analysis to ascertain the heat content of the discharge fluids (enthalpy) and reservoir temperature. The department locates feeder zones in the well bore and approves the usability of the fluids in terms of power production or other uses.

The department also carries out consultancy work on geothermal exploration and development locally and internationally.

Briefly describe the sections that constitute RD.

Resource Development department has five sections: geology; geophysics; geochemistry; GIS and Information Science (Library)

Since the inception of GDC, which geothermal fields have you explored?

We have successfully undertaken geo-scientific exploration in Menengai, Silali, Homa Hills and Lake Baringo geothermal prospects. We have also done a reconnaissance survey in Mwana Nyamala at the Kenya coast, Barrier in the Kenyan north rift and most recently in Malawi (on consultancy). We have provided consultancy services to KenGen on several occasions which included training their staff on data interpretation.

What were the results from your exploration?

The results have been good. We have sited exploration wells in Menengai. More work is to be done in Silali and Homa Hills to confirm up the well sites

Which other prospects are you exploring soon?

We will set off to the Coast where we will carry out a detailed survey of Mwana Nyamala geothermal prospect, and to Barrier in the southern part of Lake Turkana. These are quite exiting prospects.

How does RD link with other departments?

RD is the first port of call in geothermal energy development. It is through our effort that we announce the existence of a commercially viable resource. We guide the drilling team on where to drill. We work very closely with Reservoir Engineering department during exploration, wells testing and steam field monitoring. We are always in close contact with Supply Chain Department when procuring equipment, while HR provides personnel to the department. In short, all our departments are interlinked to drive the bigger GDC dream.

What is it like to work in RD?

In my estimation, this is one of the most exciting departments. Imagine working out there in Silali in the middle of nowhere and coming out with fantastic results which end up in opening areas and availing steam wells for power generation!. Take Menengai for instance. Just a year ago it was inaccessible. When the RD team descended there, we came up with results that send everyone into action. Menengai will never be the same again.

Something even more fancy about working in this highly scientific department is that it never gets boring.

What are some of the challenges of the job?

Most of the time, we work in tough terrain; it really calls for a strong spirit to work in exploration.

To overcome these challenges, we used choppers to ferry staff to and from the Silali geothermal prospect. We also trained staff to ensure a sufficient pool of knowledge.

Describe your team?

RD department is comprised of the widest varieties of specializations from geologists, geochemists, geophysicists, GIS analysts and librarians. Having to interact with all these great minds to me is very exciting. The team is great and wonderful to work with. I just like the way they interact and work together even in the remotest areas.

What is the most important aspect you want to see GDC achieve?

My dream is to see GDC achieve the 5,000MWe goal. This will mean all persons in Kenya can enjoy affordable, reliable and clean energy.

Circuited to geophysics

The Sacramento Convention Center in California is brimful. Geothermal presentations cascades over each other as scientists from the world over share and interrogate their latest findings. In Room 4, Charles Muturia carefully and confidently takes the audience through geophysics results that earn him accolades.

Muturia, a Senior Geophysicist at GDC humbly nods to acknowledge the claps. A seasoned expert, his down to earth demeanor hardly betrays his significance in the geothermal field following his down-to-earth demeanor.

It is at Denver International Airport, a strange place to be biting chicken tikka, also a strange place to conduct an interview that Steam finally catches up with Muturia for an interview.

"My work is to supervise a team thats interpret electromagnetic data drawn from the earth and advise accordingly whether we have a geothermal resource or not," he explains softly.

Geophysics is centrally placed in any geothermal endeavor. GDC is no exception as it pursues to capture 5000MWe by 2030. It is guys like Muturia who are playing a pivotal role in detecting where the company can put its money.

As a geophysicist, he identifies areas of possible prospect for geothermal development. He investigates these using electrical methods such as TEM and MT. These methods capture image under the ground - what geologists can't see. He gets the pictures and interprets them to establish availability of resource.

Interestingly, Muturia did not train as a geophysicist. His entry was simply fortuitous. He trained as an electrical engineer. However, he found himself interacting with geophysicists in Olkaria where he was employed, and he was hooked into the discipline unreservedly, so he says.

"It was exciting" he says with a smile. And he put all his cards into it. The stake paid off. This opened doors for further studies that has seen him training at the Iceland-based United Nations University Geothermal Training Program (UNU-GTP). He has also been to Italy, US and Canada for short courses.

And so, the past ten years have been eventful and fulfilling to him, he admits.

"Geophysics was easy because my electrical engineering background afforded me a greater understanding than someone who has just done pure sciences. I understand right from equipment to the actual work," he explains.

'It's been challenging and interesting though. Geophysics is a dynamic area. Everyday new developments emerge. New software is developed, new techniques, new equipment and new way of doing things. You have to be on top of things to remain relevant. It calls for continuous reading and exposure to the area," explains Egerton University graduate who also studied Industrial Engineering at Mombasa Polytechnic.

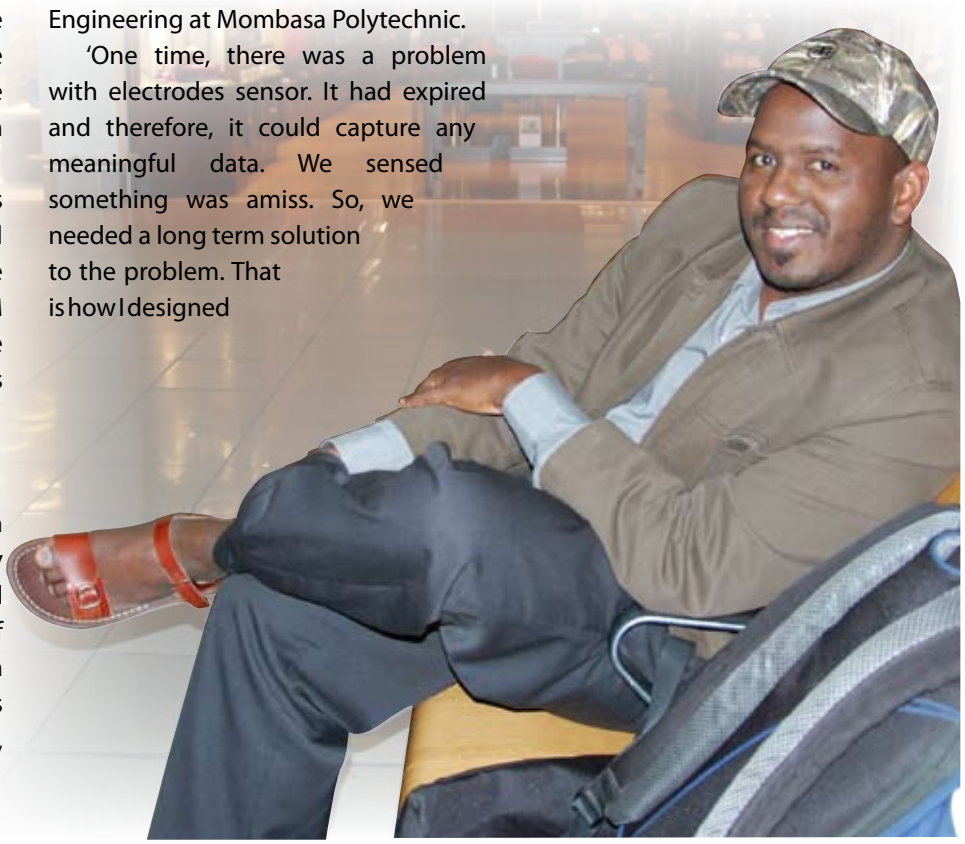
'One time, there was a problem with electrodes sensor. It had expired and therefore, it could capture any meaningful data. We sensed something was amiss. So, we needed a long term solution to the problem. That is how I designed and modified the equipment such that it could work. It never disappointed again."

Today, Muturia supervises 11 people. The biggest task for him is to nurture and mentor new talent that will be supportive of the section's demands.

"My high point is when I interpret data correctly so that we correctly indicate where a resource is. I'm glad that I have always got it right; that's a great source of inspiration," he says.

His job is demanding that is why he will be seen working at odd hours including weekends. "But I'm happy. GDC is a great employer. It gives staff an opportunity to grow. This kind of support is very rare elsewhere," admits the father of three sons.

And Muturia is widely traveled too. He has consulted on behalf of GDC in such places like Rwanda, Djibouti, and Malawi. Besides he is also a trainer and has for years been working with the UNU-GTP GDC KenGen short course program. Muturia has also presented numerous papers in local and international conferences.



Charles Muturia, Senior Geophysicist, GDC

The pastor who engineers geothermal reservoirs

Joseph Wambua, the Chief Superintendent, Reservoir Engineering Department, GDC

In geothermal energy, Joseph Wambua, the Chief Superintendent, working in Reservoir Engineering department at GDC, is a man who has seen it all. He saw Kenya's first power plant being assembled and coming online in Olkaria; he saw the creation of KenGen and then of course he joined GDC at its infancy.

"I have lived the geothermal revolution in Kenya," he chuckles. "I'm still thrilled of having seen the first geothermal power plant grow from scratch to production level," he says blissfully.

Wambua started off as a novice right from high school when he was absorbed by the now defunct East Africa Power & Lighting Company in 1981. "Honestly, when I was recruited I didn't not know what I was going to do," he says between laughter.

But that is then. Today, Wambua is a seasoned reservoir engineering expert. He is now now on a mission to nurture a new crop of young engineers who will take the mantle further.

Most of the time reservoir deals with heat and heat loss, size of the reservoir which is crucial to appreciate before drilling begins. Therefore Wambua will be talking about natural temperature, fumaroles, hot springs, and discharge tests. "The highest moment for me is when a well has been successfully tested," he enthuses.

"Understanding the nature of a reservoir is critical in geothermal energy. That is the only way we can ensure management of the reservoir for continuous production," he explains. "I strongly believe in geothermal energy as the fuel that will provide social economic transformation for Kenya."

Learned the ropes

When he began at Olkaria 30 years ago, knowledge on geothermal was scanty. For instance it is then that the first 12 wells had been sunk in Olkaria and the project was entirely being managed by expatriates. The Expatriate Reservoir Engineer had time to train the section staff both in the field and in class.

He got attached at the reservoir section where he worked with Hari Pratomo an Indonesian. "It is Pratomo who impressed on me take reservoir engineering," says Wambua.

All along Wambua has learnt the ropes on the job. However, he has also attended numerous short courses in the USA and Canada.

"My training in Reservoir Engineering was under a lot of pressure because of the high volume of work of testing wells and commissioning of Olkaria I."

He continues: "this intense training I would say is what made me to really get interested in Reservoir Engineering. Within two years I had learnt enough to be entrusted as a team leader while conducting Downhole Temperature and Pressure Surveys. I was also involved with Geothermal well assembling and Discharge testing," he recalls.

A keen Wambua then rose through the ranks to senior management level position before leaving in Sept. 2010. By then the Company had changed names from EAP&L Co to KPLC which was later on to be split into KenGen and KPLC.

On Sundays you will find Wambua who boasts a military height, pastoring at his Heaven's Gate Worship Centre, Naivasha. "I got saved way back in 1976," he says then clasps his hands. "That's why I have remained youthful," says Wambua who also has a Bachelor of Arts degree in Theology.

The father of four, and a teetotaler, insists that success is at the disposal of all the only difference is that the wise see opportunities while others see obstacles.

In his latest job, he deals with procurement of equipment, tools and materials for the department. It has been tricky, he concedes. Still he is grateful to his Manager Mr. Cornel Ofwona for the guidance and support.

"When I joined GDC, we were only two in the department – I and the Manager. It was a challenge to start off. Together with the manager we were able to assemble what is today the Reservoir Department."

"The reservoir team is also cooperative and I'm happy we are contributing something to the growth of Kenya," he offers.

"The critical task ahead is to train a team of reservoir specialists within the shortest time possible to meet the GDC Vision of 5000Mwe by 2030," he concludes.

In search of a nati

Scientists at work...*Marietta Mutonga (centre) and her team at a cliff in Baringo while Fred Ogada, Geophysicist uses his laptop to collect data in Silali.*

Exploring for geothermal steam is as exciting as it is energy sapping. **Erick Wamanji** *joins a team of GDC scientists on this whirlwind expedition that seeks to give Kenya 5000MW by 2030*

On a blistering July day, we slither under the thorny and tangled shrubbery at the rim of Silali caldera. Then we appear at a gulf created by years of flush floods.

Here, geophysicists lay loops to send TEM centres. Across, geologists are a top a rugged crag collecting soil and rock samples for later analysis. Critical to this enterprise is to determine the geothermal heat source and to map out any steam manifestations. The availability of steam requires the right blend of hot rock, permeability, water, pressure and time.

This makes it a heyday for geothermal scientists in Kenya. The country is on a high mode to harness her geothermal steam bestriding under the surface in excess of 10, 000MW.

Thus, over 100 GDC geologists, geochemists, geophysicists and GIS scientists have been traversing the breath and width of lonely calderas and volcanic cones searching for any indication of steam. The Resource Development (RD) Department at GDC leads these exploratory operations. Their previous findings have been inspiring.

For instance, the team zealously tackled Menengai caldera which promises 1250 MWe potential. Menengai is now ready for drilling and is likely to be the epicenter of Africa's geothermal energy.

"The geothermal resource in Kenya is plentiful," James Wambugu, the Manager RD once told me. "All these areas, you see, cry to be developed," he said pointing a stretch from L. Magadi in the south to L. Turkana in the north home to the most sought-after indigenous and clean source of energy.

The Government of Kenya created GDC as a special-purpose vehicle to drive this geothermal sector -a critical cog for Vision 2030. In this period, GDC is targeting over 5000MWe.

This explains why even as the scientists endure barbs, soiled cloths or a searing sun of the semi-arid, the determination is unwavering. Exploration is key to determining resource availability. Results inform policy, budgeting and guides drilling engineers where to sink their bits.

And after reading their data, the geophysicists code it into their laptops, haul their equipment, and board a chopper to another location. Geologists carry their samples and move on too. I tag on. Yonder is the caldera, lonesome but idyllic nonetheless, with an intimidating simplicity. What this world is lacking in productive vegetation it is making it up in steam. We trek past an acacia groove, down a valley to another site…

Homa here we come!

A week after Silali, our Surf is parked at Pala, a rusty market at the foothills of the rolling Homa Hills. This is approximately 700 km South-West of Silali.

"Homa Hills is at the Nyanzian Rift Valley and the least explored," says John Lagat, the GDC's Chief Geologist who has offered us a ride in his Surf.

We follow a cattle track to a chasm-like gorge whose floor has poodles of bubbling hot water -the Abundu Hot Springs. Lagat takes the temperature; it is 720C. Small wonder someone has been boiling eggs and sweet potatoes here.

Here, Fimbristylisexilis 'geothermal grass' galore. Lagat uproots, scrutinizes and records in his notebook. He notes the bubbles too. Geochemists, armed

on's fuel

with PH meters measure the soil and water acidity.

"There is another hot spring at Kathimu," our guide offers. We trek there.

On the way, Ogada and Waswa are sending TEM soundings. At the end a total of 24 soundings had been carried out using a 200 by 200 meter transmitter wire loop.

"The MT method has the greatest depth of exploration of the available electromagnetic methods and is basically the only method for studying deep resistivity structures," Ogada explains as he turns off the generator.

We take a different trajectory towards Got Homa, the highest peak of the ranges flanked by Nyansanja and Apoyo peaks. On the meandering paths, our boots crush on dry leaves, pebbles and undergrowth; occasionally we bend to dodge a thorny twig. Lagat picks a rock and gives it a close scrutiny as if it is the lost link to the sought-after heat source. "Ah, it hasn't much to tell us," he tosses it aside.

After a kilometer or so, he picks another rock and pours hydrochloric acid. It fizzes. "It is a carbonatite," he whispers. Still not better. On the way, his team picks a stone here and pours acid on others. Some react, some don't.

It dawns on me that exploration needs fortitude, grit and passion in order to work in some of the harshest spots of the country.

"Geothermal," Lagat continues, after the bulls have crossed the path, "is clean, a base load, in fact available at 95 percent, it's long lasting and has little or no emissions." Geothermal generates electricity continuously as opposed to other alternative sources of energy.

Friday is sunny and windy. At 12:45 pm we are at the shores of Lake Victoria. I have joined the GIS team. Fishermen are struggling to pool a net from the sea. Levi Shako, Irene Mboin and Calistus Ndongoli join to help. Mboin stops mid-way to record the fishing outpost in her GPS.

In this business of GIS, everything is captured. Earlier we recorded schools, roads, churches, markets,and we stopped along the way to note a prehistoric site. "These features will be updated on the base map to make it more comprehensive," Shako explains.

It dawns on me that exploration needs fortitude, grit and passion in order to work in some of the harshest spots of the country.

Muddy ride

Saturday morning is drizzly and hazy as I park at Tamarind in Lake Baringo. I'm slightly late for fieldwork since the day here for scientists begins at 6:00. Luckily, a Land Cruiser drives in; it is coming for water. I hitch a ride.

Marietta Mutonga, the team leader, is scrutinizing a map the size of a tabloid newspaper.

Towards Salabani the Cruiser wades and glides on muddy stretches. There was a torrential rain last night. We drudge on nonetheless.We have to go and capture sites and formations. On the way, we get lost, so, we pick Daniel Lempeina, a local, to guide us. Occasionally we get stuck and are called upon to push the Cruiser. However the Cruiser fails to proceed at River Endau which has burst its banks. We go back.

After trekking for three kilometers, we reach a jutting cliff and Gideon Yator who has been carrying a geological hammer starts hitting a rock. It's a stubborn rock, but finally it cracks and falls. The team rushes to it, and on preliminary examination they conclude that it contains the elements that are desirable by the geology team as an indication of the availability of a heat source.

At around 4:00 pm the skies have swiftly changed from azure to gray and grimy. There is a thunderbolt and then sharp zigzags of lightening slash the west over the Tugen Hills. Pregnant, the sky promises hailstorm.

"In exploration it's common for rain to ambush you anywhere. After that, you continue with your work," Marietta says. I'm worried for my cameras. We rush to the Cruiser several kilometers downhill.

Evening, and Charles Muturia, the Senior Geophysicist, is at the satellite office. Here data is streaming in. He shows me a screen with lines, contours and shades. It is the representation of the Silali Caldera.

"You see here, with deep blue, that is where the heat source is. It is not necessarily inside the caldera," Muturia announces.

(...Cont. page 17)

Menengai ripe for the driller's bit

The sprawling caldera is one of the most enigmatic geological formations on the continent. Initially a shunned and dreaded area, today Menengai has stuck its head high attracting international attention. ***Erick Wamanji*** *has been following the Menengai transformation.*

One of the he world's newest geothermal projects is gearing up for development in Menengai, Kenya. The Geothermal Development Company (GDC) has brought in two new rigs that will soon be piercing steam wells in this iconic prospect.

Already massive preparatory ground has been covered in civil works: roads have been paved, boreholes drilled, water tanks erected, water pipelines laid, a power substation build and a water pump installed. Besides, a rig camp has been set up and the rigs assembled – all set for the historic drilling.

From a lonesome and shunned caldera, Menengai has been a flurry of activities in the past year. Bulldozers have roared here and a file of long distance trucks has snaked past the windy and dusty roads to deliver rigs, water pipes and assorted parts. Moreover, detailed surface studies in geology, geochemistry, geophysics and surface heat measurement have been successfully completed.

"We are expecting to start drilling anytime soon," says Michael Mbevi, the Manager, Drilling Operations at GDC. "We're optimistic that Menengai will yield bountiful steam."

To GDC and indeed Kenya, Menengai is a jewel prospect. It is the first field to be drilled in Kenya outside the traditional Olkaria area. Besides, the resource here is a cause for smile – an estimated 1200MWe potential.

And when the drillers bit sinks in Menengai, GDC will harness 400MW of steam by 2014, 600MW by 2016 and 1000MW by 2018, says Dr. Silas Simiyu the company's Managing Director and CEO.

There are every indication that Menengai is geothermally active. Such manifestations include: the young volcanism represented by the numerous recent eruptions both inside and outside the caldera; the large caldera collapse and intense tectonics resulting in faults. Furthermore, there are occurrences of active fumaroles, steaming grounds, the geothermal grass and warm or even hot water from boreholes and rocks. All these are indications of a geothermal resource.

The towering collosus... *The first GDC rig towers the Menengai landscape with majesty.*

And thus, anyone who understands geothermal energy will appreciate the prospect. Menengai has all the hallmarks of a great geothermal project. Its proximity to power grids, its geological and hydrological design is just awesome not to mention the bountiful geothermal resource.

Triple Rift Junction

The Menengai-Olbanita area is located within a region of intercontinental crustal triple rift junction. This is where

the Kavirondo Rift joins the main Kenyan rift. The Kavirondo rift has been inactive since at least upper Pliocene, wrote Dr. Silas Simiyu in a paper titled Application of Micro-Seismic Methods to Geothermal Exploration: Examples from the Kenyan Rift.

Huge amounts of pyroclastics cover the slopes of Menengai and areas around Ol-Banita. These vary from ash fall, pumice rich ash deposits, welded pyroclastic flows (Ignimbrites) and some proximal lithic tuff outcrops adjacent to the Menengai explosive caldera. The source of the pyroclastic eruptives is obviously the explosive eruption accompanying the formation of Menengai caldera.

To GDC, Menengai is a flagship geothermal project arguably going to be the epicenter of Africa's geothermal energy.

The Menengai project began in earnest soon after GDC was formed. A team of scientists was deployed to for exploration. The two-month exercise gave Menengai a clean bill of health.

There is a resource

This prompted the GDC infrastructure team to move to the caldera in February 2010. The engineers were moving into a hostile and unpredictable terrain. Yet this did not deter the team. Boulders, stones, lava rocks and soil had to be turned one after another to pave way for accessibility.

To GDC, Menengai is a flagship geothermal project arguably going to be the epicenter of Africa's geothermal energy.

Two rig camps have been set up while the rig assembly is complete. The rig is a colossus of engineering and towers the contours of the Menengai caldera with majesty.

Menengai is an indication of the government of Kenya's commitment towards the development of geothermal energy in the country. On this vein, GDC has invited bids from interested investors to put up power plants in the prospect. (See Investor Talk on Page 26).

Geologically, the Menengai Caldera and the less distinct Ol-Rongai and Ol-Banita calderas imply that partially emptied magma chambers which provide a heat source for the geothermal systems exist in the prospect.

This heat source is covered by thick layers of condensed volcanic ash and lava flows that serve as a cap rock. The cap rock seals the heat beneath the surface.

Temperatures for the reservoir show that it exceeds 250 degrees. This is excellent to sustain heat and pressure.

Additional reporting by Sylvia Malimo.

In search of a nation's fuel

(From page 15)

Scientists trickle in with data in their flash disks. Muturia downloads, analyses and occasionally communicates with Nairobi about the progress in the field.

Fissures and faults

Sunday has come faster and the predawn darkness is fading swiftly to give way to a bright day. It is my last day here. We are already at Tamarind restaurant to collect our water bottles. We head north, and then veer N.E off-road for about five kilometers in the scrubland of the Baringo Fault. We abandon the Cruiser and follow a ridge on foot. We are searching for fumaroles that are said to be in plenty here.

The hot air hisses faintly escaping from loose rubble. I place the back of my hand, and jerk; it is hot. Marietta stops to record the fumerole in her GPS. Meanwhile, geochemists take samples for laboratory analysis. This way they can predict reservoir temperatures. They also carry out leakage areas which are good targets for drilling.

"Come, I show you something," Vincent our guide of the day whispers. He quickly leads the way to a small depression. "This hole was not here," he mutters pointing with his walking stick. "But two years ago it appeared; we are worried. May be our earth is sinking," he looks at the scientists for an explanation.

Marietta and team inspect the rectangular drop, the size of a coffee-table, exchange knowing smiles before assuring Vincent that all is well.

"It's a fissure," Marietta enthuses. "It's an indication that this place is still active geologically and there could be a heat source. Such fissures are caused by the movement of the tectonic plate," Marietta continues; Vincent listens attentively.

The Abundu hot spring in Homa.

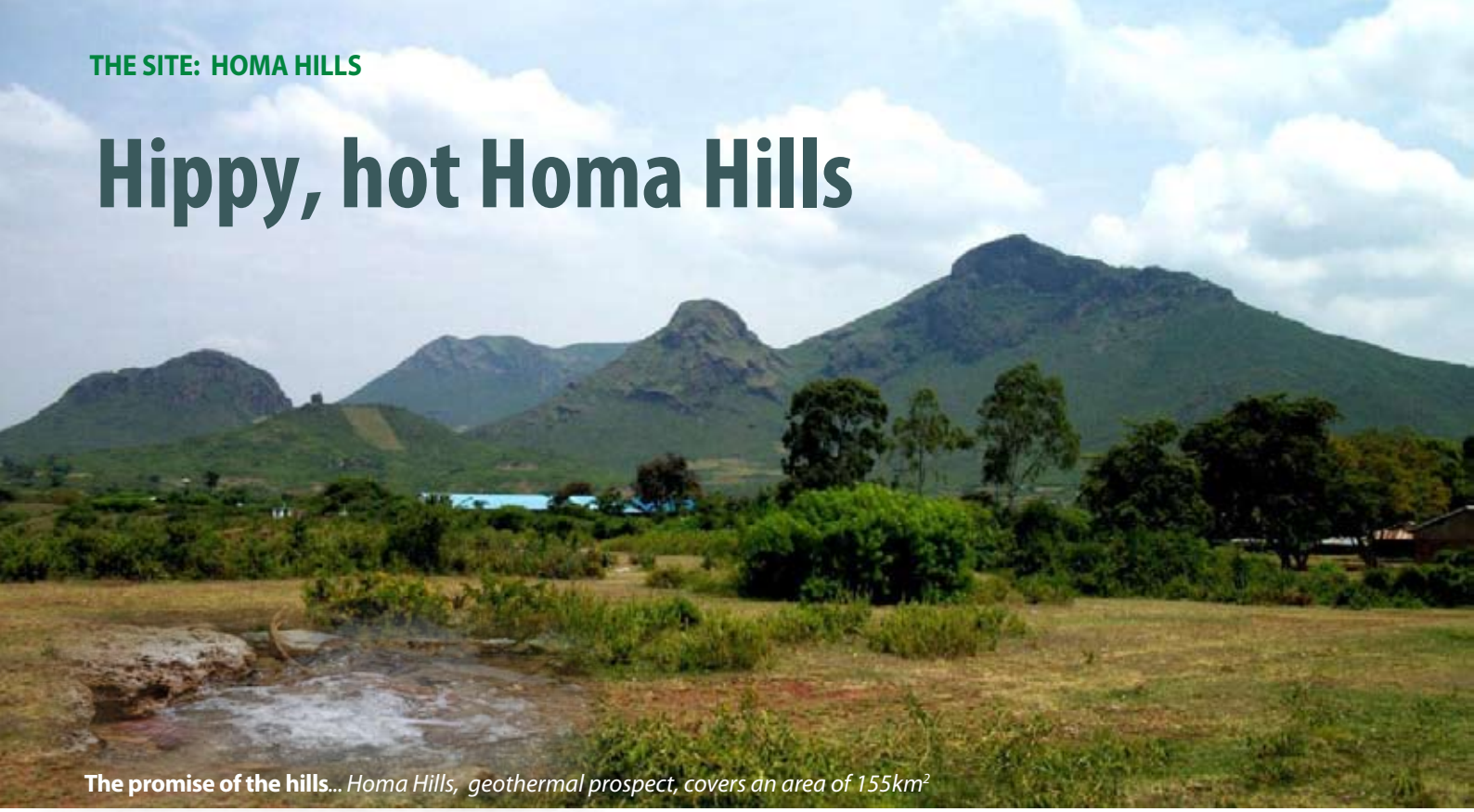
Marietta reaches for her GPS to record the finding. She takes a picture too. She also compares her tallies: six fumaroles, one fissure, and extensive cap rock.

"You see this layer," Marietta starts after a long silence. "This is the cap rock. It's made by volcanic ash from the Korosi volcano just nearby. Cap rocks are crucial in geothermal because they preserve heat." She explains. The cap rock is like several layers of blankets.

We reach the edge of the cliff and the team goes gaga. 'It's the fault!' "A fault is critical to geothermal systems. It shows permeability which is good for a geothermal reservoir," Marietta explains. Her team sits on the cliff, spreads the map and locates the massive fault. She shades yellow on the base map.

Dusk has come and our Cruiser zips towards the twinkling lights of 'Kampi ya Samaki,' beyond is the sparkling moonlit L. Baringo. Dinner is at 'Mama Mombasa Hotel,' a nondescript structure fashioned of aged timber and poorly hewn furniture. I join the scientists as they recap the day. There is an international football match and residents of the former fishing outpost peep to catch a glimpse.

Hippy, hot Homa Hills



The promise of the hills... *Homa Hills, geothermal prospect, covers an area of 155km²*

By John Lagat

Homa Hills, at the shores of Lake Victoria is as scenic as it is productive for geothermal development especially for generation of electricity using binary cycle and for direct utilization.

The prospect is located in the Nyanzian rift, which is a branch of the main Kenya rift. Geothermal activity in the area occur at the surface through a few widespread hot and warm springs, gas release in the springs and the Fimbristylis exilis 'geothermal grass' which is prevalent in the area. Hot springs temperatures of up to 88°C were measured from the hot springs at Abundu, 72°C at Kakdhimu, 43°C at Kokoth and 78°C at Rakombe.

These surface manifestations normally indicate existence of a hydrothermal system in a prospect. Consequently, Geothermal Development Company Ltd (GDC) as part of its mandate to develop geothermal resources in the country carried out detailed surface exploration to evaluate the geothermal resource potential in the area during the months of July and August 2010. The prospect covers an area of about 155 km².

The methods employed during the study included detailed geological mapping in order to understand the volcanological evolution of the volcano, hydrogeological regime and structural controls which are crucial in the development of a geothermal system.

Water and gas samples were obtained and analysed to determine the nature of the geothermal reservoir and also to estimate the reservoir temperatures. Geophysical techniques employed in the study included, transient electromagnetic (TEM) and magnetotellurics (MT). Joint TEM and MT inversions were processed to study the subsurface for the existence of electrically conductive zones that form the geothermal reservoirs.

The prospect is located in the Nyanzian rift, which is a branch of the main Kenya rift.

Integrated results of the studies indicate the existence of a geothermal resource in Homa Hills. The heat source is postulated to be associated with shallow magmatic/dyke intrusives along fractures. Estimated subsurface temperatures from gas geothermometers range from 160-200°C, which is ideal for production of electricity using binary cycle and for direct-use utilization.

The Homa Mountain sticks out sharply from its broad base of gentle slopes, has a flat top with a diameter of approximately 2 km across and is surrounded by a number of steep and gentle secondary hills. The hill has, as a whole, an oval shape approximately 6 km in long axis and 5 km in short axis. Its top reaches an elevation of 1571 m above sea level or of 610 m above the level of Lake Victoria. Most of the hill is government owned forest land.

The primary forms of direct applications that can be utilized in the Homa Hills geothermal prospects include spa pools, greenhouse heating, and agricultural produce drying and industrial processes. Most of these direct use applications utilize geothermal fluids in the low to moderate temperatures.

The prospect's proximity to Lake Victoria, a fishing haven, may prove to be a blessing to the local community. Availability of drying and cooling facilities powered by the available geothermal resource will create more business sense of the local community.

The Writer is the Chief Geologist at GDC.

Facts on Homa:

- Estimated Potential area: 11 km².
- Falls under the Nyanzian Rift
- The resource is suitable for electric generation using binary cycle and direct uses.

Defying barriers to Barrier Geothermal Prospect

By Debby Kalei

The mail inviting me to a tour of the Barrier Geothermal Prospect indicated that we would traverse for two days. "How far could is this place be anyway?" That was the question that lingered on as we prepared for the epic journey to Barrier.

Our destination, the Barrier Volcanic Complex, is the furthest of Kenya's geothermal prospects to the North. It last erupted in 1921 bringing to nine the number of times the volcano has erupted. The volcano derives its name from its location which is between Lake Turkana and the Suguta Valley, which hosts Lake Logipi.

Sites of the arid...*The GDC crew in Barrier.*

The sun spurred our enthusiasm as the 16-member team comprised of our resource development; reservoir engineering and performance management staff hit the road to Barrier. The reconnaissance trip was meant to scout for the most suitable access route to the prospect to pave way for logistical planning.

As we headed through to Rumuruti, Calistus Ndongoli, the only one in our car who had been to Barrier remarked, "This is the last time you will see tarmacked road for next five days." And his words came to pass. The tarmac road ended abruptly soon after we entered Rumuruti Township. The rough road stretched on boldly, barricaded each side by shrubs and it slowly but surely drew us deeper into its terrain, its monotonous tranquility broken by the scurrying hooves of dik-diks.

The terrain set the stage for a show down between man, machine and nature. Boulders and rocks seemed to have forged alliances to attempt to stop us from reaching our destination. At some point, actually, many a times, we had to stop to scoop sand from under the trees and pull rocks aside for the cars to pass through. Nothing could stop our journey to Barrier!

On the way, we came across a 200 year old tongue-shaped lava flow called Namurinyang that caused excitement to the resource development team. This was largely a stamp of approval on our trip as it means that the area has potential of being a geothermal gold mine.

On day three since our departure from Nairobi, we arrived at Parakati. Our arrival disrupted what would have otherwise been a quiet Tuesday for the Turkana Township. The four roaring engines drew most of the residents to the town centre. The locals informed us that there was no road to the domes through Parakati and advised us to use the Lake Turkana route instead.

Rocks spanned out kilometer after kilometer. The threatening roads accorded the powerful wind the mantle. The wind did not waste the opportunity to make its presence known to the strangers. Fighting to open doors and making gigantic steps in an attempt to hold the ground was the order of the day. Caps were held on tightly as we marveled and at times struggled at how strong the wind was. The locals, however, walked by normally, having made peace with the raging wind.

From the shores of Lake Turkana, we could see Likaiu, better known as Andrews Volcano. The Barrier volcanic complex is comprised of four overlapping shield volcanoes, including Andrews, and separates Lake Turkana from the broad Suguta trough to the south, the site of a former lake. The Andrews volcano separated from Lake Turkana 9600 years ago. Tuff cones are very common on the north and south sides of the volcanic complex. These cones, marked with sediments left from lakes, show that Lake Turkana and Lake Logipi were very high at one time. There are also many faults located on the Barrier Volcanic Complex.

The Persian green mighty and unending waters of Lake Turkana taunted us, peaking our curiosity by the second but simultaneously denying us access to the phenomenon that is Andrew's Cone. There were no roads to Andrews Cone and a boat had to be used to reach the Cone.

To reach the Andrews cone, we opted to use the Pararkati road, the one with boulders and narrow steep roads that humble both beast and machinery. The now routine activity of road works by hand took center stage as we skirted our way to the Cone.

Once again, nature boasted of its strength and we could not go past Pakasirto by car. If we had to reach the Cone, we would have to trek. The unforgiving sun by this time, was also in the loop. We learnt that it takes the locals three hours to go to 'Karai' as Andrew's Cone is locally known.

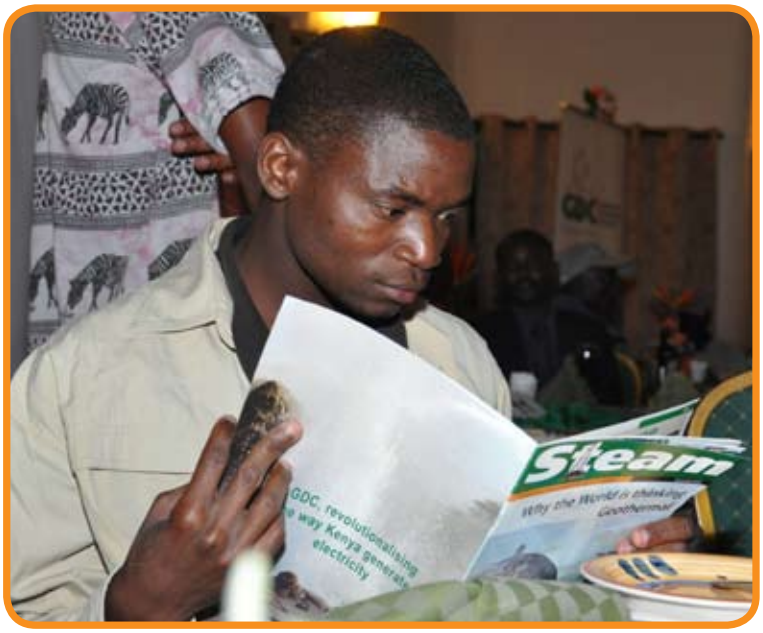
As we turned back to depart to Nairobi, we could not help but feel a sense of nostalgia. Though the trip had its challenges, we will definitely return to Turkana again and again. It was an amazing experience.

Debby is a PR Officer at GDC.

This is how we will get energy...*Paul Ngugi, Manage, Corporate Planning and Strategy makes a point to MPs during a visit to the Menengai Geothermal Project.*

The GDC song...*Lorraine Odundo, a Community Liaison Officer at GDC strums her guitar as she and her colleagues entertain staff during a past event.*

Titration...*GDC lab technicians, Rahel Baya (Left) and Roselyne Lovega at the Nakuru lab testing fluid samples from the field.*



Mmmm juicy stuff this...*A man keenly reads last month's issue of STEAM.*

No longer a man's domain...*GDC Director Rhoda Loyor tries her hand on a bulldozer in Menengai.*

Management for growth: The need to delegate

By Bruno Linyiru

GDC is now over a year old going by the fiscal calendar. Ours has been a breathtaking speed though it was worth the effort considering the rallying call of the 5000MW Team. The tasks, the assignments, the travels and the meetings have been energy sapping yet exhilarating. It is time to delegate!

But what is delegation

Delegation plays a central role in the proper functioning of every formal organization. It is the practice of conferring specified authority to act on behalf of a higher authority. In essence it creates shared responsibility. In this situation a special relationship is created between the manager and subordinate.

The key elements of delegation are authority, responsibility and accountability. It is important for the parties involved (manager and subordinate) to appreciate the implications of these elements. By delegation it means the subordinate can exercise legitimate authority and can exercise power within the rules and structure of the organization. He/she however has to be responsible and be ready to accept the reprimands and accolades that arise out of exercising this authority.

Ultimately the manager delegating has to be accountable for the performance and the buck stops with him/her the manager cannot shift back responsibility to subordinates as he is now

Arguments against delegation are many;

- we are few in the department,
- the capacity is not developed,
- the structures are not in place,
- we make decisions on our feet,
- it will take too long to train the staff,
- others fear that if they delegate and staff excel they may become dispensable.

The ultimate test of leadership is to leave behind men and women who can equally do your job well if not better. Managers need to allow employees who have and commitment and competency the space to do so. Delegation is not just the off-loading of work to the subordinates, but a carefully planned and executed supervisor-subordinate relationship within the company structure.

While the practice of delegation may appear easy on paper, experience shows that if not properly handled it may lead to abdication of responsibility. In order to realize the full benefits of delegation it is highly recommended that we adopt a structured approach by addressing a few basic areas:

- What tasks could be performed better by other staff
- What are the opportunities available for staff to learn through delegation?
- Who should get what tasks?

The million dollar question is how we will monitor the tasks delegated to ensure proper execution without exercising a lot of control.

By delegating you build trust, confidence, but ultimately it helps you meet your expectations and that of your staff. It takes a great deal of energy and commitment to be able to successfully delegate but the fruits are immense yields greater job satisfaction, motivation and commitment. Innovation is improved and more time is released for faster decision making.

The writer is the Manager, Finance at GDC

The ultimate test of leadership is to leave behind men and women who can equally do it good if not better i.e. allowing employees who have conviction and commitment and competency to achieve the space to do so.

Betting on Saccos

By Wendy Amondi

When Michael Joseph, former Safaricom CEO, said that Kenyans have peculiar habits, we made noise. How dare he say that! However, I see where he came from. The 'Makmende' craze is a case in point. The prominence given to the Kenyan 'superhero' made us make headlines in CNN, and notably not for bad news! Kenyans are known to take up a craze, run with it fully, or reject something ever so vehemently. How long the 'Makmende' craze lasted, you answer is as good as mine.

Three years ago, we did what we do best- we took up the pyramid scheme craze and sprinted with it. Most people in Kenya know someone who either benefitted or lost from the pyramid scheme scam. One thing for sure, we learnt our lesson, at least with regard to quick money. Kenyans now walk on eggshells when it comes to matters money. The get-rich quick schemes do not encounter the African open-arm welcome as was the norm.

Sacco magic

The government, during the pyramid scheme craze, cautioned Kenyans, and in the same breadth endorsed Savings and Credit Cooperative Societies. Popularly known by their acronym, Saccos are financial cooperative institutions fully owned and controlled by their members.

It is important to note that Saccos are not pyramid schemes or a merry-go-round. The monthly deposits are good collateral for loans.

One such outfit is Stima Sacco- an energy sector SACCO. Stima Sacco, in tandem with other SACCOs, has its low interest loans as its unique selling proposition. In times where bank loans are yes, easily accessible, but still maintain ludicrous interest rates, SACCOs offer much needed reprieve as one goes about acquiring assets or using the money for whatever purpose intended.

Taking a walk down the proverbial memory lane- how much have you made in terms of dividends from your bank account? Is it really an amount to write home about? Saccos on the other hand offer high dividends which are paid out yearly. The dividends are commensurate to the money you save- the more the saved money, the higher the dividends. For the financial year ending 2008, Stima Sacco paid a whooping 10.7% interest to its members, winning an award of highest dividend rate in the Parastatal sector.

Saccos have re-invented themselves to have more perks than banks. They offer similar services as do banks, but they have better terms. For instance, in Stima Sacco, members can use their accounts as their main accounts for transactions. The Sacco offers electronic transfer funds services, standing orders, cheque clearance, banker's cheques and ATM services. To keep with the current mobile banking trend, Stima Sacco also offers M-Pesa services.

The other reason why people prefer Sacco societies as opposed to pyramid schemes is the fact that members are involved in the running of the society. The supreme decision making powers are vested in the members.

Furthermore members are advised to be aggressive and active in knowing how the society works so that they can maximize their gains. Truth be told, Saccos are a perfection of banks, who knows maybe in the future Saccos will actually totally take the place of banks in Kenya's economy!

Wendy is a PR Officer at GDC.

Saccos have re-invented themselves to have more perks than banks. They offer similar services as do banks, but they have better terms.

Greening Menengai

By Ben Kubo

Green energy has now become a buzzword in energy circles as a sure way toward sustainable development. Geothermal energy is vital in this new energy dispensation. It is clean, renewable and affordable.

Appreciating that any development designs may impact on the environment, we at GDC have decided to monitor and reduce any possible negative environmental.

That is why as the Menengai Geothermal Project progresses, the environment team is busy re-greening the site by planting grass and trees in a bid to restore Menengai's lost green glory. The sheer presence of GDC at Menengai has caused natural vegetation to sprout. This is because, with GDC, there is now control over illegal charcoal burning which has for long contributed to the depletion of the once lush forest.

At the same time, a tree nursery is incubating and soon we will be planting the seedlings. We have even sourced forest soil from Dondori to ensure the seedlings thrive.

This approach has proved beneficial even to the local community who we engage in tree planting jobs.

Geothermal energy provides clean, stable and reliable source of electricity over traditional fossil fuels. Harnessing the green energy from naturally occurring steam and hot water trapped in reservoirs of permeable rocks beneath the earth's surface presents great potential to alleviate global warming.

Geothermal energy provides clean, stable and reliable source of electricity over traditional fossil fuels.

The fact that multiple wells can be achieved through directional drilling, land space required for development of the resource is therefore minimal. This also means less vegetation clearance during the preparations of a well pad. This is the principle that we are applying in Menengai with much success.

Our foremost endeavor is to restore geothermal areas close to their natural states thus enhancing biological diversity conservation. This will be achieved through afforestation and reforestation. This way, multiple land uses can then prevail in such habitats. A case in point is when wildlife conservation is engaged alongside geothermal development projects as well as use of the geothermal areas for leisure and recreation.

It is our commitment at GDC to pursue all practises that will save the environment from pollution as we strive toward getting affordable, safe and reliable energy.

Striking a balance between society, environment and geothermal development is crucial in achieving both intra and inter-generational equity.

Kubo, the Area Manager Central Rift, is the Manager, Environment, Health and Safety.

How GDC is putting the community into perspective

Menengai residents in a past meeting with GDC.

By Grace Mwai

Geothermal development and community progression are intertwined. That is why we at GDC are taking the community welfare and interest as an integral part of our business.

We engage in community sensitization, land compensation, stakeholder consultation and community empowerment.

The geothermal resource cuts across diverse communities. Most of these are in remote areas with different social-cultural backgrounds which call for various approaches in an effort to create rapport.

Therefore, dialogue is at the heart of our enterprise. We explain the geothermal concept – from exploration to power generation with a view of winning the community's understanding and support. This exercise is always exciting as the team interacts with new people and learns new cultures.

We enjoy brain storming with communities to identify priority areas where the company's CSR initiatives can be channeled. It has been interesting to hear their stories, dreams and aspirations. Mostly, the community knows what it needs; ours to simply to provide a facilitation platform.

We collaborate with the communities in the implementation of community-oriented projects such as afforestation. We strongly involve locals in establishing tree nurseries. Currently, we are in the process of rehabilitating the Menengai Forest.

GDC has so far interacted with communities in Menengai, Homa Hills, Baringo, Baringo East Pokot, Mwananyamala and Barrier in Turkana. This engagement is continuous.

Our interest has been in socio –economic surveys which involve collection of data on population, economic activities, social activities, institutions that exist, resources available within the locality and cultural practices that dictate GDC's engagement with these communities.

Challenges

Dealing with communities is not easy though especially when introducing a new concept like geothermal energy.

But the trickiest bit has been on the cultural-religious angle embedded on geothermal manifestation like hot springs and steam. To most, these are shrines and can only be accessed for special prayers and sacrifices. It calls then for prudence.

We educate the community on the presence of geothermal energy and what it means for local and national development.

Certain cultural practices such as cattle rustling put at bay our team for security reasons. Still, GDC staff has been as diplomatic as possible, avoiding to be drawn to local politics but focusing on the greater good- developing resources and people.

The most exciting reality is that when the existing communal governance is engaged, it has been smooth penetration to such areas and GDC is embraced.

Enculturation has been embraced in our work. Liaison staff had to learn the basics of the local language to mingle with the community and this enhances acceptance and understanding between the community and the company. We attend certain cultural ceremonies, such as initiation ceremonies, in Silali for instance, and this enhances bonding with the local communities.

Offering diverse perspectives to issues has been critical to us. For instance, we discuss and sensitize the communities on certain cultural practices such as Female Genital Mutilation, early marriages, among others.

In other places like Menengai, we had to compensate the farmers to surrender strips of their land for road expansion. It was a complicated process whose successful conclusion marked a major score for GDC.

The community liaison team plays a significant role in enhancing community participation in the company's exploration enterprise. This way, we facilitate in ensuring that all casual jobs in our areas of operation go to locals on a fair basis.

To us, the community is a critical part of our success. We so believe in empowering the community and ensuring a healthy relationship.

400MW geothermal investment up for grabs

By Ruth Musembi and Paul Ngugi

They say the taste of the pudding is in the eating. In the last issue, we promised you that the geothermal cake in Kenya has become bigger and sweeter. And now, here comes the first chunk of that cake.

GDC now invites investors to partner in the development of an estimated 400 MW under the Menengai Phase I Geothermal Project. By 2014 The investors will have an opportunity to install the first four power plants each with a capacity of at least 100 MW.

The entire infrastructural framework is in place with an access road and drilling water pipeline. The National Environment Management Authority (NEMA) has given the Menengai project a nod.

Having acquired two 2000HP drilling rigs which are already at the Menengai geothermal field, GDC is ready to commence the drilling of 120 wells. Additional rigs are on order and are expected by the end of 2011. GDC will drill exploration, appraisal and production wells, undertake feasibility studies, and reservoir management, as well as develop a brine re-injection system.

The investors' role

Investors will be expected to finance, design, construct, operate and maintain power plants. Prior to the construction of the power plants, GDC will require the selected investors to partner in financing GDC to undertake steam development. The investors will, in return, have the opportunity to install wellhead generation units for early power generation as they await the development of adequate steam for 100MW power plants.

Arising from the expression of interest, GDC will shortlist interested investors who will subsequently be invited to submit proposals. The appraisal of submitted proposals will be complete by November, 2011.

Prior to selection, an investor will be expected to successfully negotiate a Power Purchase Agreement (PPA) with Kenya Power and Lighting Company Limited (Kenya's national power off-taker), secure a generation license from the Energy Regulatory Commission and conclude a steam supply agreement with GDC. The investor will be expected to conclude financing by November 2012 after which a period of 24 - 36 months will be provided for power plant construction.

While GDC has obtained an ESIA from NEMA for entire Menengai geothermal project, investors will need to obtain ESIA license for the power plant.

Prequalification will be based on the capability of investors to mobilize adequate financing for the power plant construction. The expected capital structure for the power plants is at least 25% equity and 75% debt. The interested investor(s)/consortia shall establish that they have the capability to raise at least US$ 400 million for the development of at least 100 MW supported by letters from credible financier(s).

Further, investors must demonstrate experience in geothermal/thermal project implementation with at least one project of a size not less than 30 MW implemented in the last 10 years. Also required will be the names, location, current power plant(s) status and size of geothermal projects and other power generation projects undertaken by each investor in the last 10 years with indicative project costs.

GDC will need a list of the lead project managers from within their organizations, contractors and consultants who will be in charge of the Menengai generation project in the event that the investor is selected.

As part of legal requirements, the investor must provide certified copies of audited annual reports for the last five years, articles and memorandum of association and certificate of incorporation will be required.

In addition, investors must make a declaration of all pending litigation(s) against the investor(s)/consortia which shall in total not represent more than 10%, (ten percent) of the investor(s)/consortia's net worth.

Although the government of Kenya will not provide sovereign guarantees relating to this investment, investors can seek other alternatives such as MIGA (World Bank)

GDC is a 100% state-owned corporation, tasked with accelerating the development of geothermal energy in Kenya. The Menengai Phase I geothermal project aims to realize about 400 MW by year 2014, 600 MW by 2016 and 1000 MW by 2018. The long term plan is to develop 1000 MW. Detailed surface studies comprising of geology, geophysics, and surface heat measurement estimate the field potential to be about 1250 MW.

For more information contact pngugi@gdc.co.ke

Steam condensate from a geothermal power plant.

Photo: Courtesy National Geographic

Where it all began

Myth and medicine from a hot earth

Long before the first geothermal power plant was built in 1904 in Lardarello, Italy, ancient people had ingeniously engaged geothermal energy in their lifestyles. Consequently, they set the ground for direct geothermal uses and for modern utilization.

Hissing steam vents, geysers, steam jets, bubbling hot springs have been around for ages. Documentary evidence adduce that people of yore utilized these geothermal manifestations for bathing, cooking and for skin therapy. Ancient Chinese for instance as much as Americans, Greeks, Romans and Japanese developed spas from these geothermal marvels.

They also generated epics and religious myths around these manifestations that inspired odes from enchanted poets with equal measure. In fact, tales abound of these specters gathered from communities; fascinating tales that cut across the spectrum from Tibet in China to the Red Indians in Americas; from Pokot in Kenya to Indonesia. The manifestations have been nothing but entrancing.

In Stories from a Heated Earth, a GRC publication, People from Asia and Africa to Europe and Americas have bathed in hot springs to alleviate arthritis, rheumatism, psoriasis and leprosy.

Take the Bath City in Britain for example. Legend has it that one Bladud, son of King Lear- yes he of Shakespeare - was a leper and would labour as a swine-herder. He noticed that his pigs enjoyed the hot mud near the meadows. The pigs would soon heal from scabs and scurf - skin diseases. Bladud thence wriggled himself in the muddy pool and was healed. He would later become the ninth king of the Brit, founded the Bath City and built many public baths for others to get the healing.

Bladud's is just one among hundreds of legends revolving around early geothermal.

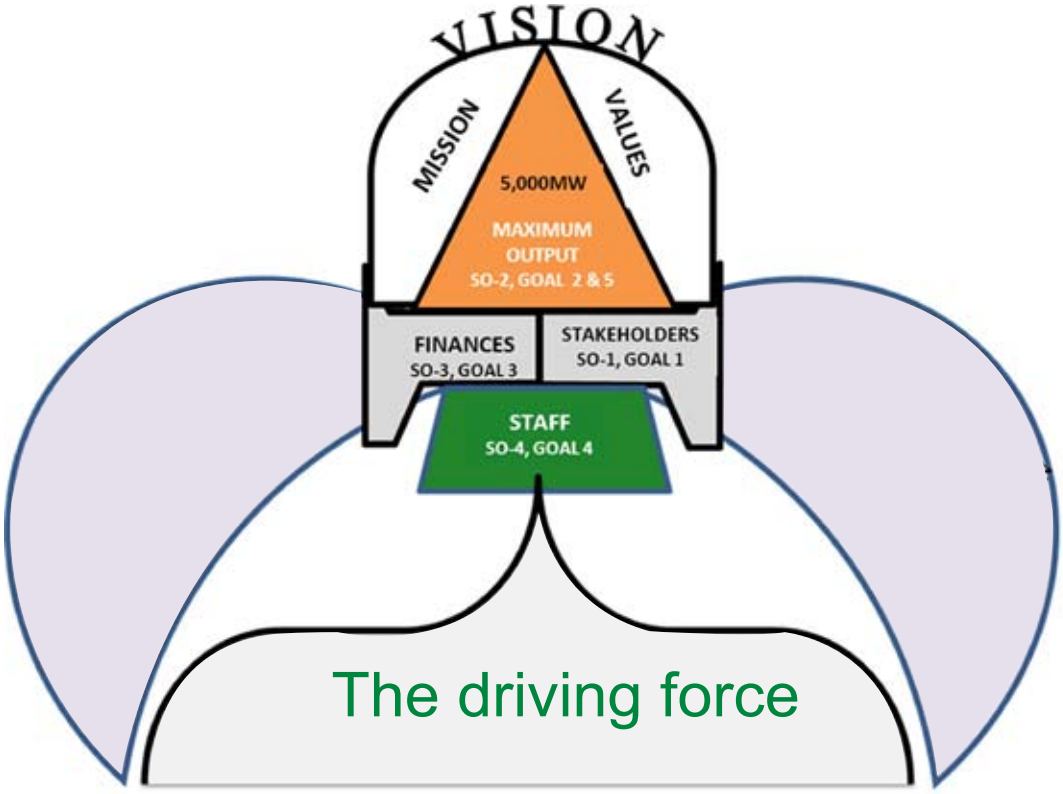
This is how the National Geographic captured the Indonesian case: "on a less earthly plane, volcanoes stand at the heart of a complicated set of mystical beliefs that grip millions of Indonesians and influence events in unexpected ways. Their peaks attract holy men and pilgrims…"

Apart from bathing, Romans created ice using thermal differentials – carving pits, putting in water and covering them during the day so they would freeze at night. They also employed the same to treat eyes and skin diseases.

In Kenya for instance, geothermal manifestation have attracted intriguing religio-cultural dispensation. In Pokot, Kenya, the fumeroles are equated to actions of a deity reigning over rain, while in Menengai it was believed the devil lit fire at the caldera.

Today, the sophistry of geothermal technology is incredible, and it keeps on evolving. Of course you well know about geothermal energy for electricity generation. Beyond that, direct utilization of geothermal energy has emerged as a multibillion lucrative industry. And this cuts from recreation to industrial applications for food preservation like milk pasteurizing, drying of vegetables and fruit products. Greenhouse heating and sterilization is also a common feature for direct utilization of geothermal energy picking up from the ancient societies.

THE GDC DOVE



The GDC Dove is flying us into our Vision, guided by the two eyes which are our Mission and Core Values. The Dove's anchor and foundation is having focused management of our key stakeholders and the Government which is our sole Shareholder. It is on this foundation that we shall be able to build great financial muscle and develop the required human capacity to support our main objectives which is to accelerate the development of geothermal to deliver 5,000MW by 2030. The panoramic View of GDC is anchored on the key four strategic objectives and five strategic goals summarized below.

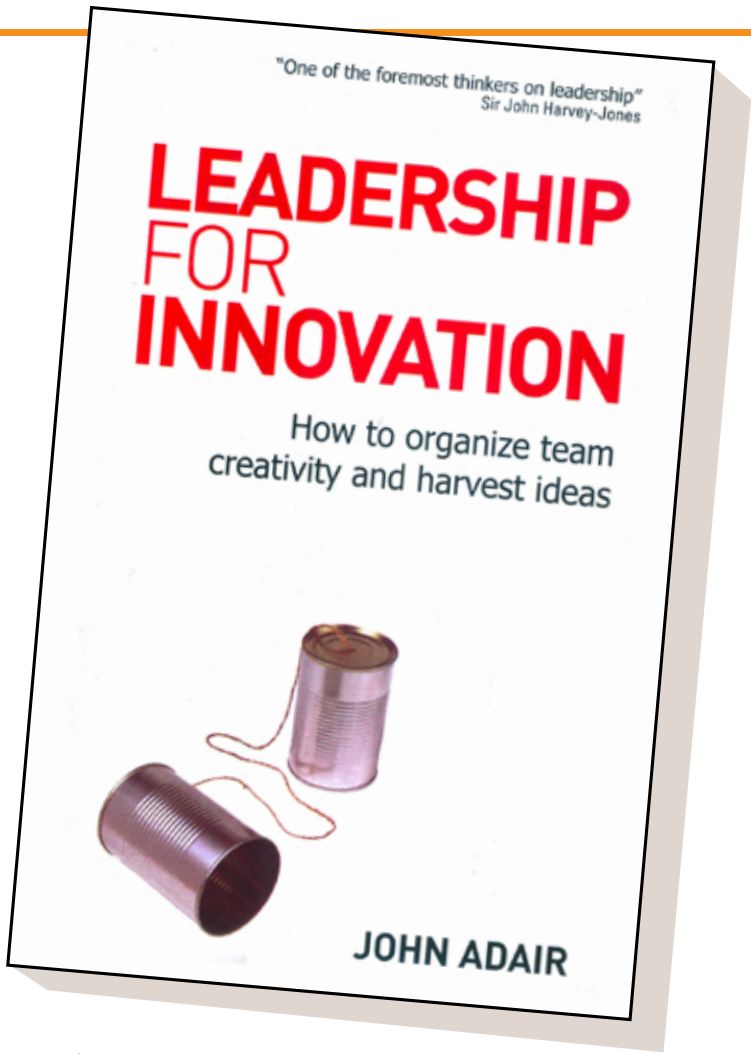
STRATEGIC OBJECTIVES

- To enhance working relationship with the Shareholder /Stakeholders
- Fast track and maximize addition of steam capacity
- Raise adequate initial capital, attain financial self-sustenance & maximization of profitability
- Recruit, develop and retain highly skilled and motivated workforce

STRATEGIC GOALS

- Facilitate Private Sector participation in the development of geothermal resources in the country
- Facilitate the realisation of 5,000MWe by 2030 through sustainable geothermal development
- Attain financial sustainability through prudent financial mobilisation and management
- Build and develop human capacity in geothermal to support accelerated resource development in the Country and the entire region
- Facilitate the development of alternative utilisation of geothermal resources

GDC Geothermal Development Company
Powering the Vision



Title: **Leadership for Innovation**
Author: **John Adair**
Publisher: **Vinod Vasishtha for Kogan Page India Private Limited**
Pages: **134**
Price: **Kshs 995**
Year of publication: **2007**
Reviewer: **Godffrey Olali**
Available at leading bookshops & supermarkets

Leadership for Innovation is an essential book which looks at how you can encourage new ideas as a leader and then create teamwork necessary to translate them into improved products or services. It is a simple piece of literary work useful to managers and aspiring leaders in the corporate world.

Written in simple, concise and precise corporate language, renown Leadership author John Adair, helps in inspiring teams to create the kind of products and services that are the foundations for organizational success.

Drawing from real-life examples, including huge successes of organizations like Google, Honda Corporation and 3M, Adair sets out clear and practical ways for bringing about desirable change in organizations, through innovation, change and competent leadership.

Leaders who encourage creativity will provide general direction and perform the necessary leadership functions-defining objectives, planning, controlling, supporting, and reviewing to meet team and individual needs.

Leadership for Innovation advices leaders to embrace change and innovation in organizations. It also highlights barriers facing organizations which do not embrace innovation.

Citing the works of Sydney Brenner, Adair says "innovation is a gamble." He further warns that 'if you have never worked on the edge of failure, you will not have worked on the edge of real success." He says that "creative people respond well to an organization which encourages them to take calculated risks."

Adair says that a company which does not confront change, or sees no need to innovate, will stagnate, decay and eventually die.

Major change may come as a challenge to some people; but while it comes as a threat to others. Nevertheless, Adair observes that the spirit of innovation is evolutionary rather than revolutionary.

Unwise leaders

"Only unwise leaders try to push change against a sea of determined and sustained opposition. If that happens to you, you have come up by the wrong path. But innovation that better satisfies a perceived want, or reduces a source of annoyance or complaint, will soon gather a massive following and win acceptance."

Educated at St. Paul's School, in Britain, John Adair has enjoyed a colourful career. He served as adjutant in a Bedouin regiment in the Arab Legion. After Cambridge, he became Senior Lecturer in Military History and Leadership Training Adviser at the prestigious Royal Military Academy, Sandhurst, before becoming the first Director of Studies at St George's House in Windsor Castle. He rose to become the world's first Professor in Leadership.

HIGHLIGHTS

- Innovation calls for good leadership throughout an enterprise.
- Innovation turns ideas into useful, practicable and commercial products or services.
- Innovation encompasses gradual improvement of existing ideas and forms, products and services as well as the marketing of new inventions or creations.
- Change throws up the need for leaders; leaders tend to bring about change.

GDC offers professional services in:

1. Geology

- Field mapping
- Well logging,
- Preparation of thin and polished sections
- Petrographic analysis
- XRD Analysis and Interpretation of clay and mineral aggregates
- Strategies for field development and management

2. Geophysics

- Training on data processing and interpretation
- Geothermal Exploration Surveys using Magnetotellemic, Transient Electromagnetics

3. Geochemistry

- Geochemical exploration
- Chemical analysis of liquid and gas samples
- Assessment of geochemical characteristics of geothermal reservoirs
- Reservoir chemical tracer tests
- Geochemical monitoring of producing fields
- Interpretation of geochemical field production data

4. GIS and Survey

- Digitizing of maps using ArcGIS
- Deformation Monitoring
- Mapping of infrastructure, land use/cover
- Production of Visualization Maps for Geoscientific investigations
- Design Suitability Models for Geothermal Well site selection

5. Geothermal Reservoir Management

- Well tests
- Reservoir Assessment
- Re injection scheme design, production field monitoring and management
- Simulation studies for predicting field life

6. Drilling

- Drill hole design
- Drilling of geothermal wells
- Design and construction of brine disposal systems

7. Environmental Management

Environmental Social and Impact Assessment and Audit

- Environmental education
- Air quality assessment
- Waste assessment and management

For more information contact:
Geothermal Development Company Limited
Taj Tower, Upper Hill 9th Floor
P.O. Box 100746-00101, Nairobi • Tel:+254 20 2427516/19
email: jwambugu@gdc.co.ke • www.gdc.co.ke

GDC Geothermal Development Company
Powering the Vision

The Kenya Geothermal Conference 2011

Focus on:- Geothermal Exploration, Drilling, Reservoir Management, Project Financing, Generation, Direct Utilization, Environment and Investment Opportunities.

This conference will focus on all aspects of geothermal exploration, development and utilization in Africa.

You are all welcome.

Who will you meet?

This will be a great opportunity to meet professionals from across the African region and beyond. This will include:

- Geothermal professionals
- Policy makers
- Project developers
- Environmentalists
- Utilities
- Investors
- Manufacturers
- Financiers
- Drilling contractors

For more information please email: kgc2011@gak.co.ke
or call 0722 569 764

Sponsored by

REPUBLIC OF KENYA
MINISTRY OF ENERGY

KenGen

The Kenya Power & Lighting Co. Ltd.

GDC Geothermal Development Company
Powering the Vision