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CLIMATE POLICY AND INSTRUMENTS FOR GEOTHERMAL ENERGY DEVELOPMENT IN KENYA

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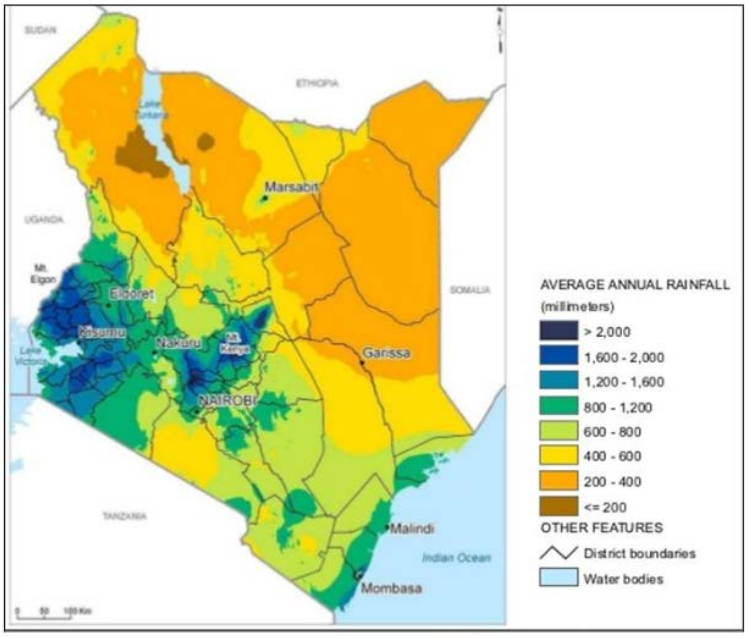
ABSTRACT

Kenya's contribution to global emission is only 0.10%. The country's development blue print Vision 2030 projects 10% economic growth and that 3% of that growth will be affected by climate change, hence limiting the desired double digit growth. Climate change impact is felt across several sectors with diverse social, economic and environmental consequences. In the power sector, hydropower generation which was the main source of generation is affected by the impact of recurrent droughts. This paper discusses the interventions that Kenya has put in place to accelerate development of geothermal energy as the most stable indigenous form of energy to spur economic development. Climate change mitigation and adaptation, requires that energy resources of the proper type and magnitude be available. The paper further discusses how these interventions have increased geothermal energy contribution to national and international climate change response. The current installed capacity of geothermal power is about 600 MW and being exploited within the Olkaria Geothermal fields. Geothermal energy contributes up to 51% of energy generated and used by Kenyans because it is operated on base load compared to other sources. Kenya has registered four geothermal clean development mechanism (CDM) projects. The registered projects are at different stages of monitoring, reporting and verification (MRV) with an estimated total annual emission reduction potential of 1.6 million tCO_2e per year as per the Project Design Document (the actual emission reduction are based on annual power plant performance). The Second national Communication 2015 and National Climate Change Action Plan (2013-2017) develop low carbon development options for electricity supply. In their analysis, geothermal power has by far the largest abatement potential of 14 $MtCO_2e$ per year in 2030 equivalent to 5 GW, with other technologies varying between 0.5 and 1.4 $MtCO_2e$. The Intended Nationally Determined Contribution (INDC or NDC) target takes a conservative approach and puts geothermal contribution at 2.7 GW (factoring the risks and barriers associated with geothermal energy development and indeed other sectors). Geothermal energy is expected to abate more than 75% of GHG from power generation/supply sector. Unexploited opportunity also exists for geothermal energy in adaptation as presented in the Lindal diagram and the *Geo-AdaM* conceptual framework in this paper. Opportunities exist for accelerating geothermal energy through climate finance.

1. INTRODUCTION

1.1 Background information about Kenya

Kenya is located in East Africa with a land mass of 582,650 km^2 and a population of about 45 million. The country has varying climatic and ecological extremes, and altitude varying from sea-level to >5,000 m in the highlands. The mean annual rainfall ranges from < 250 mm in semi-arid and arid areas to > 2,000 mm in high potential areas (Figure 1).



Source: World Resources Institute (2013)

FIGURE 1: Location of Kenya and average annual rainfall

More than two thirds of land in Kenya is arid and semi-arid and is characterised by low and unreliable rainfall, high evapo-transpiration rates, nomadic pastoralism and poor infrastructure. Most of the geothermal resources occur in such environments.

The Kenyan energy system is dualistic, mainly consisting of a small percentage of the population relying on modern energy and a majority on traditional or non-commercial fuels. The installed capacity of interconnected electricity is 2200 MW (about 26 MW of off-grid). The estimated per capita average consumption is about 175 kWh/year and over 50% electricity access rate with a short-term target of 70% by the end of 2017 with the aim of reaching 100% electricity connectivity by 2020, 10 years earlier than originally targeted from a rate of 35% in 2014. The current energy supply outstrips the current demand hence the need to increase economic growth rate and access to electricity.

2. GEOTHERMAL ENERGY IN KENYA

2.1 Geothermal energy prospects

Geothermal energy in Africa occurs along the East African Rift System. It is estimated that the continent has a potential of 15 GW. The geothermal resources of Kenya are located along the East African Rift valley with a resource potential of between 7,000 MW and 10,000 MW along >14 prospective sites in Kenya (Figure 2). Different fields are at different development phases with power generation currently in Olkaria and Eburru Geothermal Prospects. The Menengai geothermal prospect is confirmed 105 MW of well-head steam and has awarded tender to three bidders for construction of power plants. Other fields are currently undergoing exploration studies.

The current installed capacity of geothermal power is about 600 MW and being exploited within the Olkaria Geothermal fields. Kenya has 5 geothermal power plants as shown below:

- 45 MW Olkaria I Geothermal Power Plant (currently under-going rehabilitation to increase the capacity to about 60 MW);
- 105 MW Olkaria II Geothermal Power Plant;

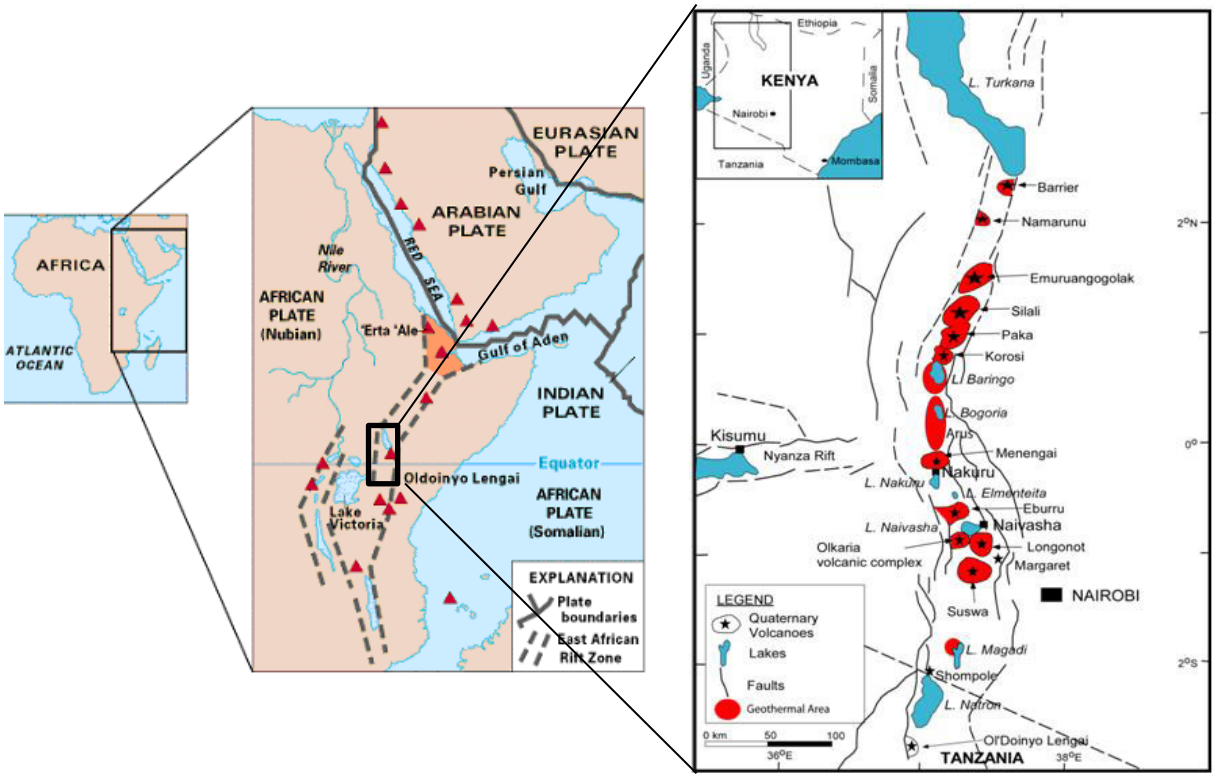


FIGURE 2: Location the East African Rift and Kenya geothermal prospects

- 140 MW Olkaria I additional units (AU) 4 & 5;
- 140 MW Olkaria IV Unit I and II;
- 110 MW Olkaria III Geothermal power plant;
- 70 MW Olkaria Geothermal Well Head projects; and
- 2.5 MW Eburru Geothermal project.

The Kenya Electricity Generating Co. Ltd is also in the process of planning for the development of the 560 MW Geothermal energy projects in Olkaria, in addition to the 70 MW Olkaria I AU Unit 6 and the 140 MW Olkaria V.

Geothermal energy is the most stable indigenous form of energy in Kenya and can also provide low carbon heating requirements. Kenya ranks 8th in the world in geothermal energy installed capacity and first in Africa. Installed capacity of geothermal energy in the national energy mix increased from 11% in 2010 to 17% in 2014 and 27% by June 2015. The installed capacity of thermal plants is about 35% contributing to 10% of power generation (used for peaking). Geothermal energy contributes up to 51% of energy generated and used by Kenyans because it is operated on baseload compared to other sources. About 90% of electric power consumed by Kenyans comes from renewable sources with hydro contributing 38%, geothermal 51%, wind 1% and 10% from thermal sources. The increase in power access rate is as result of commissioning of the 280 MW Olkaria Geothermal Power Plants and subsequent connections of the well-heads to the national grid.

2.2 Planned investment in the power sector

Under Kenya's Vision 2030 flagship projects, the installed capacity of geothermal will be 5000 MW contributing about 30% of expected total capacity of about 17,800 MW by 2030. Coal, oil and gas will contribute about 4500 MW, Nuclear 4200 MW (subject to completion of ongoing studies and

institutional framework), hydro imports from Ethiopia 2200 MW, wind 1600 MW, local hydro 300 MW).

2. POLICY AND INNOVATIONS IN GEOTHERMAL ENERGY

Climate change mitigation and adaptation, requires that energy resources of the proper type and magnitude be available. However, conversion of fossil fuel based energy is a major contributor to climate change. At least 70% of global greenhouse gas emissions come from combustion of fossil fuels for electricity generation, use in buildings, industry and transport (Ebinger and Walter, 2011). Deliberate intervention must be made by countries to promote deployment of renewable energy. These efforts are supported a number of national and international interventions.

2.1 Current enabling environment

Kenya has taken some innovative policy intervention and other business innovation to increase deployment of renewable energy sources including geothermal. These interventions have put geothermal energy at a strategic place in-term of achieving the countries objective of increasing access to electricity, provision of affordable and sustainable power for economic development and low carbon development.

2.2.1 Review of the energy policy and law

The Kenya Government is in the process of enacting a law which is currently in draft form, to create new opportunities for investments in the energy and petroleum sub-sectors. The intervention include the draft Energy and Petroleum Policy 2015 and the Energy Bill 2015 and Petroleum Bill 2015 to replace the Energy Act of 2006. Local content regulations have also been prepared for the two Bills. In the review, the Geothermal Resources Act, 1982 was merged with the Energy Bill, 2015 to safeguard national energy interests.

The draft Energy Bill 2015 proposes upgrading of Rural Electrification Authority (REA) to REREC (Rural Electrification and Renewable Energy Corporation) in Sections 42 – 52 in order the promote renewables through REREC initiatives. It also proposes creation of a Renewable Energy Resources Advisory Committee (RERAC) an Inter-Ministerial Committee to advise the government on prudent use of renewable energy resources (Government of Kenya, 2015b).

2.2.2 Current intervention and business innovation

In addition to reviewing the Energy Policy and Act, some of the innovative initiatives and regulations in the current Act have led to accelerated rate of geothermal development in Kenya with positive implications for Climate Change. These include but no limited to:

- **Government declaration of a geothermal** strategy with defined growth targets linked to specific projects. In its Vision 2030 blue print for development, Kenya plans to install up to 5000 MW of geothermal energy from the current potential of 10,000 MW and an interim target of about 1700 by 2020. Setting of clear targets and announcing a geothermal energy strategy gave a clear signal to investors of the government intentions and support.

- **Deregulation of the power sector through the Energy Act of 2006** also created the Geothermal Development Company (GDC) to take over the risks associated with initial geothermal exploration, drilling and the assessment of the resource. Other players in the sector under the current Act include Kenya Power Company Ltd (the off-taker and retail distributer), KenGen (generator), KETRACO (energy transmission), Rural Electrification Authority (REA-

decentralised energy systems), Energy Regulatory Commission (ERC the regulator), Ministry of Energy and Petroleum (MoEP - Policy) and Independent Power Producers (IPPs -Private Sector).

- Promoting **use the use of well-head technology** (Figure 3) which only takes 6 months to implement and **to** evacuate power between the phases of geothermal field exploration and drilling, and before steam field and power plant construction. Currently, KenGen generates about 70 MW of energy from geothermal well-heads. The estimated cost of well-head technology is about USD/MW 2.5 million. The deployment of well-heads and their connection to the grid has increase the contribution of geothermal energy in power generation and led to quick decommissioning of the emergency diesel power plants, hence emission reduction.

FIGURE 3: A 5 MW well-head at Olkaria geothermal field

- Clear demarcation of **geothermal license areas** to attract multiple investors e.g. KenGen, AGIL, Marine Park, Ol Suswa, Or-Power, Menengai, Bogoria- Silali block etc, thus encouraging multiple players to invest in geothermal energy projects at the same time. Kenya has more than 14 geothermal prospects which are open for licensing.

- **Joint venture and group procurement of projects:** Procurement for a series of geothermal power projects on a public private partnership (PPP) basis e.g. the 560 MW Olkaria geothermal projects and open tender for the 800 MW Baringo- Bogoria Silali block. The government of Kenya passed a Public Private Partnership Act which has created opportunity for PPP projects with positive implications for geothermal development among others.

- **Feed in Tariff Policy for renewable energy**: A 20-year fixed tariff for wind, solar, **geothermal**, hydro, biomass and biogas projects less than or equal to 10 MW to promote the uptake of renewables and attract investors (also used for well-heads). Feed-in Tariff (FiT) Policy provides investment security to renewable electricity generators, reduce administrative and transaction costs and encourage private investors. The tariffs apply to grid-connected plants and are valid for a 20-year period from the beginning of the Power Purchasing Agreement (PPA), with approval of the PPAs granted by the ERC (Government of Kenya, 2010). The FiT Policy further guarantees the PPA with the main power utility KP (the off-taker). A Renewable Energy Feed-in-Tariff

System has been formally entrenched in the Energy Bill, 2015, Sections 90 – 91 and will be made into law.

- **Standardized power purchase agreement (PPAs)** for projects below 10 MW and also above 10 MW (negotiated). This reduces the time and transaction cost for developing and negotiating PPAs.

- **Tax exemptions:** The government has put in place a range of tax reductions and import duty exemptions e.g. supplies imported for the construction of a power plant or **for geothermal exploration**, wind turbines, specialised solar equipment and accessories etc.

- **Capacity building:** Kenya has made significant and long-term investments in developing local skills and expertise in geothermal energy. Over the period 1982-2015, 109 Kenyans have completes the 6 months training in United Nations University Geothermal Training Programme (UNU-GTP) in different fields, 18 have completed MSc and one completed PhD studies with UNU-GTP support. Capacity building has also been sought from New Zealand, Japan and the US. More is needed with the current deployment rate.

- **One stop shop**: All information can be obtained in the renewable energy portal in the Energy Regulatory Commission (ERC) website, making it easier for investors to access information on real-time basis regardless of their location.

- **Reliable off-taker:** Kenya Power Ltd has never defaulted as an off-taker, hence boosting investor confidence on their returns, as per the PPA.

- The **Geothermal Industrial Park** is expected to access affordable steam and electricity from geothermal resources at Olkaria at an affordable rate, hence attract a range of industries with co-benefits in offsetting emissions from fossil fuel based fired boilers.

3. CLIMATE CHANGE POLICY AND GEOTHERMAL ENERGY IN KENYA

Kenya's contribution to global emission is about 0.10%. Vision 2030 projects 10% economic growth and that 3% of that growth will be affected by climate change, hence limiting a double digit growth. Impact of climate change has mostly been felt on the energy sector, particularly hydropower projects and food security due to increase in extreme weather events such as droughts and floods (Government of Kenya 2013).

The interventions in the energy sector discussed above and the geothermal energy strategy have led to acceleration of its development and put it as a front runner for key climate change intervention for mitigation under the Kyoto Protocol, New Market Mechanisms (NMM) and Intended Nationally Determined Contributions (INDC or NDC) and Cooperative Mechanisms adopted under the Paris Agreement (UNFCCC, 2015).

3.1 Implementation of international climate change regime on geothermal energy projects

3.1.1 Kyoto Protocol and Clean Development Mechanism

Geothermal energy took the lead in implementation of the Kyoto Protocol in terms of volumes of emission reduction and issuance of Certified Emission Reduction (CERs). Kenya has registered four geothermal clean development mechanism projects namely:

- 35 MW Olkaria Geothermal Expansion Project;

- 140 MW Olkaria IV, Units I and II Geothermal Project
- 140 MW Olkaria I, Unit IV and V Geothermal Project; and
- Olkaria III Phase 2 Geothermal Project.

The registered projects are at different stages of monitoring, reporting and verification (MRV) with an estimated total annual emission reduction potential of 1.6 million tCO_2e per year as per the Project Design Document (the actual emission reduction are based on annual power plant performance). The Olkaria II Geothermal Expansion was the first project in the County to be issued with 152,000 Certified Emission Reduction (CER). One ton of CO_2 equivalent is equal to a unit of CER after it has undergone verification and issuance. Despite the collapse of the CER price, the emission reductions generated from these projects are enough to recover the transaction cost even at one US dollar per ton of CO_2 equivalent.

3.1.2 Pre-2020 ambition

Under the Pre-2020 ambition, Kenya has tried two mechanisms; NAMA and JCM. Nationally Appropriate Mitigation Actions (NAMA), refer to a set of mitigation policies and/or actions that a developing country voluntarily undertakes in an effort to reduce its GHG emissions. Kenya developed a geothermal energy NAMA whose objective was to identify barriers or risks associated with geothermal development in Kenya and how they can be reduced. The component of the Geothermal NAMA are summarised in Table 1. The NAMA did not receive support and hence was not implemented as planned, however, the Directorate of Climate Change intends to review and revive the NAMA and seeks new support for its implementation. The geothermal NAMA study was jointly funded by the United Kingdom (UK) Department of Energy and Climate change (DECC) and German Federal Ministry of Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

TABLE 1: Potential benefits of Geothermal NAMA (extracted from Geothermal NAMA proposal)

Component	**Potential benefit for KenGen**
Short-term loan/grant facility for high risk in early stage development	Grant support for feasibility studies, geological surveys, site preparation, etc
Premium payment mechanism	Premium on top of PPA negotiated tariff (from international climate funds) for certain developments (mirrors CDM)
Geological risk mitigation instruments	Risk mitigation instruments will improve the risk-return profile for KenGen for its drilling activities.
Performance guarantee mechanism	This could support KenGen's obligations under a Steam Sale Agreement with external parties, facilitating these agreements.
Transaction support for PPA	A Transaction Advisory could assist the Government of Kenya, GDC and KenGen to liaise with and support private developers in obtaining a PPA.
Capacity building	Enhanced capacity building in geothermal development

Some initial activities were also undertaken under the Japanese Joint Credit Mechanism (JCM) on a pilot geothermal project design document (Olkaria I AU 6) but were dropped. Other opportunities still exist for geothermal in carbon markets in the voluntary carbon markets and under Article 6 of the Paris Agreement under the cooperative mechanism and sustainable development mechanism.

3.1.3 Paris Agreement and emission reduction target for Kenya

In December 2015, the world adopted the Paris Agreement which has a legal force and is considered an international treaty under the Vienna Convention. The Paris Agreement on Climate Change underpins the importance of increasing renewable energy in developing countries particularly Africa. The Agreement also adopts an ambitious emission reduction pathway consistent with holding the increase in the global average temperature to well below 2°C and while working towards 1.5 °C above preindustrial levels. The high mitigation ambition calls for scaling up of clean technologies, which will bolster low carbon investments growth across different sectors. Kenya signed the Paris Agreement on the 22nd of April 2016 and is in the process of preparing ratification documents for approval by National Assemblies. To date, 180 countries out of 195 have signed the Agreement and 23 have also deposited their instruments of ratification.

Articles 3 and 4 of the Paris Agreement require that all Parties undertake and communicate ambitious effort through their Intended Nationally Determined Contributions (INDC). In July 2015, Kenya submitted an INDC with an emission abatement potential of 30% by 2030 against a Business as Usual Scenario (BAU). Article 7 of the Paris Agreement focuses on enhancing adaptation efforts in a gender responsive way across all sectors. Part of the INDC or NDC included priority adaptation actions for Kenya.

Kenya's INDC/NDC focused on emission reduction from 6 sectors namely; energy, transport, industry, wastes, agriculture, forestry (carbon sinks) and adaptation actions in several sectors. The country's emission reduction potential based on the National Climate Change Action Plan (2013-2017) is shown in Figure 4.

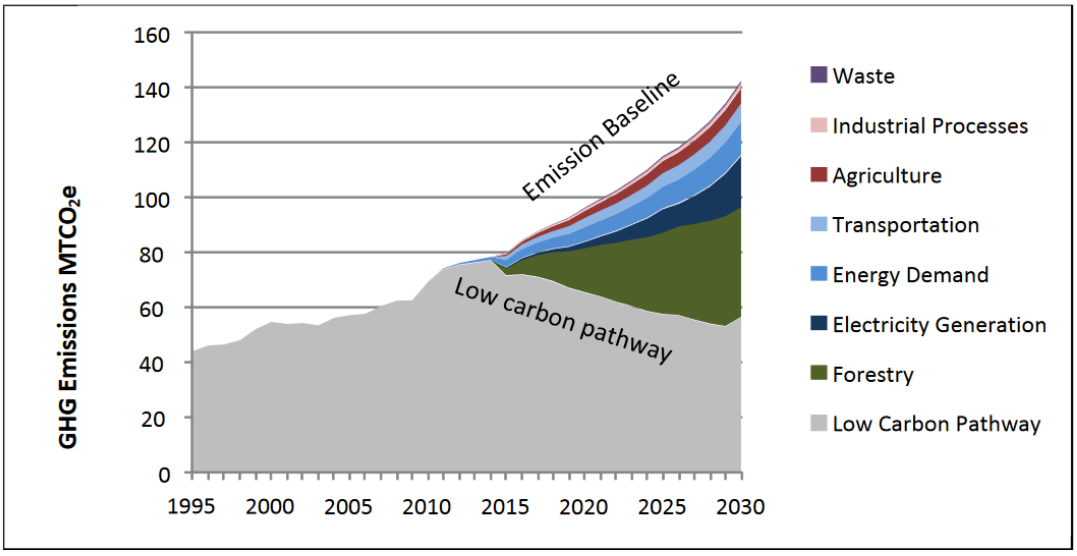


FIGURE 4: Composite abatement potential for all sectors for Kenya (technical potential) in $MtCO_2e$. Source: Government of Kenya (2015a), Second National Communication.

The National Climate Change Action Plan (2013-2017) determined that Kenya's projected emissions for 2030 are 143 $MtCO_2e$/year. Kenya has potential to reduce projected emissions by 60% equivalent to 86 $MtCO_2e$/year. The INDC/NDC mitigation target takes a conservative approach of half the potential which is equivalent to 43 $MtCO_2e$ /year hence the 30% abatement target. According to the GHG inventory from the Second National Communication 2015, National Climate Change Action Plan (2013-2017), forestry and agriculture sector has the highest abatement potential of all sectors, followed by the energy sector (energy demand, electricity generation). The Second National Communication of 2015, however, projects an abatement potential of GHG emission of 138 $MtCO_2e$/year compared to the143 $MtCO_2e$/year in the National Climate Change Action Plan (2013-2017). The Second National

Communication 2015 was completed after the INDC target and slight variance is because some projects which were planned between 2012 and 2015 were not implemented and changes in the planned projects. The slight variation has minimal impact of the projections. More minor deviations are likely to be seen after the Third National Communication GHG inventory is complete. For the purpose of this paper, the INDC/NDC is considered as the official document in terms of Kenya's international commitment.

3.1.4 Emission reduction from electricity generation

Kenya is mainstreaming climate change issues at national and county government levels. The process has begun in the energy sector. The Second national Communication 2015 and National Climate Change Action Plan (2013-2017) develop low carbon development options for electricity supply (Figure 5). In their analysis, geothermal power has by far the largest abatement potential of 14 $MtCO_2e$ per year in 2030 equivalent to 5 GW, with other technologies varying between 0.5 and 1.4 $MtCO_2e$. However, as explained in sub-section 3.13 above, the INDC/NDC target takes a conservative approach and puts geothermal contribution at 2.7 GW (factoring the risks and barriers associated with geothermal energy development and indeed other sectors). As a result, power generation is expected to contribute 9.32 $MtCO_2e$ /year from the projected total of 43 $MtCO_2e$ /year from all sectors by 2030 at 30% abatement target. Energy demand will contribute 6.09 $MtCO_2e$ /year. The rest will come from other sectors (Government of Kenya 2013; Government of Kenya 2015a). In terms of sector abatement, geothermal energy is expected to abate more than 75% of GHG from power generation/supply sector. The abatement potential will be determined by deployment of other energy sources, such as the number of thermal plants, as these may increase the emission intensity in terms of CO_2/MWh especially if clean technologies are not applied. Successful implementation of the first Nuclear Power Plant can also reduce the national grid emission factor.

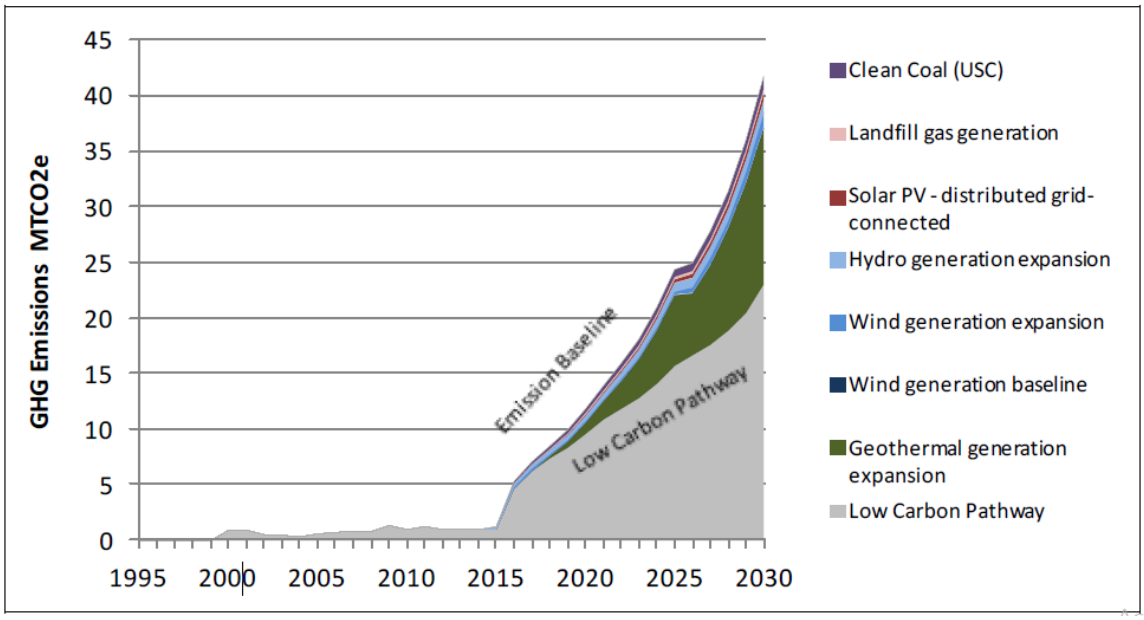


FIGURE 5: Composite abatement potential for all sectors for Kenya (technical potential) in $MtCO_2e$. Source: Government of Kenya (2015a), Second National Communication.

The baseline projection was based on the National Climate Change Action Plan 2013-2017 and updated in the Second National Communication to the UNFCCC using data from the Least Cost Power Development Plan based on reference scenario to 2030.

The abatement potential in both the Second National Communication National Climate Change Action Plan 2013-2017 did not include low temperature utilisation of geothermal energy since this sector is not

well developed. KenGen Olkaria Industrial Park could contribute to further mitigation effort especially from utilisation of geothermal steam in industrial processes.

3.2 National policy and legislation supporting implementation of climate change

3.2.1 The National Climate Change Response Strategy (2010) and National Climate Change Action Plan (2013 -2017)

The National Climate Change Response Strategy (2010) was the first national policy document on climate change in Kenya. To implement the Strategy, a National Climate Change Action Plan (NCCAP) was developed. National Climate Change Action Plan (NCCAP) 2013-2017, which is based on Kenya's Vision 2030, identifies low carbon action priority areas which include geothermal power generation (Government of Kenya, 2013). The National Climate Change Action Plan is under review and a new one will be developed for the period 2018-2022, and will be in line with the requirements of the Paris Agreement.

3.2.2 Climate Change Act 2016

The President of Kenya assented into law the Climate Change Act, 2016 on 6 May 2016. The Act was published in the *Kenya Gazette* on 13 May 2016, and commenced operation on 27 May 2016. Section 5 of the new law provides for a high level nine oversight National Climate Change Council to govern climate change interventions in Kenya chaired by the president of his deputy. Cabinet Secretary (Minister) for Energy is a member of the council (Government of Kenya, 2016). Representation of energy sector in the council with a clear national strategy on geothermal energy development will give impetus for accelerating its development.

The Act sets a new institutional framework, new legal obligations, and a system of governing the mainstreaming of climate change actions into sectoral policy areas of public administration, and private sector. The enactment of the new Act in the wake of Paris Agreement is instrumental in driving Kenya's mitigation ambition and commitment into action as it clearly sets out the framework for achieving emission reduction targets through regulations, penalties and incentive.

3.2.3 Draft Climate Change Framework Policy and draft Climate Finance Policy

The draft Climate Change Framework Policy sets the framework for mainstreaming climate change in all sectors, while the draft Climate Finance Policy sets legal and institutional frameworks for accessing and managing climate finance for low carbon resilient development.

3.2.4 Other policy instruments

Other legal instruments include the Energy Act discussed above, Vision 2030, plans and strategies relevant to geothermal development as discussed above.

3.3 Geothermal energy and adaptation

Other potential also exist in utilisation of geothermal energy in adaptation potential as presented by Ogola et al. (2012) and develops the first Lindal diagram for the region (Figure 6). Geothermal contribution in adaptation can be achieved by identifying climate vulnerable sectors such as, agriculture (most vulnerable), energy (hydropower, biomass), fisheries, livestock, health, water, as well as heating and cooling requirements among others. Ogola et al. (2012) assessed the potential role of geothermal utilisation in drought vulnerable sectors using local resources within a radius of 50 km in Eastern Baringo lowlands, Kenya. Some of the lessons learned from this study indicate that geothermal energy can be used in reducing vulnerability to famine through different aspects of utilisation, and other impacts of recurrent drought, while contributing towards global mitigation.

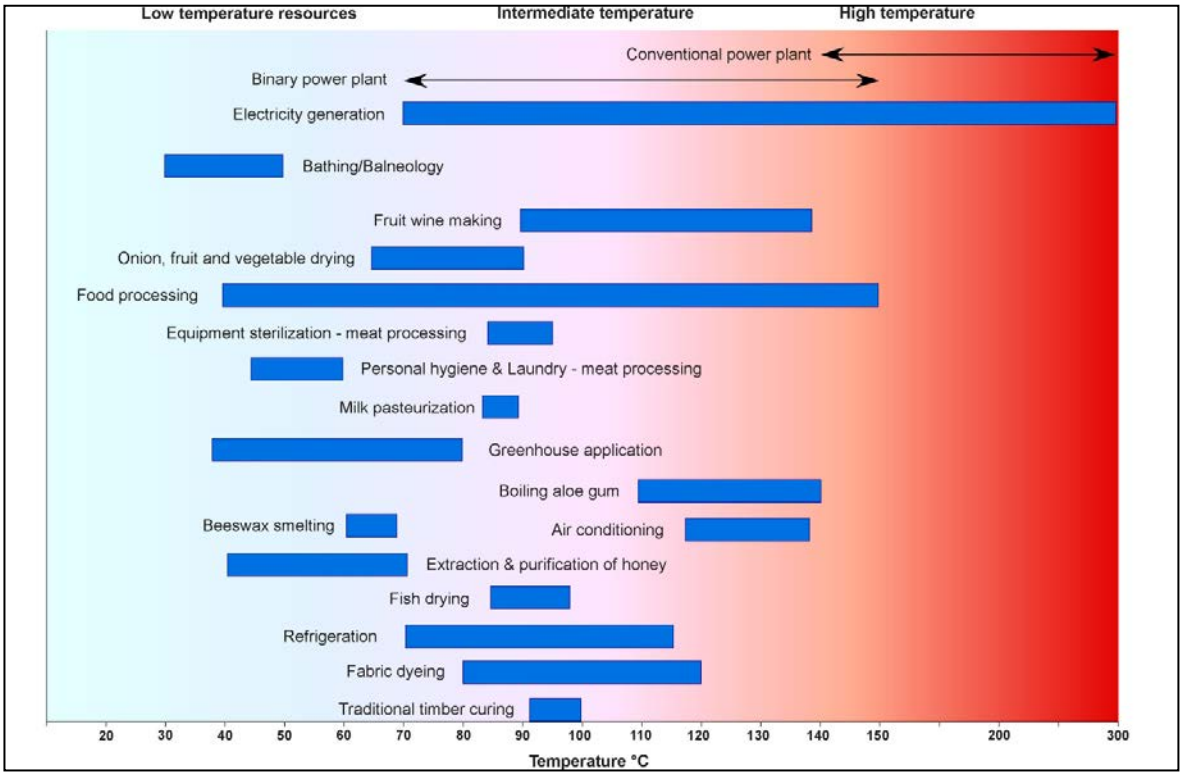


FIGURE 6: Líndal diagram for potential adaptation projects for Bogoria –Silali geothermal fields (Ogola et al., 2012)

Climate change impacts have long-term impact on geothermal aquifers (which are usually recharged in decades or centuries, deforestation of water catchments located at geothermal recharge points either near or far from geothermal fields has occurred. Previously, the focus has been on building resilience in the hydropower sector. Building resilience in the geothermal sector through sustainable reservoir management and restoration of geothermal recharge areas which may or may not be in close proximity to geothermal fields is equally important. These recharge areas should be mapped and protected. Such interventions should be captured in the review of the National Climate Change Action Plan 2018-2022.

3.4 Mitigation and adaptation co-benefits through the Geo-AdaM conceptual framework

The article creates the Geothermal Adaptation-Mitigation (*Geo-AdaM)* conceptual frameworks that can be used in combining mitigation and adaptation in geothermal projects by introducing adaptation additionality in mitigation projects, using geothermal energy in climate vulnerable sectors, combining geothermal development with carbon forestry to improve recharge of geothermal systems, displacing fossil fuels in heating and cooling among others (Ogola et al., 2011). These principles, with mitigation, adaptation co-benefits and vice versa are yet to be applied in the Kenyan context and should be included in the climate change programmes for financing. These should include vulnerability that can be created by geothermal expansion.

The *Geo-AdaM* concept for geothermal energy projects is summarized in the Figure 7.

5. CLIMATE FINANCE AND GEOTHERMAL ENERGY

The Paris Agreement underscores the importance of renewable energy and IRENA sets targets on the same for Africa. It also requires developed countries to provide finance, capacity building and technology for implementation of such projects. The United Nation Framework Convention on Climate

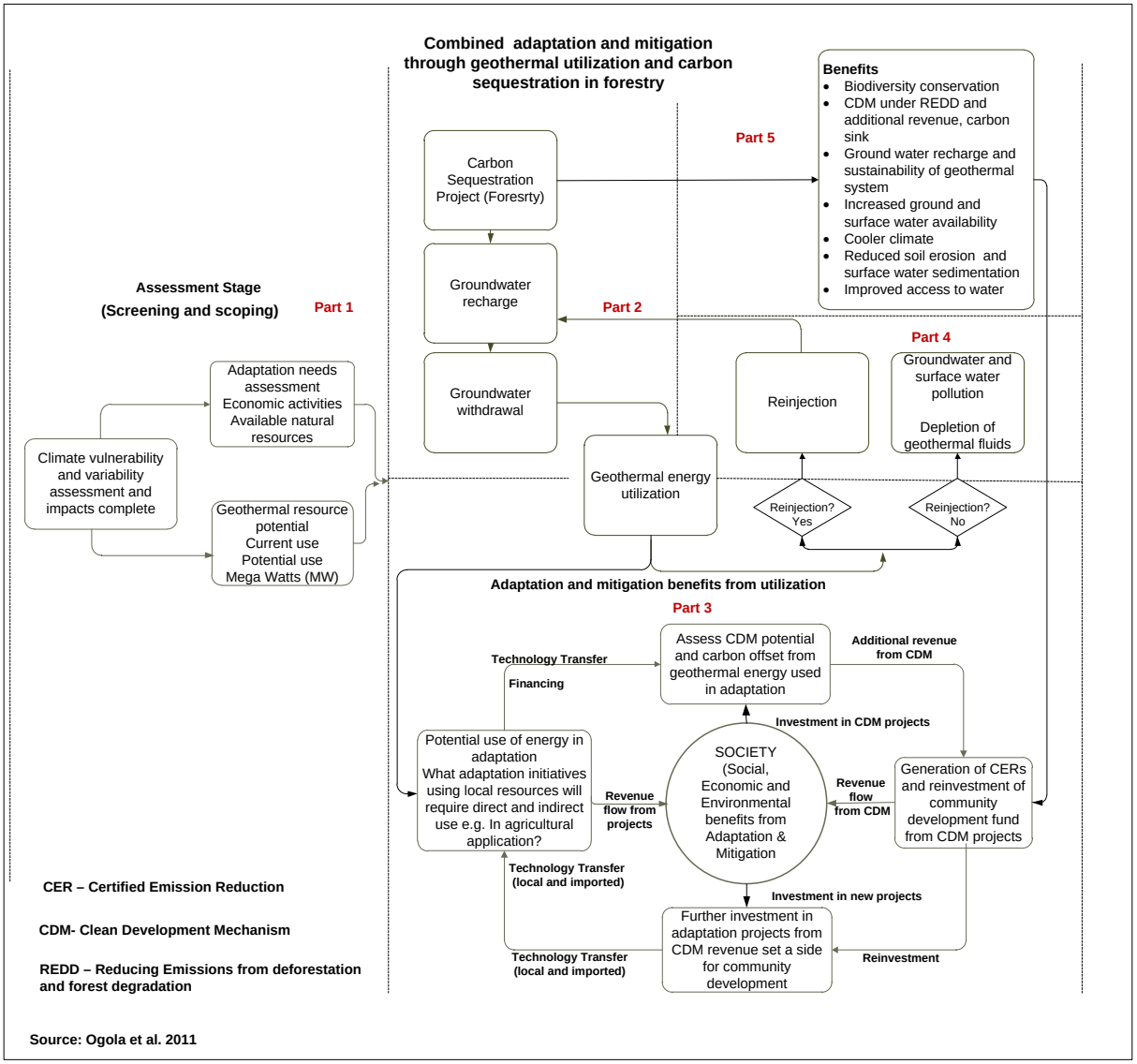


FIGURE 7*:* Geo-AdaM conceptual framework (Ogola et al., 2011)

Change (UNFCCC) established the Green Climate Fund (GCF) to support countries in implementing their Nationally Determined Contributions, or NDCs. Given the clear geothermal strategy and its contribution in Kenya's INDC/NDC, there should be considerably increase available resources to green finance investments in geothermal energy. Current climate finance is s delivered as loans and grants through bilaterally and multilateral funding mechanisms. Some of the initiatives include:

- Menengai Geothermal Development Project was financed under the Scaling Renewable Energy Program by the African Development Bank. More funds are expected under phase II of the project.
- Climate finance has also been received through the carbon markets from CDM projects from geothermal projects.
- The geothermal NAMA was also designed to attract investment in geothermal by removing barriers and risks associated with geothermal development but was not implemented. Intentions to revive the NAMA and seek support from climate finance are under consideration.
- Geothermal Development Corporation (GDC) has submitted a proposal to GCF to be considered as one of the National Implementing Entities (NIE) of the Fund with a specific objective of getting access to climate finance for drilling in the new geothermal fields.

- More opportunities for geothermal energy under climate change financing exist under the bilateral and multilateral agreements, green bonds, concessional loans and grants etc. Financing is particularly required for drilling risk mitigation and non-technical aspects of development such as; contracts around geothermal energy and financial models for analysing the same.
- The Ministry of Energy and Petroleum (MoEP) has requested support from the World Bank to prepare a National Geothermal Strategy. The Bank has accepted the request. The Strategy is expected to build on the current sector structure and development models and seek to improve the enabling environment to facilitate accelerated geothermal development.

The World Bank in its reviewed/revised draft Environmental and Social Standards (ESS) which will replace the safeguard policies introduces an ESS on Climate Change. There is a general indication that most development partners will capture climate change in their safeguard policies or standards for and also through financing due diligence processes.

Unlike most African countries, Kenya has a good track record of developing geothermal projects and hence likely to attract more climate finance particularly in geothermal.

6. CONCLUSION

Geothermal energy plays a central role in Kenya's access to electricity, attainment of Sustainable Development Goals and well as setting the country to a low emission pathway. The Country has a potential of between 7,000 and 10,000 MW out of which only 6% has been developed. The policy intervention and innovation put in place by the government and the pronouncement of geothermal strategy will attract more investment in the industry particularly private sector. Despite the positive progress in energy reforms and formulation of the new feed in tariff (FiT) in Kenya of US cents 8.5/kWh (Government of Kenya, 2010) for geothermal electricity to attract investors, legal barriers related to low temperature utilisation have not been addressed and the tariff has not been fixed.

Kenya has signed the Paris Agreement and enacted a Climate Change Act both in 2016, which shows commitment in addressing climate change. The national framework policy and the Act have already given a clear signal to developers and financiers on government priorities in the energy sector among others. Despite the fact that the INDC/NDC target take conservation approach to implementation of geothermal and ultimate contribution to GHG abatement by 2030. More can be done to surpass that target with adequate and timely financing, capacity building and technology transfer

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